# Fuel System (G6BA – GSL 2.7)

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P0172	.FLA-249
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P0230	.FLA-254
P0261	.FLA-259
P0262	
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P0265	.FLA-265
P0267	.FLA-259
P0268	.FLA-265
P0270	.FLA-259
P0271	.FLA-265
P0273	.FLA-259
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P0276	.FLA-259
P0277	.FLA-265
P0300	.FLA-269
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P0302	.FLA-277
P0303	
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P0305	
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P0315	.FLA-283
P0325	.FLA-287
P0330	.FLA-293
P0335	
P0340	
P0350	.FLA-310
P0351	.FLA-317
P0352	.FLA-317
P0353	.FLA-317
P0354	.FLA-317
P0355	.FLA-317
P0356	.FLA-317
P0420	.FLA-321
P0430	.FLA-321
P0441	.FLA-324
P0442	.FLA-328
P0444	.FLA-334
P0445	.FLA-339
P0447	.FLA-342
P0448	.FLA-347
P0449	.FLA-350
P0451	.FLA-352
P0452	.FLA-356
P0453	.FLA-360
P0454	.FLA-363
P0455	
P0456	
P0461	.FLA-372
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REMOVAL (INCLUDING FUEL FILTER	ZAND
FUEL PRESSURE REGULATOR)	
FUEL TANK	🗀 🕻 🛨 1
REMOVAL	FI A-442
TALIVIO VAL	

### **GENERAL**

### SPECIFICATIONS EF75B1ED

### FUEL DELIVERY SYSTEM

Items	Specification		
Fuel Tank	Capacity 55 lit. (14.5 U.S.gal., 12.1 Imp.gal.)		
Fuel Retrun System	Туре	Returnless	
Fuel Filter	Туре	High pressure type (built in Fuel Pump Assembly)	
Fuel Pressure Regulator	Туре	Built in fuel pump assembly	
Fuel Pressure Regulator	Regulated Fuel Pressure	350 kpa (3.5 kg/cm2, 49.8 psi)	
Fuel Pump	Туре	Electrical, in-tank type	

### **ENGINE MANAGEMENT SYSTEM**

SENSORS	Mass Air Flow Sensor (MAFS)	Туре	Hot fi	lm type	
		Output Volta	Output Voltage	Idle: 0.	6 ~ 1.0 V
				1.3 ~ 1.5 V 1.7 ~ 1.9 V	
	Intake Air Temperature	Туре	Thermistor type	e (built in MAFS)	
	Sensor (IATS)	Resistance	-20 °C (-4° F)	11.72 ~ 19.54 kΩ	
			0 ℃(32°F)	4.75 ~ 7.11 kΩ	
			<b>20℃(68°</b> F)	2.22 ~ 2.82 kΩ	
			40℃(10 <u>4</u> °F)	1.06 ~ 1.31 kΩ	
		<b>60 ℃(140°</b> F)	0.55 ~ 0.66 kΩ		
			<b>80℃(176</b> °F)	0.30 ~ 0.36 kΩ	
	Engine Coolant Temperature	Type	Thermistor type		
	Sensor (ECTS)  Resistance	Resistance	-40 °C (-40°F)	48.14 kΩ	
			-20 ℃ (-4°F)	14.13 ~ 16.83 kΩ	
			0 ℃(32°F)	5.79 kΩ	
				20 ℃(68°F)	2.31 ~ 2.59 kΩ
			40℃(104°F)	1.15 kΩ	
				60 ℃(140°F)	0.59 kΩ
		80℃(176°F)	0.32 kΩ		

FLA -4 FUEL SYSTEM

SENSOR	Throttle Position Sensor (TPS)	Туре	Variable Re	esistor Type
		Resistance	1.6 ~	<b>2.4</b> kΩ
		Output Voltage	C.T	0.2 ~ 0.8 V
			W.O.T	4.3 ~ 4.8 V
	Heated Oxygen Sensor (HO2S)	Туре	Zirconia Sensor	(including Heater)
		Output Voltage	0 ~	- 1V
		Heater Resistance	3.0 ~ 4.0Ω at 23±5℃	
	Knock Sensor	Туре	Piezo-ele	ectric type
		Capacitance	0.8 ~	1.6 nF
	Camshaft Position Sensor	Туре	Hall Effe	ct Sensor
	(CMPS)	Output Voltage	0 ~	5.0V
	Crankshaft Position Sensor	Туре	Hall Effe	ct Sensor
	(CKPS)	Output Voltage	0 ~	5.0V
	Full Tark Bureau Consul	Туре	Piezo-Resistivity type	
	Fuel Tank Pressure Sensor (FTPS)	Output Voltage	Approx. 2.5V at idle	
ACTUATORS	ACTUATORS Injector		Electromagnetic Type	
		Number	ı	6
		Coil Resistance	13.8 ~ 15.2 Ω at 20 ℃	
	Purge Control Solenoid	Туре	Duty Co	ntrol Type
	Valve (PCSV)	Coil Resistance	24.5 ~ 27.5 Ω at 20 ℃	
	Idle Speed Control Actuator	Туре	Double	Coil Type
	(ISCA)	Coil Resistance	CLOSE	17.0 ~ 18.2 Ω (at 20℃)
			OPEN	14.9 ~ 16.1 Ω (at 20℃)
	Ignition Coil	Туре	Mold Coil type	
			0.74±10% Ω	
		Secondary Coil	13.3±15% kΩ	
		Туре	ON/OFF O	Control type
	Canister Close Valve (CCV)	Resistance	23.9 ~ 26.9Ω at 20°C(68°F)	

### SEALANTS ECF45685

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

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

### TIGHTENING TORQUES E9124308

### **ENGINE CONTROL SYSTEM**

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

### FUEL DELIVERY SYSTEM

Items	N·m	kgf⋅m	lbf-ft
Delivery pipe installation bolts	9.8 ~ 14.7	1.0 ~ 1.5	7.2 ~ 10.9
Throttle body installation bolt/nut	14.7 ~ 19.6	1.5 ~ 2.0	10.9 ~ 14.5
Accelerator pedal installation bolt	12.7 ~ 15.7	1.3 ~ 1.6	9.4 ~11.6
Fuel pump assembly mounting screws	2.0 ~ 2.9	0.2 ~ 0.3	1.4 ~ 2.2
Fuel vent valve mounting	2.0 ~ 2.9	0.2 ~ 0.3	1.4 ~ 2.2
2-way valve mounting	2.0 ~ 2.9	0.2 ~ 0.3	1.4 ~ 2.2

FLA -6 FUEL SYSTEM

### SPECIAL SERVICE TOOLS ECCEA3B9

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

### BASIC TROUBLESHOOTING ED6E648D

### 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



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

### 6 Inspect Vehicle Visually

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

### 7 Recreate (Simulate) Symptoms the DTC

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

### 8 Confirm Symptoms of Problem

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

### 9 Recreate (Simulate) Symptom

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

### 10 Check the DTC

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

### 11 Perform troubleshooting procedure for DTC

### 12 Adjust or repair the vehicle

### 13 Confirmation test

14 END

LW8F1001

FLA -8 FUEL SYSTEM

### CUSTOMER PROBLEM ANALYSIS SHEET

1.	VEHICLE INFORMATION	

(I) VIN:	(I) VIN:				
(II) Production Date:					
(III) Odometer Reading: (km)					
2. SYMPTOMS	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	<ul> <li>□ Rough idling □ Incorrect idling</li> <li>□ Unstable idling (High: rpm, Low:rpm)</li> <li>□ Other</li> </ul>				
☐ Engine stall	<ul> <li>□ Soon after starting □ After accelerator pedal depressed</li> <li>□ After accelerator pedal released □ During A/C ON</li> <li>□ Shifting from N to D-range</li> <li>□ Other</li> </ul>				
☐ 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				
☐ 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 ( $20^{\circ}C$ ,  $68^{\circ}F$ ), unless there is any notice.

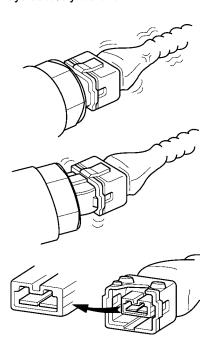


The measured resistance in except for ambient temperature (20°C, 68°F) is reference value.

### 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).
- 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.



BFGE321A

Slightly shake the connector and wiring harness vertically and horizontally.

- 4. Repair or replace the component that has a problem.
- 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

 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

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

### **CONNECTOR INSPECTION PROCEDURE**

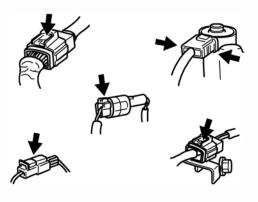
- 1. Handling of Connector
  - Never pull on the wiring harness when disconnecting connectors.

FLA -10 FUEL SYSTEM



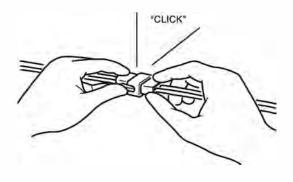
BFGE015F

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



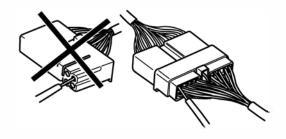
BFGE015G

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



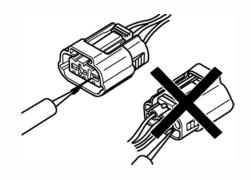
BFGE015H

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



BFGE015I

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

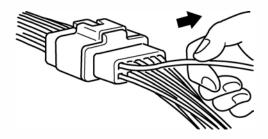


BFGE015J

### **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
  - 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.



BFGE015K

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



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

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

### WIRE HARNESS INSPECTION PROCEDURE

- Before removing the wire harness, check the wire harness position and crimping in order to restore it correctly.
- 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.
- Check the connection between the wire harness and any installed part.
- If the covering of wire harness is damaged; secure, repair or replace the harness.

### **ELECTRICAL CIRCUIT INSPECTION PROCEDURE**

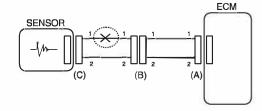
### CHECK OPEN CIRCUIT

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



BFGE501A

2. Continuity Check Method



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

Specification (Resistance)

1 $\Omega$  or less  $\rightarrow$  Normal Circuit

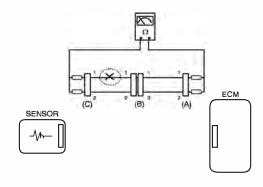
1 $M\Omega$  or Higher  $\rightarrow$  Open Circuit

 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  $1^{M\Omega}$  and below  $1^{\Omega}$  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.

FLA -12 FUEL SYSTEM

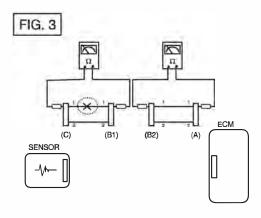
FIG. 2



BFGE501B

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

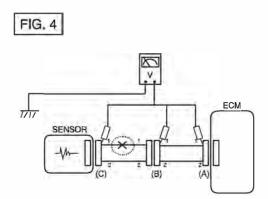
In this case the measured resistance between connector (C) and (B1) is higher than  $1^{M\Omega}$  and the open circuit is between terminal 1 of connector (C) and terminal 1 of connector (B1).



BFGE501C

### 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).



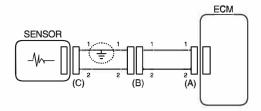
BFGE501D

### CHECK SHORT CIRCUIT

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

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

FIG. 5



BFGE501E

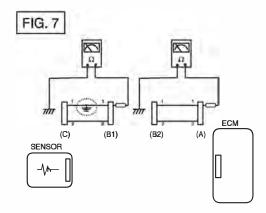
5. Continuity Check Method (with Chassis Ground)

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

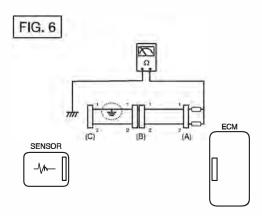
Specification (Resistance)  $1\Omega$  or less  $\rightarrow$  Short to Ground Circuit  $1M\Omega$  or Higher  $\rightarrow$  Normal Circuit

 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  $\Omega$  and higher than 1M $\Omega$  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 following step.



BFGE501G



BFGE501F

 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  $1\Omega$  or less. The short to ground circuit is between terminal 1 of connector (C) and terminal 1 of connector (B1).

FLA -14 FUEL SYSTEM

### SYMPTOM TROUBLESHOOTING GUIDE CHART

MAIN SYMPTOM	DIAGNOSTIC PROCEDURE	ALSO CHECK FOR
Unable to start (Engine does not turn over)	<ol> <li>Test the battery</li> <li>Test the starter</li> <li>Inhibitor switch (A/T) or clutch start switch (M/T)</li> </ol>	
Unable to start (Incomplete combustion)	Test the battery     Check the fuel pressure     Check the ignition circuit     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	Test the battery     Check the fuel pressure     Check the ECT sensor and circuit (Check DTC)     Check the ignition circuit	<ul><li>DTC</li><li>Low compression</li><li>Intake air leaks</li><li>Contaminated fuel</li><li>Weak ignition spark</li></ul>
Poor idling (Rough, unstable or incorrect Idle)	Check the fuel pressure     Check the Injector     Check the long term fuel trim and short term fuel trim (Refer to CUSTOMER DATASTREAM)     Check the ISCA and ISCA circuit (Check DTC)     Inspect and test the Throttle Body     Check the ECT sensor and circuit (Check DTC)	DTC Low compression Intake air leaks Contaminated fuel Weak ignition spark
Engine stall	Test the Battery     Check the fuel pressure     Check the ISCA and ISCA circuit (Check DTC)     Check the ignition circuit     Check the CKPS Circuit (Check DTC)	DTC     Intake air leaks     Contaminated fuel     Weak ignition spark
Poor driving (Surge)	Check the fuel pressure     Inspect and test Throttle Body     Check the ignition circuit     Check the ECT Sensor and Circuit (Check DTC)     Test the exhaust system for a possible restriction     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	Check the fuel pressure     Inspect the engine coolant     Inspect the radiator and the electric cooling fan     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)	<ol> <li>Test the canister close valve</li> <li>Inspect the fuel filler hose/pipe         <ul> <li>Pinched, kinked or blocked?</li> <li>Filler hose is torn</li> </ul> </li> <li>Inspect the fuel tank vapor vent hose between the EVAP. canister and air filter</li> <li>Check the EVAP. canister</li> </ol>	Malfunctioning gas station filling nozzle (If this problem occurs at a specific gas station during refueling)

FLA -16 FUEL SYSTEM

# GASOLINE ENGINE CONTROL SYSTEM

### OBD-II REVIEW E6827E47

#### 1. OVERVIEW

The California Air Resources Board (CARB) began regulation of On Board Diagnostics (OBD) for vehicles sold in california beginning with the 1988 model year. The first phase, OBD-I, required monitoring of the fuel metering system, Exhust Gas Recirculation (EGR) system and additional emission related components. The Malfunction Indicator Lamp (MIL) was required to light and alert the driver of the fault and the need for repair of the emission control system. Associated with the MIL was a fault code or Diagnostic Trouble Code (DTC) idenfying the specific area of the fault.

The OBD system was proposed by CARB to improve air quality by identifying vehicle exceeding emission standards. Passage of the Federal Clean Air Act Amendments in 1990 has also prompted the Environmental Protection Agency (EPA) to develop On Board Diagnostic requirements. CARB OBD-II regulations will be followed until 1999 when the federal regulations will be used.

The OBD-II system meets government regulations by monitoring the emission control system. When a system

or component exceeds emission threshold or a component operates outside tolerance, a DTC will be stored and the MIL illuminated.

The diagnostic executive is computer program in the Engine Control Module (ECM) that coordinates the OBD-II self-monitoring system. This program controls all the monitors and interactions, DTC and MIL operation, freeeze frame data and scan tool interface.

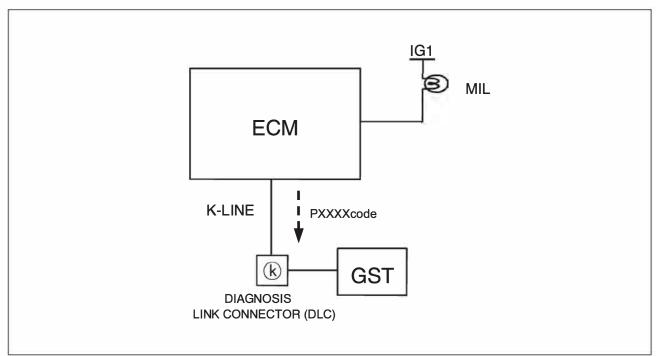
Freeze frame data describes stored engine conditions, such as state of the engine, state of fuel control, spark, RPM, load and warm status at the point the first fault is detected. Previously stored conditions will be replace only if a fuel or misfire fault is detected. This data is accessible with the scan tool to assist in repairing the vehicle.

The center of the OBD-II system is a microprocessor called the Engine Control Module (ECM).

The ECM receives input from sensors and other electronic components (switches, relays, and others) based on information received and programmed into its memory (keep alive random acess memory, and others), the ECM generates output signals to control various relays, solenoids and actuators.

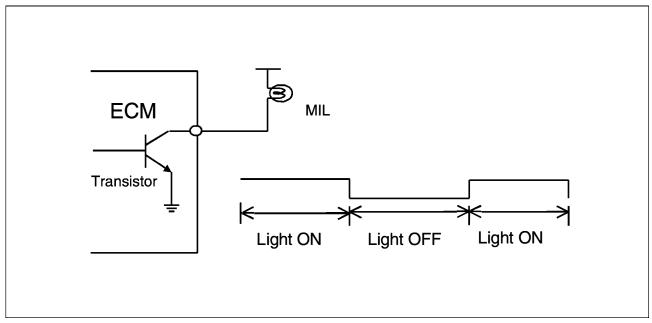
### 2. CONFIGURATION OF HARDWARE AND RELATED TERMS

### 1) GST (GENERIC SCAN TOOL)



BFGE501H

### 2) MIL (MALFUNCTION INDICATION LAMP) - MIL ACTIVITY BY TRANSISTOR



BFGE501I

The Malfunction Indicator Lamp (MIL) is connected between ECM-terminal Malfunction Indicator Lamp and battery supply (open collector amplifier).

In most of car, the MIL will be installed in the instrument panel. The lamp amplifier can not be damaged by a short circuit.

Lamps with a power dissipation much greater than total dissipation of the MIL and lamp in the tester may cause a fault indication.

▷ At ignition ON and engine revolution (RPM) 〈 MIN. RPM, the MIL is switched ON for an optical check by the driver.

### 3) MIL ILLUMINATION

When the ECM detects a malfunction related emission during the first driving cycle, the DTC and engine data are stored in the freeze frame memory. The MIL is illuminated only when the ECM detects the same malfunction related the DTC in two consecutive driving cycles.

### 4) MIL ELIMINATION

### Misfire and Fuel System Malfunctions:

For misfire or fuel system malfunctions, the MIL may be eliminated if the same fault does not reoccur during monitoring in three subsequent sequential driving cycles in which conditions are similar to those under which the malfunction was first detected.

### All Other Malfunctions:

For all other faults, the MIL may be extinguished after three subsequent sequential driving cycles during which the monitoring system responsible for illuminating the MIL functions without detecting the malfunction and if no other malfunction has been identified that would independently illuminate the MIL according to the requirements outlined above.

### 5) ERASING A FAULT CODE

The diagnostic system may erase a fault code if the same fault is not re-registered in at least 40 engine warm-up cycles, and the MIL is not illuminated for that fault code.

### 6) K-LINE

- · Bidirectional line
- K-Line is defined as the line which provides information in a serial digital form from ECM to the diagnostic tester. K-Line is used bidirectionally, in which case it may carry commands or data from the diagnostic tester to the ECM. K-Line is also used to initialize the serial communication.

### 7) DRIVING CYCLE

A driving cycle consists of engine start up, and engine shut off

### 8) WARM-UP CYCLE

A warm-up cycle means sufficient vehicle operation such that the engine coolant temperature has risen by at least 40 degrees Fahrenheit from engine starting and reaches a minimum has risen by at least 40 degrees Fahrenheit from FLA -18 FUEL SYSTEM

engine starting and reaches a minimum temperature of at least 160 degrees Fahrenheit.

### 9) TRIP CYCLE

A trip means vehicle operation (following an engine-off period) of duration and driving mode such that all components and systems are monitored at least once by the diagnostic system except catalyst efficiency or evaporative system monitoring when a steady-speed check is used, subject to the limitation that the manufacturer-defined trip monitoring conditions shall all be encountered at least once during the first engine start portion of the applicable FTP cycle.

### 10) DTC FORMAT

- Diagnostic Trouble Code (SAE J2012)
- DTCs used in OBD-II vehicles will begin with a letter and are followed by four numbers.

The letter of the beginning of the DTC identifies the function of the monitored device that has failed. A "P" indicates a powertrain device, "C" indicates a chassis device. "B" is for body device and "U" indicates a network or data link code. The first number indicates if the code generic (common to all manufacturers) or if it is manufacturer specific. A "0" & "2" indicates generic, "1" indicates manufacturer-specific. The second number indicates the system that is affected with a number between 1 and 7.

The following is a list showing what numbers are assign to each system.

- a. Fuel and air metering
- b. Fuel and air metering(injector circuit malfunction only)
- c. Ignition system or misfire
- d. Auxiliary emission controls
- e. Vehicle speed controls and idle control system
- f. Computer output circuits
- g. Transmission

The last two numbers of the DTC indicates the component or section of the system where the fault is located.

### 11) FREEZE FRAME DATA

When a freeze frame event is triggered by an emission related DTC, the ECM stores various vehicle information as it existed the moment the fault ocurred. The DTC number along with the engine data can be useful in aiding a technician in locating the cause of the fault. Once the data from the 1st driving cycle DTC ocurrence is stored in the freeze frame memory, it will remain there even when the fault ocurrs again (2nd driving cycle) and the MIL is illuminated.

- Freeze Frame List
  - a) Calculated Load Value
  - b) Engine RPM
  - c) Fuel Trim
  - d) Fuel Pressure (if available)

- e) Vehicle Speed (if available)
- f) Coolant Temperature
- g) Intake Manifold Pressure (if available)
- h) Closed-or Open-loop operation
- i) Fault code

### 3. OBD-II SYSTEM READINESS TESTS

### 1) CATALYST MONITORING

The catalyst efficiency monitor is a self-test strategy within the ECM that uses the downstream Heated Oxygen Sensor (HO2S) to determine when a catalyst has fallen below the minimum level of effectiveness in its ability to control exhaust emission.

### 2) MISFIRE MONITORING

Misfire is defined as the lack of proper combustion in the cylinder due to the absence of spark, poor fuel metering, or poor compression. Any combustion that does not occur within the cylinder at the proper time is also a misfire. The misfire detection monitor detects fuel, ignition or mechanically induced misfires. The intent is to protect the catalyst from permanent damage and to alert the customer of an emission failure or an inspection maintenance failure by illuminating the MIL . When a misfire is detected, special software called freeze frame data enabled. The freeze frame data captures the operational state of the vehicle when a fault is detected from misfire detection monitor strategy.

### 3) FUEL SYSTEM MONITORING

The fuel system monitor is a self-test strategy within the PCM that monitors the adaptive fuel table The fuel control system uses the adaptive fuel table to compensate for normal variability of the fuel system components caused by wear or aging. During normal vehicle operation, if the fuel system appears biased lean or rich, the adaptive value table will shift the fuel delivery calculations to remove bias.

### 4) ENGINE COOLING SYSTEM MONITORING

The cooling system monitoring is a self-test strategy within the ECM that monitors ECTS (Engine Coolant Temperature Sensor) and thermostat about circuit continuity, output range, rationality faults.

### 5) O2 SENSOR MONITORING

OBD-II regulations require monitoring of the upstream Heated O2 Sensor (H2OS) to detect if the deterioration of the sensor has exceeded thresholds. An additional HO2S is located downstream of the Warm-Up Three Way Catalytic Converter (WU-TWC) to determine the efficiency of the catalyst.

Although the downstream H2OS is similar to the type used for fuel control, it functions differently. The downstream HO2S is monitored to determine if a voltage is generated. That voltage is compared to a calibrated acceptable range.

### 6) EVAPORATIVE EMISSION SYSTEM MONITORING

The EVAP. monitoring is a self-test strategy within the ECM that tests the integrity of the EVAP. system. The complete evaporative system detects a leak or leaks that cumulatively are greater than or equal to a leak caused by a 0.040 inch and 0.020 inch diameter orifice.

### 7) AIR CONDITIONING SYSTEM MONITORING

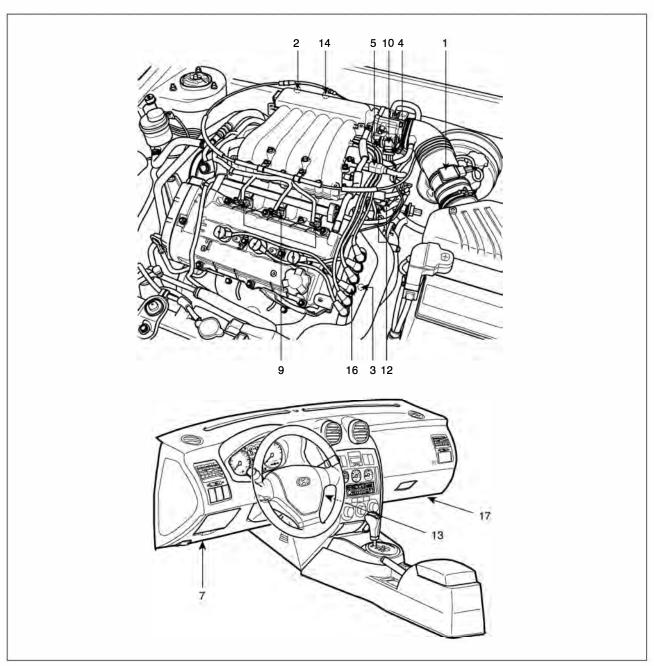
The A/C system monitoring is a self-test strategy within the ECM that monitors malfunction of all A/C system component at A/C ON.

### 8) COMPREHENSIVE COMPONENTS MONITORING

The comprehensive components monitoring is a self-test strategy within the ECM that detects fault of any electronic powertrain components or system that provides input to the ECM and is not exclusively an input to any other OBD-II monitor.

FLA -20 FUEL SYSTEM

### COMPONENTS LOCATION EBD84BB0

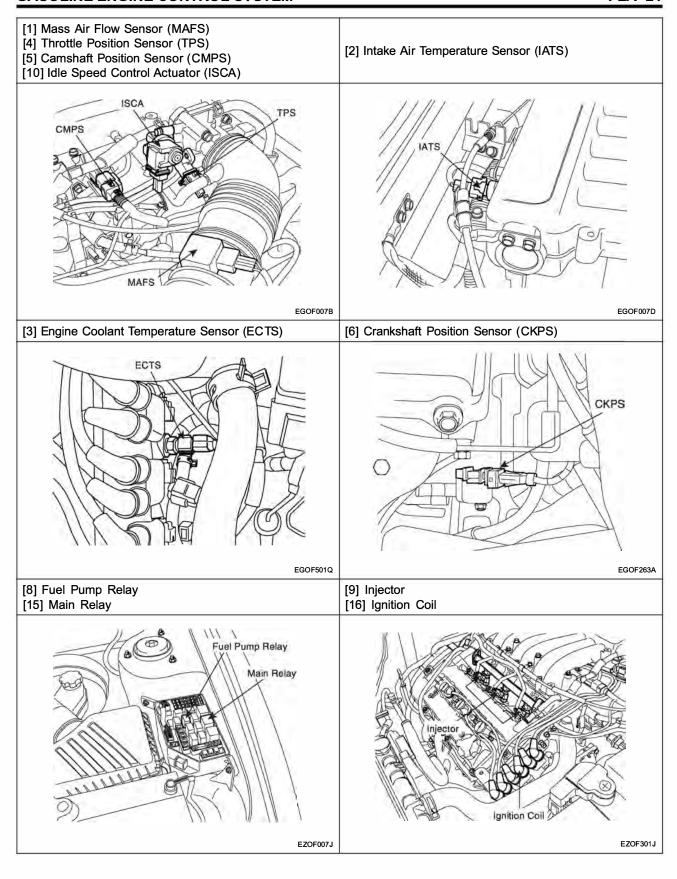


- 1. Mass Air Flow Sensor (MAFS)
- 2. Intake Air Temperature Sensor (IATS)
- 3. Engine Coolant Temperature Sensor (ECTS)
- 4. Throttle Position Sensor (TPS)
- 5. Camshaft Position Sensor (CMPS)
- 6. Crankshaft Position Sensor (CKPS)
- 7. Diagnostic Link Connector (DLC)
- 8. Fuel Pump Relay

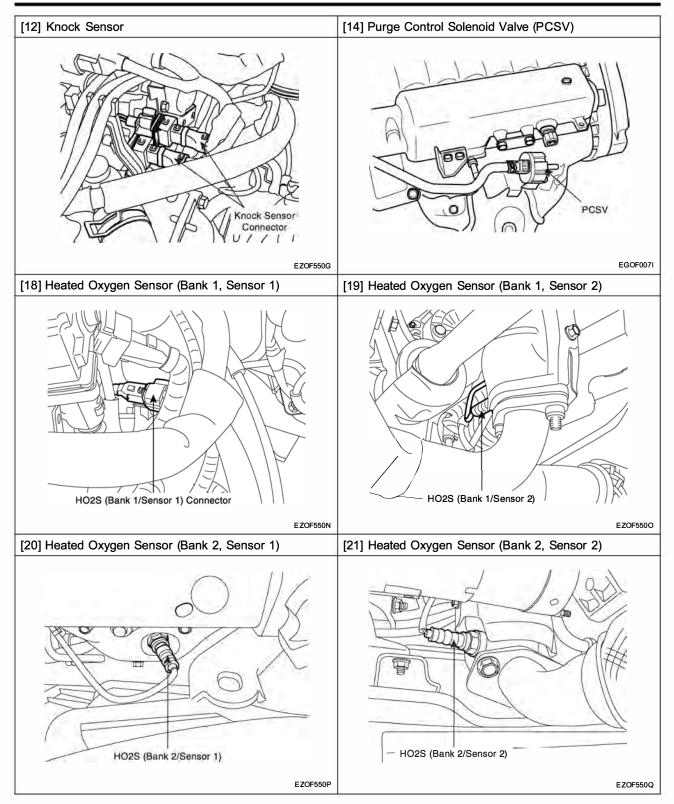
- 9. Injector
- 10. Idle Speed Control Actuator (ISCA)
- 11. Vehicle Speed Sensor (VSS)
- 12. Knock Sensor
- 13. Ignition Switch
- 14. Purge Control Solenoid Valve (PCSV)
- 15. Main Relay

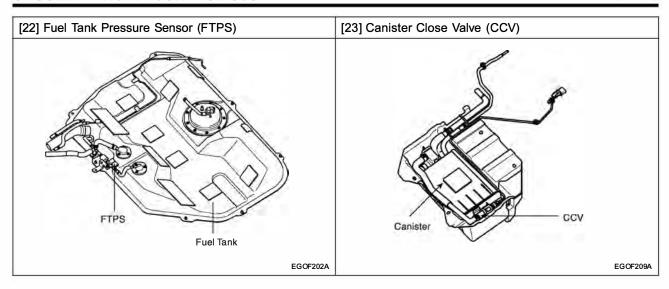
- 16. Ignition Coil
- 17. ECM
- 18. Heated Oxygen Sensor (Bank1, Sensor1)
- 19. Heated Oxygen seneor (Bank1, Sensor2)
- 20. Heated Oxygen seneor (Bank2, Sensor1)
- 21. Heated Oxygen seneor (Bank2, Sensor2)
- 22. Fuel Tank Pressure Sensor (FTPS)
- 23. Canister Close Valve (CCV)

EGOF213A



FLA -22 FUEL SYSTEM



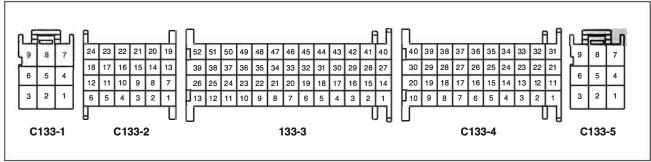


FLA -24 FUEL SYSTEM

# ENGINE CONTROL MODULE (ECM)

### ENGINE CONTROL MODULE (ECM) EE7210A1

### 1. ECM HARNESS CONNECTOR



EZOF132A

### 2. ECM TERMINAL FUNCTION

### **CONNECTOR [C133-1]**

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

### **CONNECTOR [C133-2]**

Pin No.	Description	Connected to	Remark
1	Heated Oxygen Sensor Heater (B1/S1) control	Heated Oxygen Sensor (B1/S1)	
2	Not connected		
3	Not connected		
4	Not connected		,
5	Not connected		
6	Not connected		
7	Heated Oxygen Sensor (B1/S2) Heater control	Heated Oxygen Sensor (B1/S2)	
8	Not connected		
9	Not connected		
10	Not connected		
11	Not connected		

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

### **CONNECTOR [C133-3]**

Air Flow Sensor (MAFS)  (shaft Position Sensor
shaft Position Sensor
S)
tle Position Sensor (TPS)
Air Flow Sensor (MAFS)
tle Position Sensor (TPS)
tle Position Sensor (TPS)
shaft Position Sensor S)

FLA -26 FUEL SYSTEM

Pin No.	Description	Connected to	Remark
22	Intake Air Temperature Sensor signal input	Intake Air Temperature Sensor (IATS)	
23	Intake Air Temperature Sensor ground	Intake Air Temperature Sensor (IATS)	
24	Engine Coolant Temperature Sensor signal input	Engine Coolant Temperature Sensor (ECTS)	
25	Engine Coolant Temperature Sensor ground	Engine Coolant Temperature Sensor (ECTS)	
26	Power Steering Load input	Power Steering Switch	
27	Not connected		
28	Not connected		
29	Knock Sensor #1 (Cyl. #1, 3, 5) signal input	Knock Sensor (KS) #1	
30	Knock Sensor #1 (Cyl. #1, 3, 5) ground	Knock Sensor (KS) #1	
31	Knock Sensor #2 (Cyl. #2, 4, 6) signal input	Knock Sensor (KS) #2	
32	Knock Sensor #2 (Cyl. #2, 4, 6) ground	Knock Sensor (KS) #2	
33	Injector (Cyl. 1) control output	Injector (Cyl. 1)	
34	Injector (Cyl. 2) control output	Injector (Cyl. 2)	
35	Injector (Cyl. 3) control output	Injector (Cyl. 3)	
36	Injector (Cyl. 4) control output	Injector (Cyl. 4)	
37	Injector (Cyl. 5) control output	Injector (Cyl. 5)	
38	Injector (Cyl. 6) control output	Injector (Cyl. 6)	
39	Not connected		
40	Not connected		
41	Not connected		
42	Purge Control Solenoid Valve PWM output	Purge Control Solenoid Valve (PCSV)	
43	Not connected		
44	Not connected		
45	Not connected		
46	Idle Speed Control Actuator PWM output 2 (OPEN)	Idle Speed Control Actuator (ISCA)	
47	Idle Speed Control Actuator PWM output 1 (CLOSE)	Idle Speed Control Actuator (ISCA)	
48	Knock Sensor Shield	Knock Sensor (KS)	
49	Not connected		
50	Not connected		
51	Not connected		
52	Not connected		

### CONNECTOR [C133-4]

Pin No.	Description	Connected to	Remark
1	Not connected		
2	Not connected		
3	Not connected		
4	Fuel Tank Pressure Sensor Supply	Fuel Tank Pressure Sensor (FTPS)	
5	Fuel Level Sensor Signal input	Fuel Level Sensor (FLS)	
6	Not connected		
7	Camshaft Position Sensor signal input	Camshaft Position Sensor (CMPS)	
8	Camshaft Position Sensor ground	Camshaft Position Sensor (CMPS)	
9	Not connected		
10	Fuel Pump Relay control output	Fuel Pump Relay	
11	Not connected		
12	Not connected		
13	Throttle Position PWM output	Other control modules	
14	Fuel Tank Pressure Sensor ground	Fuel Tank Pressure Sensor (FTPS)	
15	Fuel Level Sensor ground input	Fuel Level Sensor (FLS)	
16	Not connected		
17	Engine Speed signal output	Tachometer	
18	Cooling Fan Relay [Low] control output	Cooling Fan Relay	
19	Not connected		
20	Malfunction Indicating Lamp (MIL) output	Malfunction Indicating Lamp (MIL)	
21	Not connected		
22	Vehicle speed signal input	ABS Control Module	With ABS
23	Air conditioner switch [Low/High] signal input	Triple Switch	
24	Air conditioner switch signal input	Air Conditioner Switch	
25	Air conditioner switch [Middle] signal input	Triple Switch	
26	Not connected		
27	Not connected		
28	Not connected		
29	Air Conditioner Compressor Relay control output	Air Conditioner Compressor Relay	
30	Canister Close Valve control output	Canister Close Valve (CCV)	
31	Not connected		
32	Not connected		
33	Not connected		
	I .	I.	

FLA -28 FUEL SYSTEM

Pin No.	Description	Connected to	Remark
34	Fuel Tank Pressure Sensor signal input	Fuel Tank Pressure Sensor (FTPS)	
35	Not connected		
36	CAN [HIGH]	Other control modules (TCM, ABS, etc.)	
37	CAN [LOW]	Other control modules (TCM, ABS, etc.)	
38	Wheel Speed Sensor (WSS) ground	Wheel Speed Sensor (WSS)	Without ABS
39	Wheel Speed Sensor (WSS) signal input	Wheel Speed Sensor (WSS)	Williout ABS
40	Cooling Fan Relay [High] control output	Cooling Fan Relay	

### CONNECTOR [C133-5]

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

### 3. ECM TERMINAL INPUT/OUTPUT SIGNAL

### CONNECTOR [C133-1]

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

### CONNECTOR [C133-2]

Pin	Description	Туре	Vehicle State	Level	Test Result
1	Heated Oxygen Sensor Heater (B1/S1) control	PWM	Engine Run	DFGE501N  Freq. : 10Hz	14.24V 400mV 10.0Hz
2	Not connected				
3	Not connected				
4	Not connected				
5	Not connected				
6	Not connected		92		
7	Heated Oxygen Sensor (B1/S2) Heater control	PWM	Engine Run	Preq. : 10Hz	14.19V 400mV 10.0Hz
8	Not connected				:
9	Not connected				
10	Not connected				
11	Not connected				

FLA -30 FUEL SYSTEM

Pin	Description	Туре	Vehicle State	Level	Test Result
12	Not connected				
13	Heated Oxygen Sensor (B2/S1) Heater control	PWM	Engine Run	brge501N  Freq. : 10Hz	14.24V 400mV 10.0Hz
14	Heated Oxygen Sensor (B1/S1) signal input	Pulse	3000 rpm after warm up	0.8 V 0.1 V BFGE501R Freq. : 1.1Hz	0.8V 100mV 1.33Hz
15	Heated Oxygen Sensor (B2/S1) signal input	Pulse	3000 rpm after warm up	0.8 V 0.1 V BFGE501R Freq. : 1.1Hz	0.8V 100mV 1.09Hz
16	Heated Oxygen Sensor (B1/S2) signal input	Pulse	Racing	0.8 V 0.1 V BFGE501R Freq. ; 1.1Hz	0.8V 100mV -Hz
17	Fuel Consumption signal output				
18	Heated Oxygen Sensor (B2/S2) signal input	Pulse	Racing	0.8 V 0.1 V BFGE501R Freq. : 1.1Hz	
19	Heated Oxygen Sensor (B2/S2) Heater control	PWM	Engine Run	bFGE501N Freq. : 10Hz	14.01V 400mV 10.0Hz
20	Heated Oxygen Sensor (B1/S1) ground	Static Signal	3000 rpm after Warm up	0~0.4V	0V
21	Heated Oxygen Sensor (B2/S1) ground	Static Signal	3000 rpm after Warm up	0~0.4V	0V
22	Heated Oxygen Sensor (B1/S2) ground	Static Signal	3000 rpm after Warm up	0~0.4V	0V
23	Main Relay control output	DC	IG ON	0~1V	903mV
		1	IG OFF	Vbatt	13.47V
24	Heated Oxygen Sensor (B2/S2) ground	Static Signal	3000 rpm after Warm up	0~0.4V	0V

### CONNECTOR [C133-3]

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

FLA -32 FUEL SYSTEM

Pin	Description	Туре	Vehicle State	Level	Test Result
24	Engine Coolant Temperature	Analog	COLD(20℃)	3.44V	
	Sensor signal input		WARM(80℃)	1.25V	
25	Engine Coolant Temperature Sensor ground	GND		0~0.5V	4.7mV
26	Power Steering Load input	DC	Active	0~0.5V	-26mV
			Inactive	Vbatt	11.55V
27	Not connected				
28	Not connected				
29	Knock Sensor #1 (Cyl. #1,	Fre-	Knocking	-0.3 ~ 0.3V	224mV
	3, 5) signal input	quency	Normal	0V	0mV
30	Knock Sensor #1 (Cyl. #1, 3, 5) ground				
31	Knock Sensor #2 (Cyl. #2,	Fre-	Knocking	-0.3 ~ 0.3V	247mV
	4, 6) signal input	quency	Normal	0V	0mV
32	Knock Sensor #2 (Cyl. #2, 4, 6) ground				
33	Injector (Cyl. 1) control output				High: 14.01V Low: 185mV Idle: 5.86Hz 3000rpm: 25.04Hz
34	Injector (Cyl. 2) control output	1		Below 1 V  BFGE5010  (20 ~ 30Hz)	
35	Injector (Cyl. 3) control output	DO(D)A(A)	0000		
36	Injector (Cyl. 4) control output	DC(PWM)	3000rpm		
37	Injector (Cyl. 5) control output				
38	Injector (Cyl. 6) control output			(20 ~ 30HZ)	
39	Not connected				
40	Not connected				
41	Not connected			,	
42	Purge Control Solenoid Valve	PWM	Inactive	Vbatt	
	PWM output		Active (After warm up & racing)	BFGE501P Freq. : 20Hz	
43	Not connected				
44	Not connected				-
45	Not connected				
46	Idle Speed Control Actuator PWM output 2 (OPEN)	PWM	ldle	Vbatt Below 0.5 V BFGE501S Freq: 100Hz	High: 15.05V Low: 178mV Freq:100.0Hz

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

### CONNECTOR [C133-4]

Pin	Description	Туре	Vehicle State	Level	Test Result
1	Not connected				
2	Not connected				
3	Not connected				
4	Fuel Tank Pressure Sensor	DC	IG OFF	0 ~ 0.5V	0V
	Supply		IG ON	4.9 ~ 5.1V	5.05V
5	Fuel Level Sensor signal input	DC	IG ON	0 ~ Vbat	
6	Not connected				
7	Camshaft Position Sensor signal input	Fre-		1.5-5.5 V 0 - 0.5 V	High: 5.02V Low: 529mV
		quency	Idle	5.25~7.25Hz	ldle: 5.84Hz
			3000rpm	20~30Hz	3000rpm: 25.14Hz
8	Camshaft Position Sensor ground	GND		0~0.5V	
9	Not connected		,		
10	Fuel Pump Relay control output	DC	IG ON	Vbatt	13.08V
			Idle	0~0.5V	93mV
11	Not connected				
12	Not connected				
13	Throttle Position PWM output	Pulse		Below 0.5 V  BFGE501S  Freq.: 100Hz	High: 12.72V Low: 88mV Freq:100.0Hz
			C.T	5% DUTY	C.T:4.92%
			W.O.T	91% DUTY	WOT:90.92%
14	Fuel Tank Pressure Sensor ground	DC	Idle	0 ~ 0.5V	
15	Fuel Level Sensor ground	DC	Idle	0 ~ 0.5V	

FLA -34 FUEL SYSTEM

Pin	Description	Туре	Vehicle State	Level	Test Result
16	Not connected				
17	Engine Speed signal output	Pulse		Vbatt Below 0.5 V BFGE501S	High: 10.35V Low: 13.6mV
			Idle	40Hz	Idle: 35.25Hz
			3000 rpm	150Hz	3000rpm: 151.25Hz
18	Cooling Fan Relay [Low]	DC	FAN ON	0~0.5V	497mV
	control output		FAN OFF	Vbatt	13.95V
19	Not connected				
20	Malfunction Indicating Lamp	DC	MIL ON	0~0.5V	16.4mV
	(MIL) output		MIL OFF	Vbatt	13.54V
21	Not connected				
22	Vehicle speed signal input	Pulse	Vehicle Run(80km/h)	Below 0.5 V	High: 5.02V Low: 0.92mV
				From ABS: 250Hz	252Hz
		-		From VSS: 25Hz	-
23	Air conditioner switch [Low/High]	DC	S/W OFF	0~0.5V	0.02V
	signal input		S/W ON	Vbatt	12.22V
24	Air conditioner switch signal input	DC	S/W OFF	0~0.5V	0mV
			S/W ON	Vbatt	12.45V
25	Air conditioner switch [Middle]	DC	S/W OFF	0~0.5V	0mV
	signal input		S/W ON	Vbatt	12.22V
26	Not connected				
27	Not connected				
28	Not connected				
29	Air Conditioner Compressor	DC	Relay ON	0~0.5V	118mV
	Relay control output		Relay OFF	Vbatt	13.7V
			Inactive	Vbatt	
30	Canister Close Valve control output	PWM	Active (After warm up & racing)	BFGE501P Frea. : 10Hz	
31	Not connected				
32	Not connected				
33	Not connected				
34	Fuel Tank Pressure Sensor signal input	DC	Idle	0.4 ~ 4.6V	2.5V

Pin	Description	Туре	Vehicle State	Level	Test Result
35	Not connected				
36	CAN [HIGH]	DC	Recessive	2.0~3.0V	2.51V
		(256kbps)	Dominant	2.75~4.5V	3.56V
37	CAN [LOW]	DC	Recessive	2.0~3.0V	2.52V
		(256kbps)	Dominant	0.5~2.25V	1.51V
38	Wheel Speed Sensor (WSS) ground	GND		0V	
39	Wheel Speed Sensor (WSS) signal input		Run Vehicle		
40	Cooling Fan Relay [High] control output	DC	Relay ON	0V	543mV
			Relay OFF	Vbatt	13.98V

### CONNECTOR [C133-5]

Pin	Description	Туре	Vehicle State	Level	Test Result
1	Ignition coil #3 (Cyl. #3,6) control output	Pulse	Engine Run	Above 350 V  Vbatt  Below 1.6 V  BFGE501 M	Hi: 14.03V Lo: 0.78~1.13V Peak: 348V Idle: 11.70Hz 3000rpm: 50.2Hz
2	Ignition coil #2 (Cyl. #2,5) control output	Pulse	Engine Run	Above 350 V  Vbatt  Below 1.6 V  BFGE501 M	Hi: 13.98V Lo: 0.77~1.13V Peak: 352V Idle: 11.79Hz 3000rpm: 50.5Hz
3	Ignition coil #1 (Cyl. #1,4) control output	Pulse	Engine Run	Above 350 V  Vbatt  Below 1.6 V  BFGE501 M	Hi: 14.07V Lo: 0.77~1.09V Peak: 352V Idle: 11.88Hz 3000rpm: 49.8Hz
4	Not connected				
5	Ignition Coil shield	GND		0V	-0.2mV
6	Not connected				
7	Not connected				
8	Not connected				
9	Not connected				

FLA -36 FUEL SYSTEM

# ECM PROBLEM INSPECTION PROCEDURE E177C4BE

 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):  $1\Omega$  or less

- 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 CODE E1955259

DTC	Description	MIL	Page
U0101	Serial Communication Problem with TCM (Timeout)	•	FLA-41
P0030	HO2S Heater Control Circuit (Bank 1 / Sensor 1)	•	FLA-47
P0031	HO2S Heater Circuit low (Bank 1 / Sensor 1)	•	FLA-53
P0032	HO2S Heater Circuit high (Bank 1 / Sensor 1)	•	FLA-56
P0036	HO2S Heater Control Circuit (Bank 1 / Sensor 2)	•	FLA-59
P0037	HO2S Heater Circuit low (Bank 1 / Sensor 2)	•	FLA-65
P0038	HO2S Heater Circuit high (Bank 1 / Sensor 2)	•	FLA-68
P0050	HO2S Heater Control Circuit (Bank 2 / Sensor 1)	•	FLA-71
P0051	HO2S Heater Circuit low (Bank 2 / Sensor 1)	•	FLA-77
P0052	HO2S Heater Circuit high (Bank 2 / Sensor 1)	•	FLA-80
P0056	HO2S Heater Control Circuit (Bank 2 / Sensor 2)	•	FLA-83
P0057	HO2S Heater Circuit low (Bank 2 / Sensor 2)	•	FLA-89
P0058	HO2S Heater Circuit high (Bank 2 / Sensor 2)	•	FLA-92
P0101	Mass or Volume Air Flow Circuit Range / Performance Problem	•	FLA-95
P0102	Mass or Volume Air Flow circuit Low Input	•	FLA-101
P0103	Mass or Volume Air Flow circuit High Input	•	FLA-106
P0111	Intake Air Temperature Sensor 1 Circuit Range / Performance	•	FLA-110
P0112	Intake Air Temperature Sensor 1 Circuit Low Input	•	FLA-115
P0113	Intake Air Temperature Sensor 1 Circuit High Input	•	FLA-118
P0116	Engien Coolant Temperature Circuit Range / Performance	•	FLA-123
P0117	Engine Coolant Temperature Circuit Low Input	•	FLA-129
P0118	Engine Coolant Temperature Circuit Hgih Input	•	FLA-133
P0119	Engine Coolant Temperture Circuit Intermittent	•	FLA-138
P0121	Throttle / Pedal Position Sensor / Switch "A" Circuit Range/Performance	•	FLA-140
P0122	Throttle / Pedal Position Sensor / Switch "A" Circuit Low Input	•	FLA-146
P0123	Throttle / Pedal Position Sensor / Switch "A" Circuit Hgih Input	•	FLA-149
P0125	Insufficient Coolant Temperature for Closed Loop Fuel Control	•	FLA-153
P0128	Coolant Thermostat (Coolant Temp. below Thermostat Regulating Temp.)	•	FLA-159
P0130	HO2S Circuit (Bank 1 / Sensor 1)	•	FLA-162

FLA -38 FUEL SYSTEM

DTC	Description	MIL	Page
P0131	HO2S Circuit Low Input (Bank 1 / Sensor 1)	•	FLA-168
P0132	HO2S Circuit High Input (Bank 1 / Sensor 1)	•	FLA-171
P0133	HO2S Circuit Slow Response (Bank 1 / Sensor 1)	•	FLA-174
P0134	HO2S Circuit No Activity Detected (Bank 1 / Sensor 1)	•	FLA-178
P0136	HO2S Circuit (Bank 1 / Sensor 2)	•	FLA-181
P0137	HO2S Circuit Low Input (Bank 1 / Sensor 2)	•	FLA-186
P0138	HO2S Circuit High Input (Bank 1 / Sensor 2)	•	FLA-189
P0139	HO2S Circuit Slow Response (Bank 1 / Sensor 2)	•	FLA-192
P0140	HO2S Circuit No Activity Detected (Bank 1 / Sensor 2)	•	FLA-197
P0150	HO2S Circuit (Bank 2 / Sensor 1)	•	FLA-200
P0151	HO2S Circuit Low Input (Bank 2 / Sensor 1)	•	FLA-206
P0152	HO2S Circuit High Input (Bank 2 / Sensor 1)	•	FLA-209
P0153	HO2S Circuit Slow Response (Bank 2 / Sensor 1)	•	FLA-212
P0154	HO2S Circuit No Activity Detected (Bank 2 / Sensor 1)	•	FLA-217
P0156	HO2S Circuit Malfunction (Bank 2 / Sensor 2)	•	FLA-220
P0157	HO2S Circuit Low Input (Bank 2 / Sensor 2)	•	FLA-225
P0158	HO2S Circuit High Input (Bank 2 / Sensor 2)	•	FLA-228
P0159	HO2S Circuit Slow Response (Bank 2 / Sensor 2)	•	FLA-231
P0160	HO2S Circuit No Activity Detected (Bank 2 / Sensor 2)	•	FLA-236
P0170	Fuel Trim (Bank 1)	•	FLA-239
P0171	System Too Lean (Bank 1)	•	FLA-244
P0172	System Too Rich (Bank 1)	•	FLA-249
P0173	Fuel Trim (Bank 2)	•	FLA-239
P0174	System Too Lean (Bank 2)	•	FLA-244
P0175	System Too Rich (Bank 2)	•	FLA-249
P0230	Fuel Pump Circuit Malfunction	<b>A</b>	FLA-254
P0261	Cylinder 1 - Injector Circuit Low	•	FLA-259
P0262	Cylinder 1 - Injector Circuit High	•	FLA-265
P0264	Cylinder 2 - Injector Circuit Low	•	FLA-259
P0265	Cylinder 2 - Injector Circuit High	•	FLA-265
P0267	Cylinder 3 - Injector Circuit Low	•	FLA-259
P0268	Cylinder 3 - Injector Circuit High	•	FLA-265
P0270	Cylinder 4 - Injector Circuit Low	•	FLA-259

DTC	Description	MIL	Page
P0271	Cylinder 4 - Injector Circuit High	•	FLA-265
P0273	Cylinder 5 - Injector Circuit Low	•	FLA-259
P0274	Cylinder 5 - Injector Circuit High	•	FLA-265
P0276	Cylinder 6 - Injector Circuit Low	•	FLA-259
P0277	Cylinder 6 - Injector Circuit High	•	FLA-265
P0300	Random / Multiple Cylinder Misfire Detected	•	FLA-269
P0301	Cylinder 1 - Misfire detected	•	FLA-277
P0302	Cylinder 2 - Misfire detected	•	FLA-277
P0303	Cylinder 3 - Misfire detected	•	FLA-277
P0304	Cylinder 4 - Misfire detected	•	FLA-277
P0305	Cylinder 5 - Misfire detected	•	FLA-277
P0306	Cylinder 6 - Misfire detected	•	FLA-277
P0315	Segment Time Acquisition Incorrect	<b>A</b>	FLA-283
P0325	Knock Sensor 1 Circuit	<b>A</b>	FLA-287
P0330	Knock Sensor 2 Circuit	<b>A</b>	FLA-293
P0335	Crankshaft Position Sensor A Circuit	•	FLA-297
P0340	Camshaft Position Sensor A Circuit Malfuntion (Signal Sensor)	•	FLA-304
P0350	Ignition Coil Primary / Secondary Circuit	<b>A</b>	FLA-310
P0351	Ignition Coil 'A' Primary / Secondary Circuit	<b>A</b>	FLA-317
P0352	Ignition Coil 'B' Primary / Secondary Circuit	<b>A</b>	FLA-317
P0353	Ignition Coil 'C' Primary / Secondary Circuit	<b>A</b>	FLA-317
P0354	Ignition Coil 'D' Primary / Secondary Circuit	<b>A</b>	FLA-317
P0355	Ignition Coil 'E' Primary / Secondary Circuit	<b>A</b>	FLA-317
P0356	Ignition Coil 'F' Primary / Secondary Circuit	<b>A</b>	FLA-317
P0420	Catalyst System Efficiency below Threshold (Bank 1)	•	FLA-321
P0430	Catalyst System Efficiency below Threshold (Bank 2)	•	FLA-321
P0441	Evap. Emission System Incorrect Purge Flow	•	FLA-324
P0442	Evap. Emission System - Leak Detected (Small Leak)	•	FLA-328
P0444	Evap. Emission System - Purge Ctrl. Valve Circuit Open	•	FLA-334
P0445	Evap. Emission System - Purge Ctrl. Valve Circuit Shoted	•	FLA-339
P0447	Evap. Emission System - Vent Control Circuit Open	•	FLA-342
P0448	Evap. Emission System - Vent Control Circuit Shorted	•	FLA-347
P0449	Evap. Emission System - Vent valve / Solenoid circuiit	•	FLA-350

FLA -40 FUEL SYSTEM

DTC	Description	MIL	Page
P0451	Evap. Emission System - Pressure Sensor Rage / Performance	•	FLA-352
P0452	Evap. Emission System - Pressure Sensor Low Input	•	FLA-356
P0453	Evap. Emission System - Pressure Sensor High Input	•	FLA-360
P0454	Evap. Emission System - Pressure Sensor Intermittent	•	FLA-363
P0455	Evap. Emission System - Leak Detected (Large Leak)	•	FLA-366
P0456	Evap. Emission System - Leak Detected (Very Small Leak)	•	FLA-328
P0461	Fuel Level Sensor "A" Circuit Range / Performance	•	FLA-372
P0462	Fuel Level Sensor "A" Circuit Low Input	<b>A</b>	FLA-376
P0463	Fuel Level Sensor "A" Circuit Hign Input	<b>A</b>	FLA-380
P0464	Fuel Level Sensor "A" Circuit Intermittent	<b>A</b>	FLA-383
P0501	Vehicle Speed Sensor "A" Range / Performancd	•	FLA-385
P0506	Idle Air Control System - RPM lower than expected	•	FLA-392
P0507	Idle Air Control System - RPM higher than expected	•	FLA-396
P0551	Power Steering Pressure Sensor / Switch Circuit Range / Performance	<b>A</b>	FLA-399
P0560	System Voltage	•	FLA-403
P0562	System Voltage Low	•	FLA-408
P0563	System Voltage High	•	FLA-407
P0605	Internal Control Module Read Only Memory (ROM) Error	•	FLA-410
P0630	VIN not Programmed or Incompatible - ECM/PCM	•	FLA-413
P0650	Malfunction Indicator Lamp (MIL) Control Circuit	<b>A</b>	FLA-416
P0700	TCM Request for MIL On	•	FLA-419
P1505	Idle Charge Actuator Signal Low of Coil #1	•	FLA-420
P1506	Idle Charge Actuator Signal High of Coil #1	•	FLA-426
P1507	Idle Charge Actuator Signal Low of Coil #2	•	FLA-429
P1508	Idle Charge Actuator Signal High of Coil #2	•	FLA-433
P1642	Non-Immobilizer-EMS connected to an Immobilizer	<b>A</b>	-

# NOTE

# DTC U0101 SERIAL COMMUNICATION PROBLEM WITH TCU (TIMEOUT)

#### GENERAL DESCRIPTION EA37BA9D

A communication line exists between the Engine Control Module(ECM) and the Transaxle Control Module(TCM). The communication is through a Control Area Network(CAN). Without CAN communication, an independent pin and wiring is needed to receive a sensor information from a ECM. The more information to be communicated, the more wirings is required. In case of CAN communication type, all the information need to be communicated among control modules such as ECM and TCM use CAN lines.

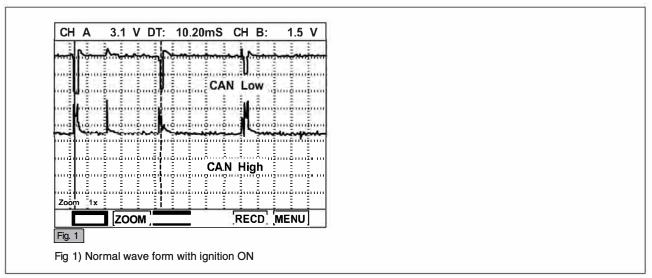
#### DTC DESCRIPTION E65CD2CC

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

#### DTC DETECTING CONDITION E2C3B1CA

		r	
Item	Detecting Condition	Possible Cause	
DTC Strategy	Missing messages TCU		
Enable Conditions	Battery voltage > 10V     Engine speed > 256 rpm	Open or short in CAN line	
Threshold Value	Time exceeded without message = 0.5 sec.	Contact resistance in connectors	
Diagnostic Time	• 1 sec.		
MIL On Condition	2 Driving Cycles		

#### SIGNAL WAVEFORM E9FE9A9F



KU01012

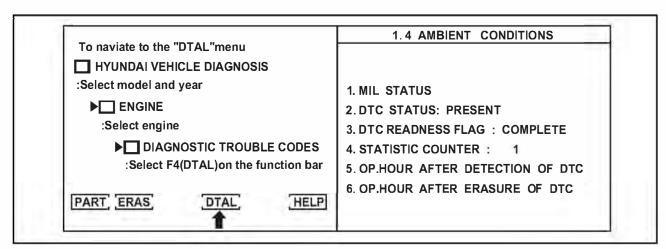
#### MONITOR DTC STATUS E9E8D477

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

FLA -42 FUEL SYSTEM

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.



EDTC GK

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



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

YES

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



▶ Go to next step as below.

#### TERMINAL AND CONNECTOR INSPECTION EAESDCEA

- 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.
- 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

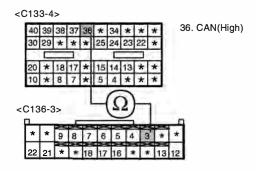
NO

▶ Go to "CAN High line Inspection" procedure.

#### CAN HIGH LINE INSPECTION EEDIABA8

- 1. Check for Open in harness
  - 1) Ignition "OFF".
  - 2) Disconnect ECM and TCM connectors.
  - 3) Measure resistance between terminals 36 of the ECM harness connector and 3 of the TCM harness connector.

Specification : Approx.  $0\Omega$ 



KU01013

4) Is resistance within the specification?



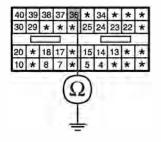
▶ Go to next step as below.

NO

- ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.
- 2. Check for short to ground in harness.
  - 1) Measure resistance between terminal 36 of the ECM harness connector and chassis ground.

Specification: Infinite

<C133-4>



36. CAN(High)

KU01014

FLA -44 FUEL SYSTEM

2) Is resistance within the specification?



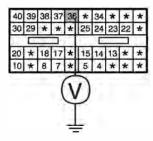
▶ Go to next step as below



- ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.
- 3. Check for short to battery in harness.
  - 1) Reconnect the ECM connector.
  - 2) Ignition "ON" & Engine "OFF".
  - 3) Measure voltage between terminal 36 of the ECM harness connector and chassis ground.

Specification: Approx. 0V

<C133-4>



36. CAN(High)

KU01015

4) Is voltage within the specification?



▶ Go to "CAN Low Line Inspection" procedure

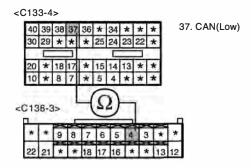


▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

### CAN LOW LINE INSPECTION EC695BC3

- 1. Check for Open in harness.
  - 1) Ignition "OFF".
  - 2) Disconnect ECM and TCM connectors.
  - 3) Measure resistance between terminals 37 of the ECM harness connector and 4 of the TCM harness connector.

Specification : Approx.  $0\Omega$ 



KU01016

4) Is resistance within the specification?



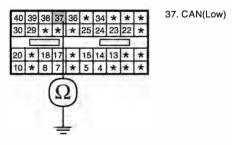
▶ Go to next step as below.



- ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.
- 2. Check for short to ground in harness.
  - 1) Measure resistance between terminal 37 of the ECM harness connector and chassis ground.

Specification: Infinite

<C133-4>



KU01017

2) Is resistance within the specification?



▶ Go to next step as below



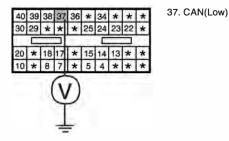
- ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.
- 3. Check for short to battery in harness.
  - 1) Reconnect the ECM connector.
  - 2) Ignition "ON" & Engine "OFF".

FLA -46 FUEL SYSTEM

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

Specification: Approx. 0V

<C133-4>



KU01018

4) Is voltage within the specification?



▶ 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.



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

#### VERIFICATION OF VEHICLE REPAIR ECFOA511

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"?



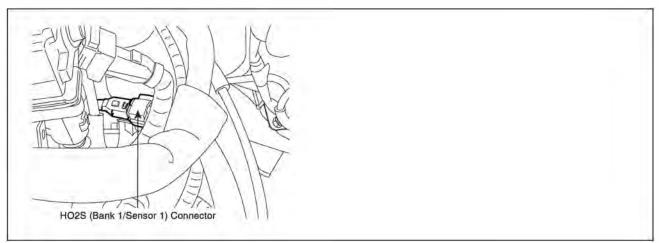
System performing to specification at this time. Clear the DTC.



Go to the applicable troubleshooting procedure.

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

#### CONNECTOR CONFIGURATION E3F356C2



EGOF250A

#### GENERAL DESCRIPTION E40B9E4F

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 ECM provides a pulse width modulated control circuit to adjust current through the heater. When the HO2S is cold, the value of the resistance is low and the current in the circuit is high. On the contrary, if the temperature in the resistor of the sensor rises, the current drops gradually.

#### DTC DESCRIPTION E31F2DA9

The ECM determines if a front HO2S heater fault has occurred and sets DTC P0030 if the front HO2S heater control driver inside the ECM 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. The ECM illuminates the MIL on the second consecutive driving cycle that the diagnostic runs and fails.

#### DTC DETECTING CONDITION EEB2C202

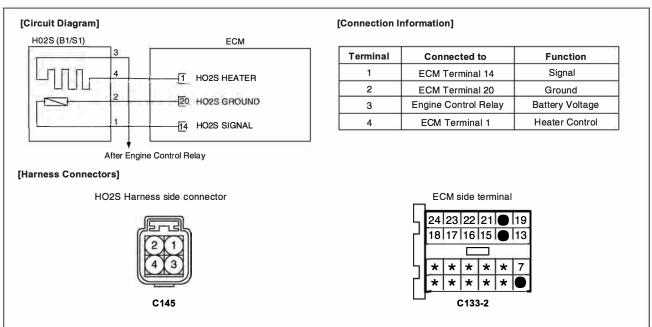
	(c)	- 20	
Item	Detecting Condition	Possible Cause	
DTC Strategy	Evaluate O2 sensor element temperature via measuring element resistance		
Enable Conditions	Sensor preheating and full heating phases finished Time after start elapsed: 240 sec. 11V < Battery voltage <16V 1% < Heater power < 99% Exhaust gas temp.model < 580℃(1076°F)	Related fuse blown or missing     Heater control circuit open or short     Power supply circuit open or short     Contact resistance in connectors	
Threshold Value	• O2 sensor element resistance > 1200Ω	Faulty HO2S	
Diagnostic Time	• 5 min.		
Fail Safe	Heater open loop control		
MIL On Condition	2 Driving Cycles		

FLA -48 FUEL SYSTEM

#### SPECIFICATION EOCCEFDE

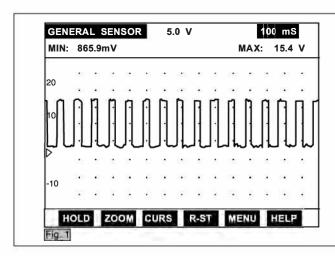
LICOC Haster	Normal Parameter
HO2S Heater	20~24℃(68~75°F)
Heater Resistance	Approx. 3~4Ω

#### SCHEMATIC DIAGRAM EFFABA49



K00301

#### SIGNAL WAVEFORM EF3E1F0



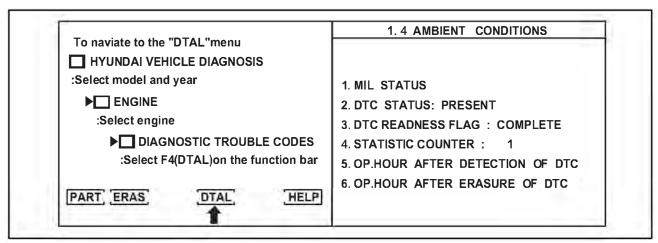
The HO2S requires a minimum temperature to provide a closed loop fuel control system. So the HO2S contains a heater element to reduce its warm-up time and ensure its performance during all driving conditions. The HO2S heater should always be ON after engine start. The ECM controls this heater element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

K00302

#### MONITOR DTC STATUS EA3F4F8A

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

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



EDTC\_GK

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

## **NOTE**

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

## YES

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

# NO

▶ Go to next step as below.

#### TERMINAL AND CONNECTOR INSPECTION EFIEED79

- 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.

FLA -50 FUEL SYSTEM

#### POWER SUPPLY CIRCUIT INSPECTION E987DB9B

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

Specification: Approx. B+

5. Is voltage within the specification?



▶ Go to "Control Circuit Inspection" procedure.

NO

- ▶ Check for an open in the power 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 ECAEEF15

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

Specification : Approx.  $0\Omega$ 

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

Specification: Approx. 0V

3) Is voltage within the specification?

YES

▶ Go to "Component Inspection" procedure.

NO

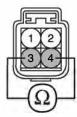
▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

#### COMPONENT INSPECTION E018FD0D

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

Specification :  $3\sim4\Omega$  [at  $20\sim24^{\circ}C(68\sim75^{\circ}F)$ ]

<C145>



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

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.

K00307

FLA -52 FUEL SYSTEM



▶ 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 E679CDBD

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"?



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



Go to the applicable troubleshooting procedure.

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

COMPONENT LOCATION EDEF9A15

Refer to DTC P0030.

GENERAL DESCRIPTION E4E215E6

Refer to DTC P0030.

DTC DESCRIPTION EBA4EBF5

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

#### DTC DETECTING CONDITION EABF4864

Item	Detecting Condition	Possible Cause
DTC Strategy	Driver Stage Check	
Enable Conditions	Battery voltage > 10V     1% < Heater power < 99%	Related fuse blown or missing     Open or short to ground in power
Threshold Value	Short to ground	supply or control harness
Diagnostic Time	• 20 sec.	<ul><li>Contact resistance in connectors</li><li>Faulty HO2S</li></ul>
Fail Safe	Heater open loop control	radity 11023
MIL On Condition	2 Driving Cycles	

SPECIFICATION ECDD2A3D

Refer to DTC P0030.

SCHEMATIC DIAGRAM EF54DC88

Refer to DTC P0030.

SIGNAL WAVEFORM EAEBA65A

Refer to DTC P0030.

MONITOR DTC STATUS EBFB5F0D

Refer to DTC P0030.

TERMINAL AND CONNECTOR INSPECTION E25DE19E

Refer to DTC P0030.

POWER SUPPLY CIRCUIT INSPECTION E9A4C635

1. Ignition "OFF".

FLA -54 FUEL SYSTEM

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

Specification: Approx. B+

5. Is voltage within the specification?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

- ▶ Check for an open in the power 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 E5D2B5AF

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

Specification: Approx. 0Ω

4) Is resistance within the specification?

YES

▶ Go to next step as below.

NO

- ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.
- 2. Check for short to ground in control circuit.
  - 1) Measure resistance between terminal 4 of the HO2S heater harness connector and chassis ground.

Specification: infinite

2) Is resistance within the specification?

YES

▶ Go to "Component Inspection" procedure.

NO

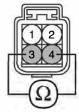
▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

#### COMPONENT INSPECTION EBBD3493

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

Specification :  $3\sim4\Omega$  [at  $20\sim24^{\circ}C(68\sim75^{\circ}F)$ ]

<C145>



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

K00307

2. Is resistance within the specification?



▶ 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.



▶ 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 EBED4705

Refer to DTC P0030.

FLA -56 FUEL SYSTEM

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

#### COMPONENT LOCATION EE7DF3EC

Refer to DTC P0030.

#### GENERAL DESCRIPTION EDA2C8A2

Refer to DTC P0030.

#### DTC DESCRIPTION E2FE6BEF

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

#### DTC DETECTING CONDITION E2424FE1

Item	Detecting Condition	Possible Cause
DTC Strategy	Driver Stage Check	
Enable Conditions	Battery voltage > 10V     1% < Heater power < 99%	Open or short to battery in
Threshold Value	Short to Battery or Line Break	control harness  Contact resistance in connectors
Diagnostic Time	• 20 sec.	• Faulty HO2S
Fail Safe	Heater open loop control	
MIL On Condition	2 Driving Cycles	

#### SPECIFICATION EBCE1312

Refer to DTC P0030.

#### SCHEMATIC DIAGRAM E62FFE96

Refer to DTC P0030.

#### SIGNAL WAVEFORM E22CB7AD

Refer to DTC P0030.

#### MONITOR DTC STATUS E5C47976

Refer to DTC P0030.

#### TERMINAL AND CONNECTOR INSPECTION E6A2AEAE

Refer to DTC P0030.

#### CONTROL CIRCUIT INSPECTION EA4B426C

1. Check for open in control harness

- 1) Ignition "OFF".
- 2) Disconnect HO2S and ECM connectors.
- 3) Measure resistance between terminals 4 of the HO2S heater harness connector and 1 of the ECM harness connector.

Specification: Approx 0Ω

4) Is resistance within the specification?



▶ Go to next step as below.



- ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.
- 2. Check for short to battery in control circuit.
  - 1) Reconnect the ECM connector.
  - 2) Ignition "ON" & Engine "OFF".
  - 3) Measure voltage between terminal 4 of the HO2S heater harness connector and chassis ground.

Specification: Approx. 0V

4) Is voltage within the specification?

YES

▶ Go to "Component Inspection" procedure.

NO

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

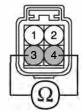
#### COMPONENT INSPECTION EFFADIBC

- 1. Ignition "OFF".
- 2. Measure resistance between terminals 3 and 4 of the sensor connector (Component side).

Specification :  $3\sim4\Omega$  [at  $20\sim24^{\circ}C(68\sim75^{\circ}F)$ ]

FLA -58 FUEL SYSTEM

<C145>



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

K00307

3. Is resistance within the specification?



▶ 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.



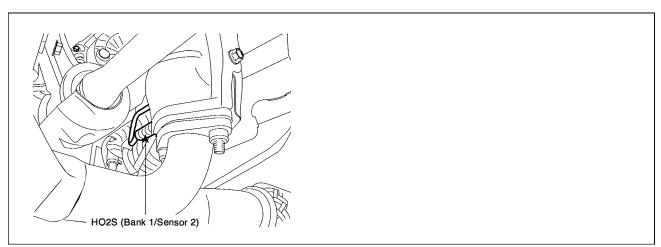
▶ Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S and then go to "Verification of Vehicle Repair" procedure.

#### VERIFICATION OF VEHICLE REPAIR ED21BB2B

Refer to DTC P0030.

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

#### COMPONENT LOCATION EE16170D



EGOF251A

#### GENERAL DESCRIPTION E9B3A355

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

#### DTC DESCRIPTION EC3114C3

The ECM determines rear HO2S heater fault and sets DTC P0036 if measured rear HO2S resistance is lower than the predetermined threshold. The ECM illuminates the MIL on the second consecutive driving cycle that the diagnostic runs and fails.

#### DTC DETECTING CONDITION E273A6CF

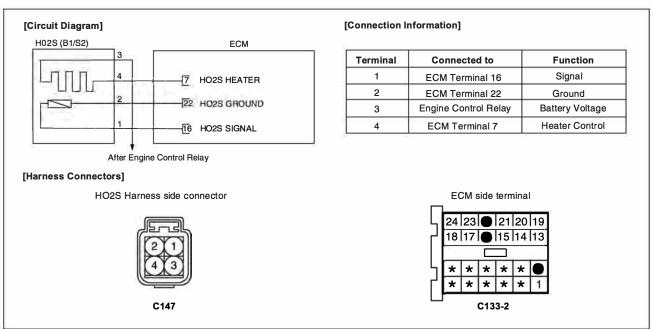
Item	Detecting Condition	Possible Cause
DTC Strategy	Evaluate O2 sensor element temperature via measuring element resistance	
Enable Conditions	<ul> <li>Sensor preheating and full heating phases finished</li> <li>Time after start elapsed: 180 sec.</li> <li>11V &lt; Battery voltage &lt;16V</li> <li>1% &lt; Heater power &lt; 99%</li> <li>Exhaust gas temperature model &lt; 520°C (968°F)</li> </ul>	<ul> <li>Related fuse blown or missing</li> <li>Heater control circuit open or short</li> <li>Power supply circuit open or short</li> <li>Contact resistance in connectors</li> </ul>
Threshold Value	• O2 sensor element resistance > 2900Ω	• Faulty HO2S
Diagnostic Time	• 5 min.	
Fail Safe	Heater open loop control	
MIL On Condition	2 Driving Cycles	

FLA -60 FUEL SYSTEM

#### SPECIFICATION ECE427AS

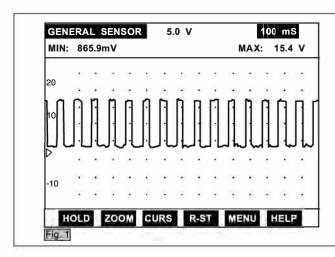
LICOC Harter	Normal Parameter
HO2S Heater	20~24℃(68~75°F)
Heater Resistance	Approx. 3~4Ω

#### SCHEMATIC DIAGRAM E2F2523A



K00361

#### SIGNAL WAVEFORM E8573



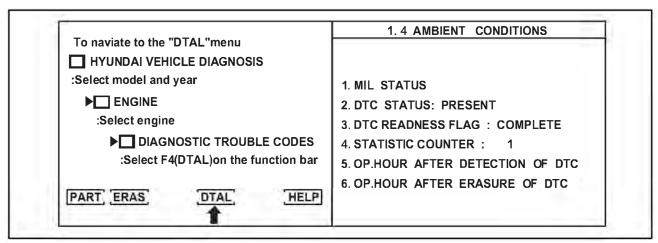
The HO2S requires a minimum temperature to provide a closed loop fuel control system. So the HO2S contains a heater element to reduce its warm-up time and ensure its performance during all driving conditions. The HO2S heater should always be ON after engine start. The ECM controls this heater element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

K00302

#### MONITOR DTC STATUS E1FBD6FA

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

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



EDTC\_GK

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

## **NOTE**

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

## YES

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

# NO

▶ Go to next step as below.

#### TERMINAL AND CONNECTOR INSPECTION E283C83F

- 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.

FLA -62 FUEL SYSTEM

#### POWER SUPPLY CIRCUIT INSPECTION EF54163C

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

Specification: Approx. B+

5. Is voltage within the specification?



▶ Go to "Control Circuit Inspection" procedure.

NO

- ▶ Check for an open in the power 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 E110EE3A

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

Specification: Approx.  $0\Omega$ 

3) Is resistance within the specification?



▶ 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?



▶ 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) Ignition "ON" & Engine "OFF".
  - 2) Measure voltage between terminal 4 of the HO2S heater harness connector and chassis ground.

Specification: Approx. 0V

3) Is voltage within the specification?



▶ Go to "Component Inspection" procedure

NO

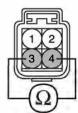
▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

#### COMPONENT INSPECTION EB363EFC

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

Specification :  $3\sim4\Omega$  [at  $20\sim24^{\circ}C(68\sim75^{\circ}F)$ ]

<C147>



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

K00367

2. Is resistance within the specification?

YES

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

NO

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

FLA -64 FUEL SYSTEM

#### VERIFICATION OF VEHICLE REPAIR E5CACF72

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"?



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



Go to the applicable troubleshooting procedure.

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

COMPONENT LOCATION E3FC6E0F

Refer to DTC P0036.

GENERAL DESCRIPTION E8404890

Refer to DTC P0036.

DTC DESCRIPTION ED811CDD

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

#### DTC DETECTING CONDITION E9AD3F8D

Item	Detecting Condition	Possible Cause	
DTC Strategy	Driver Stage Check		
Enable Conditions	Battery voltage > 10V     1% < Heater power < 99%	Related fuse blown or missing     Open or short to ground in power	
Threshold Value	Short to ground	supply or control harness	
Diagnostic Time	• 20 sec.	<ul><li>Contact resistance in connectors</li><li>Faulty HO2S</li></ul>	
Fail Safe	Heater open loop control	- Faulty HO23	
MIL On Condition	2 Driving Cycles		

#### SPECIFICATION ED2AF9EC

Refer to DTC P0036.

SCHEMATIC DIAGRAM E41BB91C

Refer to DTC P0036.

SIGNAL WAVEFORM EED07FAD

Refer to DTC P0036.

MONITOR DTC STATUS ECF2FD8E

Refer to DTC P0036.

TERMINAL AND CONNECTOR INSPECTION E23986FC

Refer to DTC P0036.

POWER SUPPLY CIRCUIT INSPECTION E6DF4CCE

1. Ignition "OFF".

FLA -66 FUEL SYSTEM

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

Specification: Approx. B+

5. Is voltage within the specification?

YES

▶ Go to "Control Circuit Inspection" procedure.

NO

- ▶ Check for an open in the power 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 E5B689ED

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

Specification : Approx.  $0\Omega$ 

3) Is resistance within the specification?

YES

▶ Go to next step as below.

NO

- ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.
- 2. Check for short to ground in control circuit.
  - 1) Measure resistance between terminal 4 of the HO2S heater harness connector and chassis ground.

Specification: infinite

2) Is resistance within the specification?

YES

▶ Go to "Component Inspection" procedure.

NO

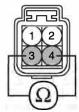
▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

#### COMPONENT INSPECTION

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

Specification :  $3\sim4\Omega$  [at  $20\sim24^{\circ}C(68\sim75^{\circ}F)$ ]

<C147>



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

K00367

2. Is resistance within the specification?



▶ 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.



▶ 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 EFACFB8E

Refer to DTC P0036.

FLA -68 FUEL SYSTEM

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

#### COMPONENT LOCATION EDCF7F05

Refer to DTC P0036.

#### GENERAL DESCRIPTION ECF1023D

Refer to DTC P0036.

#### DTC DESCRIPTION EDEBED9D

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

#### DTC DETECTING CONDITION ECAC4170

Item	Detecting Condition	Possible Cause
DTC Strategy	Driver Stage Check	
Enable Conditions	Battery voltage > 10V     1% < Heater power < 99%	Open or short to battery in control harness     Contact resistance in connectors     Faulty HO2S
Threshold Value	Short to Battery or Line Break	
Diagnostic Time	• 20 sec.	
Fail Safe	Heater open loop control	
MIL On Condition	2 Driving Cycles	

#### SPECIFICATION E3C0EC03

Refer to DTC P0036.

#### SCHEMATIC DIÁGRAM EE676394

Refer to DTC P0036.

#### SIGNAL WAVEFORM ED65FF89

Refer to DTC P0036.

#### MONITOR DTC STATUS E67F2BBB

Refer to DTC P0036.

#### TERMINAL AND CONNECTOR INSPECTION E1A8E04F

Refer to DTC P0036.

#### CONTROL CIRCUIT INSPECTION E0ABA262

1. Check for open in control harness

- 1) Ignition "OFF".
- 2) Disconnect HO2S and ECM connectors.
- 3) Measure resistance between terminals 4 of the HO2S heater harness connector and 7 of the ECM harness connector.

Specification : Approx.  $0\Omega$ 

4) Is resistance within the specification?



▶ Go to next step as below.



- ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.
- 2. Check for short to power in control circuit.
  - 1) Reconnect the ECM connector.
  - 2) Ignition "ON" & Engine "OFF".
  - 3) Measure voltage between terminal 4 of the HO2S heater harness connector and chassis ground.

Specification: Approx. 0V

4) Is voltage within the specification?

YES

▶ Go to "Component Inspection" procedure.

NO

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

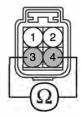
#### COMPONENT INSPECTION ED76C9AA

- 1. Ignition "OFF".
- 2. Measure resistance between terminals 3 and 4 of the sensor connector (Component side).

Specification :  $3\sim4\Omega$  [at  $20\sim24^{\circ}C(68\sim75^{\circ}F)$ ]

FLA -70 FUEL SYSTEM

<C147>



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

K00367

3. Is resistance within the specification?



▶ 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.



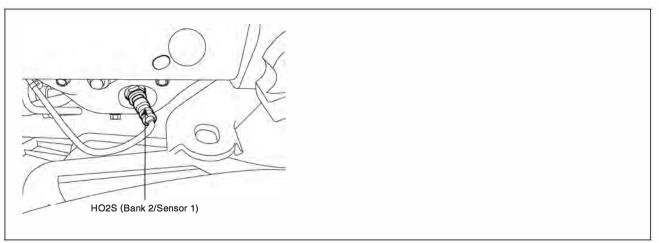
▶ Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S and then go to "Verification of Vehicle Repair" procedure.

#### VERIFICATION OF VEHICLE REPAIR EFDFF76D

Refer to DTC P0036.

## DTC P0050 HO2S HEATER CONTROL CIRCUIT (BANK 2 / SENSOR 1)

#### COMPONENT LOCATION EGFDDCCB



EGOF252A

#### GENERAL DESCRIPTION EE7652F4

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 ECM provides a pulse width modulated control circuit to adjust current through the heater. When the HO2S is cold, the value of the resistance is low and the current in the circuit is high. On the contrary, if the temperature in the resistor of the sensor rises, the current drops gradually.

#### DTC DESCRIPTION E413FAA3

The ECM determines if a front HO2S heater fault has occurred and sets DTC P0050 if the front HO2S heater control driver inside the ECM 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. The ECM illuminates the MIL on the second consecutive driving cycle that the diagnostic runs and fails.

#### DTC DETECTING CONDITION E57BAD86

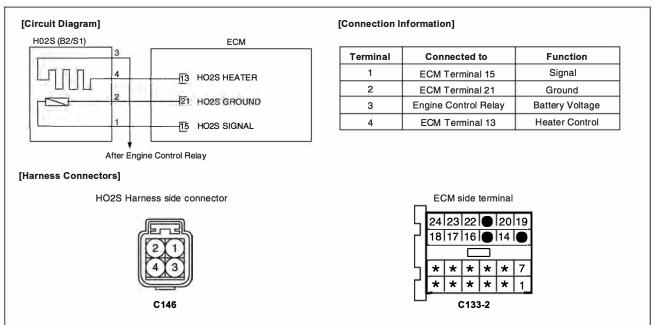
10.1	91	27
Item	Detecting Condition	Possible Cause
DTC Strategy	Evaluate O2 sensor element temperature via measuring element resistance	Related fuse blown or missing     Heater control circuit open or short     Power supply circuit open or short     Contact resistance in connectors
Enable Conditions	<ul> <li>Sensor preheating and full heating phases finished</li> <li>Time after start elapsed: 240 sec.</li> <li>11V &lt; Battery voltage &lt;16V</li> <li>1% &lt; Heater power &lt; 99%</li> <li>Exhaust gas temp.model &lt; 580 °C (1076°F)</li> </ul>	
Threshold Value	• O2 sensor element resistance > 1200Ω	Faulty HO2S
Diagnostic Time	• 5 min.	
Fail Safe	Heater open loop control	
MIL On Condition	2 Driving Cycles	

FLA -72 FUEL SYSTEM

#### SPECIFICATION E8C2796D

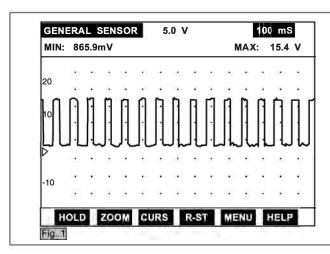
HO2S Heater	Normal Parameter	
	20~24℃(68~75°F)	
Heater Resistance	Approx. 3~4Ω	

#### SCHEMATIC DIAGRAM E6DAE7D8



K00501

#### SIGNAL WAVEFORM ECE5686A



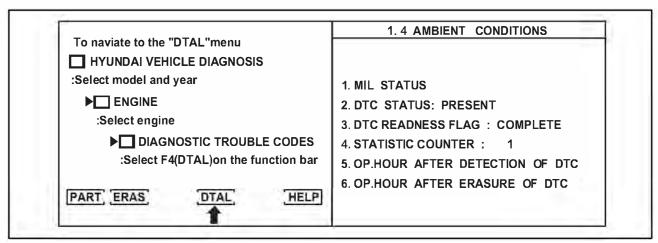
The HO2S requires a minimum temperature to provide a closed loop fuel control system. So the HO2S contains a heater element to reduce its warm-up time and ensure its performance during all driving conditions. The HO2S heater should always be ON after engine start. The ECM controls this heater element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

K00302

#### MONITOR DTC STATUS E6D55384

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

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



EDTC\_GK

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 ED736C98

- 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.

FLA -74 FUEL SYSTEM

### POWER SUPPLY CIRCUIT INSPECTION E6EBB697

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

Specification: B+

5. Is voltage within the specification?



Go to "Control Circuit Inspection" procedure.



- ▶ Check for an open in the power 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 E1807F8B

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

Specification : Approx.  $0\Omega$ 

4) Is resistance within the specification?



▶ 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 open or short to ground in control circuit and go to "Verification of Vehicle Repair" procedure.
- 3. Check for short to power in control circuit.
  - 1) Ignition "ON" & Engine "OFF".
  - 2) Measure voltage between terminal 4 of the HO2S heater harness connector and chassis ground.

Specification: Approx. 0V

3) Is voltage within the specification?

YES

▶ Go to "Component Inspection" procedure.

NO

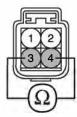
▶ Repair open or short to ground in control circuit and go to "Verification of Vehicle Repair" procedure.

### COMPONENT INSPECTION EF2DF8B

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

Specification :  $3\sim4\Omega$  [at  $20\sim24^{\circ}C(68\sim75^{\circ}F)$ ]

<C146>



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

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.

K00507

FLA -76 FUEL SYSTEM



▶ 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 ED91269D

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

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



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



▶ Go to the applicable troubleshooting procedure.

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

COMPONENT LOCATION EE4DB3F4

Refer to DTC P0050.

GENERAL DESCRIPTION E91D570E

Refer to DTC P0050.

DTC DESCRIPTION E478A5B2

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

### DTC DETECTING CONDITION E78BEAGF

Item	Detecting Condition Possible Cause	
DTC Strategy	Driver Stage Check	
Enable Conditions	Battery voltage > 10V     1% < Heater power < 99%	Related fuse blown or missing     Open or short to ground in power
Threshold Value	Short to ground	supply or control harness
Diagnostic Time	• 20 sec.	<ul><li>Contact resistance in connectors</li><li>Faulty HO2S</li></ul>
Fail Safe	Heater open loop control	- Faulty FIO20
MIL On Condition	2 Driving Cycles	

### SPECIFICATION E8DCFBFE

Refer to DTC P0050.

SCHEMATIC DIAGRAM E4DD17DE

Refer to DTC P0050.

SIGNAL WAVEFORM EB7D4F3F

Refer to DTC P0050.

MONITOR DTC STATUS EA75DE05

Refer to DTC P0050.

TERMINAL AND CONNECTOR INSPECTION EEE9A1E3

Refer to DTC P0050.

POWER SUPPLY CIRCUIT INSPECTION E6CAD8DA

1. Ignition "OFF".

FLA -78 FUEL SYSTEM

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

Specification: B+

5. Is voltage within the specification?



▶ Go to "Control Circuit Inspection" procedure.

NO

- ▶ Check for an open in the power 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 E530EEE0

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

Specification: Approx. 0Ω

4) Is resistance within the specification?

YES

▶ Go to next step as below.

NO

- ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.
- 2. Check for short to ground in control circuit .
  - 1) Measure resistance between terminal 4 of the HO2S heater harness connector and chassis ground.

Specification: infinite

2) Is resistance within the specification?

YES

▶ Go to "Component Inspection" procedure .

NO

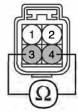
▶ Repair open or short to ground in control circuit and go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION E22C35DD

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

Specification :  $3\sim4\Omega$  [at  $20\sim24^{\circ}C(68\sim75^{\circ}F)$ ]

<C146>



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

K00507

2. Is resistance within the specification?



▶ 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.



▶ 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 E054A9D6

Refer to DTC P0050.

FLA -80 FUEL SYSTEM

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

## COMPONENT LOCATION E3B5D811

Refer to DTC P0050.

## GENERAL DESCRIPTION EAC744B9

Refer to DTC P0050.

### DTC DESCRIPTION E9BF04FC

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

### DTC DETECTING CONDITION EF7DDED4

Item	Detecting Condition	Possible Cause
DTC Strategy	Driver Stage Check	
Enable Conditions	Battery voltage > 10V     1% < Heater power < 99%	Open or short to battery in
Threshold Value	Short to Battery or Line Break	control harness  Contact resistance in connectors
Diagnostic Time	• 20 sec.	• Faulty HO2S
Fail Safe	Heater open loop control	
MIL On Condition	2 Driving Cycles	

### SPECIFICATION EC2305E2

Refer to DTC P0050.

## SCHEMATIC DIAGRAM EBEEA7EE

Refer to DTC P0050.

## SIGNAL WAVEFORM EB89C4E9

Refer to DTC P0050.

### MONITOR DTC STATUS EFAD5570

Refer to DTC P0050.

## TERMINAL AND CONNECTOR INSPECTION E5FD20FB

Refer to DTC P0050.

## CONTROL CIRCUIT INSPECTION E408DD4D

1. Check for open in control harness.

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

Specification : Approx.  $0\Omega$ 

4) Is resistance within the specification?



▶ Go to next step as below.



- ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.
- 2. Check for short to power in control circuit
  - 1) Reconnect the ECM connector.
  - 2) Ignition "ON" & Engine "OFF".
  - 3) Measure voltage between terminal 4 of the HO2S heater harness connector and chassis ground.

Specification: Approx. 0V

4) Is voltage within the specification?

YES

▶ Go to "Component Inspection" procedure.

NO

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

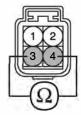
## COMPONENT INSPECTION E0F679FA

- 1. Ignition "OFF".
- 2. Measure resistance between terminals 3 and 4 of the sensor connector (Component side).

Specification :  $3\sim4\Omega$  [at  $20\sim24^{\circ}C(68\sim75^{\circ}F)$ ]

FLA -82 FUEL SYSTEM

<C146>



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

K00507

3. Is resistance within the specification?



▶ 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.



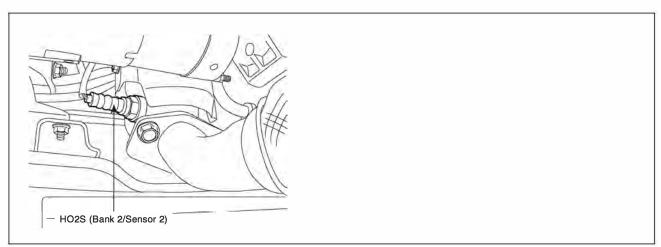
▶ Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S and then go to "Verification of Vehicle Repair" procedure.

## VERIFICATION OF VEHICLE REPAIR EE8DD6E2

Refer to DTC P0050.

# DTC P0056 HO2S HEATER CONTROL CIRCUIT (BANK 2 / SENSOR 2)

### COMPONENT LOCATION E04991AF



EGOF253A

## GENERAL DESCRIPTION E6CA58EE

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 ECM provides a pulse width modulated control circuit to adjust current through the heater. When the HO2S is cold, the value of the resistance is low and the current in the circuit is high. On the contrary, if the temperature in the resistor of the sensor rises, the current drops gradually.

## DTC DESCRIPTION E9A6C650

The ECM determines when a rear HO2S heater fault occurs and sets DTC P0056 if measured rear HO2S resistance is lower than the predetermined threshold.

The ECM illuminates the MIL on the second consecutive driving cycle that the diagnostic runs and fails.

## DTC DETECTING CONDITION EF81F673

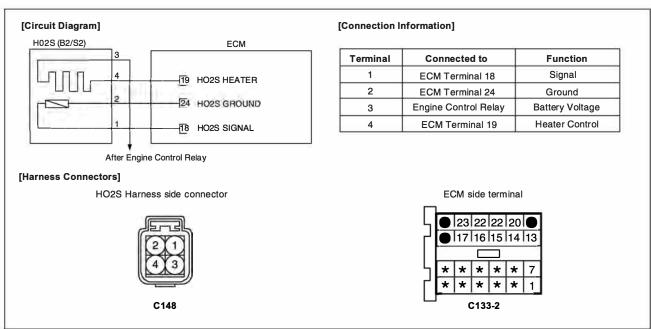
No.		
Item	Detecting Condition	Possible Cause
DTC Strategy	Evaluate O2 sensor element temperature via measuring element resistance	
Enable Conditions	Sensor preheating and full heating phases finished Time after start elapsed: 180 sec. 11V < Battery voltage <16V 1% < Heater power < 99% Exhaust gas temperature model < 520 ℃ (968° F)	Related fuse blown or missing     Heater control circuit open or short     Power supply circuit open or short     Contact resistance in connectors     Faulty HO2S
Threshold Value	• O2 sensor element resistance > 2900Ω	Faulty HO23
Diagnostic Time	• 5 min.	
Fail Safe	Heater open loop control	
MIL On Condition	2 Driving Cycles	

FLA -84 FUEL SYSTEM

### SPECIFICATION EEBA4C29

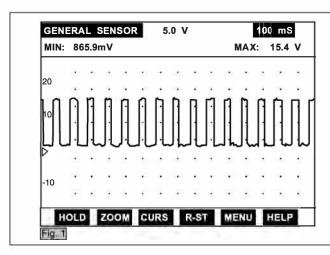
LICOS Haatan	Normal Parameter	
HO2S Heater	20~24℃(68~75°F)	
Heater Resistance	Approx. 3~4Ω	

### SCHEMATIC DIAGRAM E17D3B40



K00561

### SIGNAL WAVEFORM EDD5521



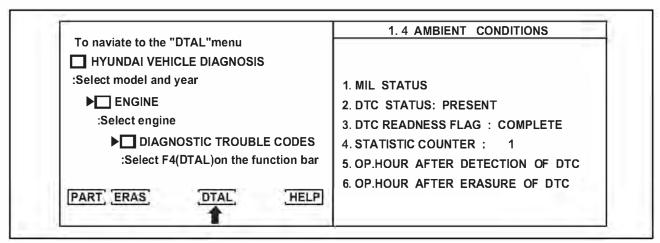
The HO2S requires a minimum temperature to provide a closed loop fuel control system. So the HO2S contains a heater element to reduce its warm-up time and ensure its performance during all driving conditions. The HO2S heater should always be ON after engine start. The ECM controls this heater element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

K00302

## MONITOR DTC STATUS E99A09DE

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

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



EDTC\_GK

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 E9F10E84

- 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.

FLA -86 FUEL SYSTEM

### POWER SUPPLY CIRCUIT INSPECTION E4B1A564

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

Specification: B+

5. Is voltage within the specification?



▶ Go to "Control Circuit Inspection" procedure.

NO

- ▶ Check for an open in the power 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 EGEDESCA

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

Specification : Approx.  $0\Omega$ 

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?



▶ Go to next step as below.



- ▶ Repair open or short to ground in control circuit and go to "Verification of Vehicle Repair" procedure.
- 3. Check for short to power in control circuit.
  - 1) Ignition "ON" & Engine "OFF".
  - 2) Measure voltage between terminal 4 of the HO2S heater harness connector and chassis ground.

Specification: Approx. 0V

3) Is voltage within the specification?



▶ Go to "Component Inspection" procedure.



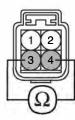
▶ Repair open or short to ground in control circuit and go to "Verification of Vehicle Repair" procedure.

### COMPONENT INSPECTION E52AF227

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

Specification :  $3\sim4\Omega$  [at  $20\sim24^{\circ}C(68\sim75^{\circ}F)$ ]

<C148>



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

K00567

FLA -88 FUEL SYSTEM

2. Is resistance within the specification?



▶ 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.



▶ 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 EF24B6BF

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

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



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



▶ Go to the applicable troubleshooting procedure.

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

COMPONENT LOCATION EFFC2D72

Refer to DTC P0056.

GENERAL DESCRIPTION E39C5639

Refer to DTC P0056.

DTC DESCRIPTION EBAFCAB6

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

### DTC DETECTING CONDITION EC796A51

Item	Detecting Condition	Possible Cause
DTC Strategy	Driver Stage Check	
Enable Conditions	<ul><li>Battery voltage &gt; 10V</li><li>1% &lt; Heater power &lt; 99%</li></ul>	Related fuse blown or missing     Open or short to ground in power
Threshold Value	Short to ground	supply or control harness
Diagnostic Time	• 20 sec.	<ul><li>Contact resistance in connectors</li><li>Faulty HO2S</li></ul>
Fail Safe	Heater open loop control	radity 11023
MIL On Condition	2 Driving Cycles	

SPECIFICATION EDDDCE84

Refer to DTC P0056.

SCHEMATIC DIAGRAM EACOFB6C

Refer to DTC P0056.

SIGNAL WAVEFORM EFDOCF97

Refer to DTC P0056.

MONITOR DTC STATUS E5BA4874

Refer to DTC P0056.

TERMINAL AND CONNECTOR INSPECTION EE0D2C53

Refer to DTC P0056.

POWER SUPPLY CIRCUIT INSPECTION E0403BDE

1. Ignition "OFF".

FLA -90 FUEL SYSTEM

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

Specification: B+

5. Is voltage within the specification?



▶ Go to "Control Circuit Inspection" procedure.

NO

- ▶ Check for an open in the power 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 E0F73028

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

Specification: Approx. 0Ω

4) Is resistance within the specification?

YES

▶ Go to next step as below.

NO

- ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.
- 2. Check for short to ground in control circuit .
  - 1) Measure resistance between terminal 4 of the HO2S heater harness connector and chassis ground.

Specification: infinite

2) Is resistance within the specification?

YES

▶ Go to "Component Inspection" procedure .

NO

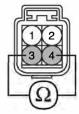
▶ Repair open or short to ground in control circuit and go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION E1346244

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

Specification :  $3\sim4\Omega$  [at  $20\sim24^{\circ}C(68\sim75^{\circ}F)$ ]

<C148>



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

K00567

2. Is resistance within the specification?



▶ 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.



▶ 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 EED3169C

Refer to DTC P0056.

FLA -92 FUEL SYSTEM

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

## COMPONENT LOCATION EBA9E43D

Refer to DTC P0056.

## GENERAL DESCRIPTION EETBCCE6

Refer to DTC P0056.

## DTC DESCRIPTION E1ADBCAE

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

### DTC DETECTING CONDITION E801D8E4

Item	Detecting Condition	Possible Cause
DTC Strategy	Driver Stage Check	
Enable Conditions	Battery voltage > 10V     1% < Heater power < 99%	Open or short to battery in
Threshold Value	Short to Battery or Line Break	control harness Contact resistance in connectors
Diagnostic Time	• 20 sec.	• Faulty HO2S
Fail Safe	Heater open loop control	
MIL On Condition	2 Driving Cycles	

### SPECIFICATION EC17F3D9

Refer to DTC P0056.

## SCHEMATIC DIAGRAM ECEB802F

Refer to DTC P0056.

## SIGNAL WAVEFORM E99D7A7A

Refer to DTC P0056.

### MONITOR DTC STATUS EF6ECE1D

Refer to DTC P0056.

# TERMINAL AND CONNECTOR INSPECTION E21ADC4D

Refer to DTC P0056.

## CONTROL CIRCUIT INSPECTION EB623428

1. Check for open in control harness.

- 1) Ignition "OFF".
- 2) Disconnect HO2S and ECM connectors.
- 3) Measure resistance between terminals 4 of the HO2S heater harness connector and 19 of the ECM harness connector.

Specification : Approx.  $0\Omega$ 

4) Is resistance within the specification?



▶ Go to next step as below.



- ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.
- 2. Check for short to power in control circuit
  - 1) Reconnect the ECM connector.
  - 2) Ignition "ON" & Engine "OFF".
  - 3) Measure voltage between terminal 4 of the HO2S heater harness connector and chassis ground.

Specification: Approx. 0V

4) Is voltage within the specification?

YES

▶ Go to "Component Inspection" procedure.

NO

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

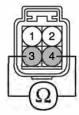
## COMPONENT INSPECTION EBFEC567

- 1. Ignition "OFF".
- 2. Measure resistance between terminals 3 and 4 of the sensor connector (Component side).

Specification :  $3\sim4\Omega$  [at  $20\sim24^{\circ}C(68\sim75^{\circ}F)$ ]

FLA -94 FUEL SYSTEM

<C148>



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

K00567

3. Is resistance within the specification?



▶ 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.



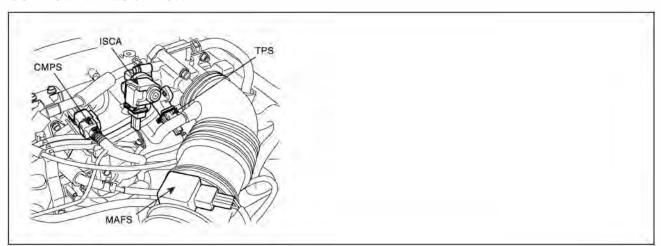
▶ Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S and then go to "Verification of Vehicle Repair" procedure.

## VERIFICATION OF VEHICLE REPAIR EA585A69

Refer to DTC P0056.

# DTC P0101 MASS OR VOLUME AIR FLOW CIRCUIT RANGE/PERFORMANCE

## COMPONENT LOCATION EFB3AC13



EGOF254A

## GENERAL DESCRIPTION E78ADCAS

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

### DTC DESCRIPTION ED43CDEC

The ECM compares the actual measured Mass Air Flow signal to the modeled Mass Air Flow value and sets the DTC P0101 when the difference between these two value is too high or too low with lambda deviation in opposite direction. The modeled Mass Air Flow value is determined by engine speed, throttle angle and ISA valve duty.

### DTC DETECTING CONDITION ED95911B

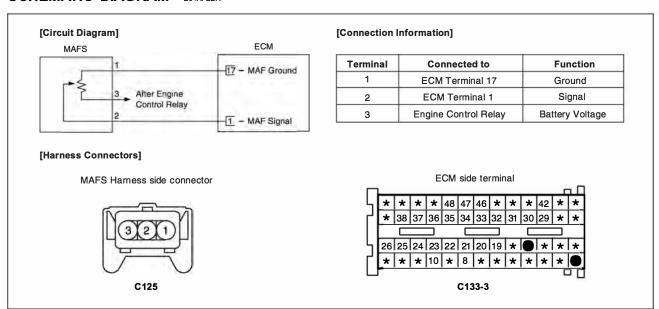
Item	Detecting Condition	Possible Cause
DTC Strategy	Compare calculated MAF with MAF signal	
Enable Conditions	1500 < Engine speed(RPM) < 3500     450 < Measured Mass Air Flow(mg/rev)     < 1050     Coolant temperature > 60 ℃(140°F)	Dirty air cleaner.     Oil Cap or Dipstick missing or not installed correctly.
Threshold Value	Measured MAF/Calculated MAF + lambda controller limit < -20% or > 20%	Air leak in intake system     Contact resistance in connectors.     Faulty MAFS or TPS
Diagnostic Time	• 110 sec.	•
MIL On Condition	2 Driving Cycles	

**FLA-96 FUEL SYSTEM** 

### **SPECIFICATION** EB465AAD

Took Condition	MAF	DATA	TPS	DATA
Test Condition	Output Voltage (V)	Mass Air Flow (kg/h)	Output Voltage (V)	Resistance ( <sup>kΩ</sup> )
Idle	0.6 ~ 1.0	11.6 ~ 15.4	0.2 ~ 0.8	0.71 ~ 1.38
Idle & A/C "ON"	1.0 ~ 1.3	20 ~ 30	-	-
W.O.T	-	_	4.3 ~ 4.8	2.2 ~ 3.4

#### SCHEMATIC DIAGRAM E91AFEBA



K01011

### SIGNAL WAVEFORM E5E611F0

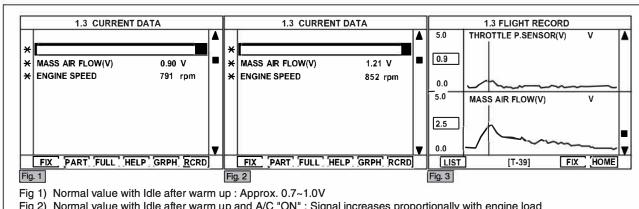


Fig 2) Normal value with Idle after warm up and A/C "ON" : Signal increases proportionally with engine load

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

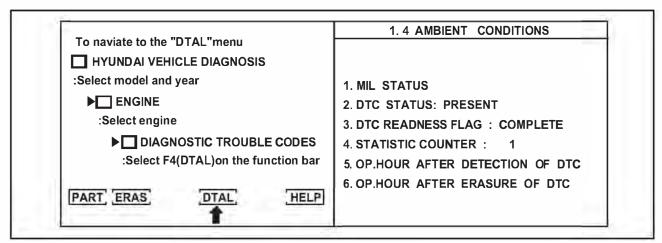
K01013

### MONITOR DTC STATUS EEEFABAO



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.
- 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.



EDTC\_GK

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.

### 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.

FLA -98 FUEL SYSTEM



▶ Go to "Air Leakage Inspection" procedure.

## AIR LEAKAGE INSPECTION E790F80B

Check intake tube, breather hose and MAFS for source of any air leaks. Are there any cracks in intake tube, MAFS
or breather hose.

- 2. Verify oil cap and dipstick are properly installed and oil cap screwed on completely.
- 3. Has a problem been found?



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



▶ Go to "TPS Inspection" procedure.

### TPS INSPECTION

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

Specification: Approx. 0.2~0.8V(Closed throttle Valve) / Approx 4.2~4.8V(Wide Open Throttle)

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



▶ Go to "Terminal and Connector Inspection" procedure.



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

### TERMINAL AND CONNECTOR INSPECTION E7DFE342

- 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?



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

## NO

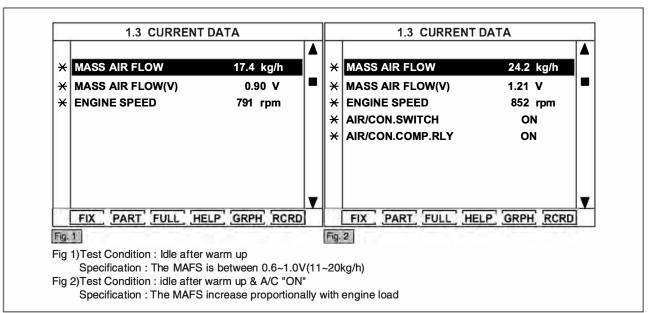
▶ Go to "Component Inspection" procedure.

### COMPONENT INSPECTION E6D068CD

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

Specification:

Approx.  $0.6 \sim 1.0V$  at idle & No load Approx.  $1.0 \sim 1.3V$  at idle & A/C "ON"



K01014

4. Is MAF sensor voltage within the specification?

# YES

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



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

### VERIFICATION OF VEHICLE REPAIR EBEDEAGE

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.

FLA -100 FUEL SYSTEM

2. Press F4DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.

- 3. Read "DTC Status" parameter.
- 4. Is parameter displayed "History(Not Present) fault"?



▶ 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 EDFECF13

Refer to DTC P0101.

### GENERAL DESCRIPTION E240DA90

Refer to DTC P0101.

## DTC DESCRIPTION EB3B0DF3

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

## DTC DETECTING CONDITION E746EF3A

Item	Detecting Condition	Possible Cause
DTC Strategy	Voltage range check	
Enable Conditions	1500 < Engine speed(RPM) < 3500     450 < Measured Mass Air Flow(mg/rev)     < 1050     Coolant temperature > 60 ℃(140°F)	Open or short to ground in signal circuit     Open in power supply circuit
Threshold Value	Measured MAF < 1.7g/sec	<ul><li>Contact resistance in connections.</li><li>Faulty MAF sensor</li></ul>
Diagnostic Time	• 0.2 sec.	
MIL On Condition	2 Driving Cycles	

### SPECIFICATION E8BD2C56

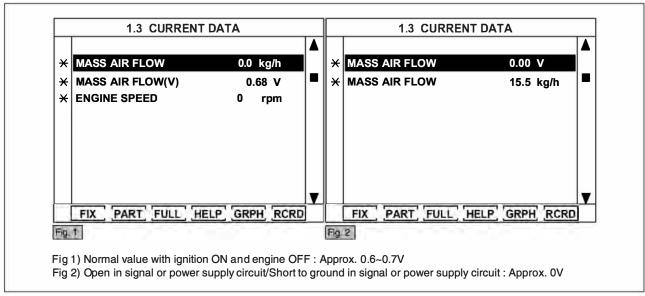
Refer to DTC P0101.

## SCHEMATIC DIAGRAM EFD69A40

Refer to DTC P0101.

FLA -102 FUEL SYSTEM

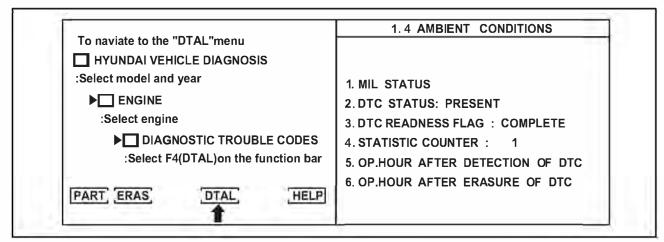
### SIGNAL WAVEFORM E9B18604



K01022

## MONITOR DTC STATUS E280B538

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



EDTC\_GK

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 EE77C1BE

Refer to DTC P0101.

## POWER SUPPLY CIRCUIT INSPECTION E95E2DFC

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

Specification: B+

5. Is voltage within the specification?

# YES

▶ Go to "Signal Circuit Inspection" procedure.

# NO

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

### SIGNAL CIRCUIT INSPECTION EA3DCADE

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

Specification : Approx.  $0\Omega$ 

4) Is resistance within the specification?



Go to next step as below.

FLA -104 FUEL SYSTEM

NO

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

- 2. Check for short to ground in signal harness.
  - 1) Ignition "OFF".
  - 2) Measure resistance between terminal 2 of the MAF sensor harness connector and chassis ground

Specification: infinite

3) Is resistance within the specification?



▶ Go to "Component Inspection" procedure.

NO

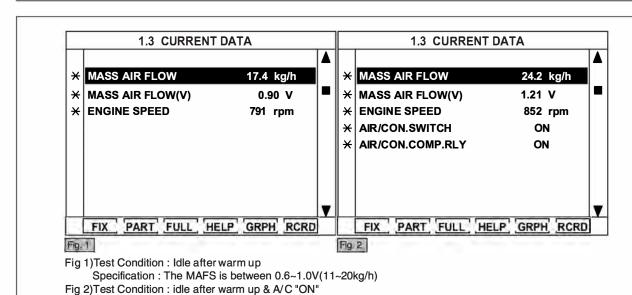
▶ Repair open or short in harness and go to "Verification of Vehicle Repair" procedure.

### COMPONENT INSPECTION ED23B37C

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

Specification:

Approx.  $0.6 \sim 1.0 \text{V}$  at idle & No load Approx.  $1.0 \sim 1.3 \text{V}$  at idle & A/C "ON"



Specification: The MAFS increase proportionally with engine load

K01014

4. Is MAF sensor voltage within the specification?

# YES

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

## NO

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

## VERIFICATION OF VEHICLE REPAIR EF85FC57

Refer to DTC P0101.

FLA -106 FUEL SYSTEM

# DTC P0103 MASS OR VOLUME AIR FLOW CIRCUIT HIGH INPUT

## COMPONENT LOCATION EF4806BE

Refer to DTC P0101.

### GENERAL DESCRIPTION E9BFFDE1

Refer to DTC P0101.

## DTC DESCRIPTION ED30A652

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

## DTC DETECTING CONDITION E2A25562

Item	Detecting Condition	Possible Cause
DTC Strategy	Voltage range check	
Enable Conditions	1500 < Engine speed(RPM) < 3500     450 < Measured Mass Air Flow(mg/rev)     < 1050     Coolant temperature > 60 ℃(140°F)	<ul> <li>Open in ground harness</li> <li>Short to battery in signal harness</li> <li>Contact resistance in connections.</li> </ul>
Threshold Value	Measured MAF > 202.8 g/sec	Faulty MAF sensor
Diagnostic Time	• 0.2 sec.	
MIL On Condition	2 Driving Cycles	

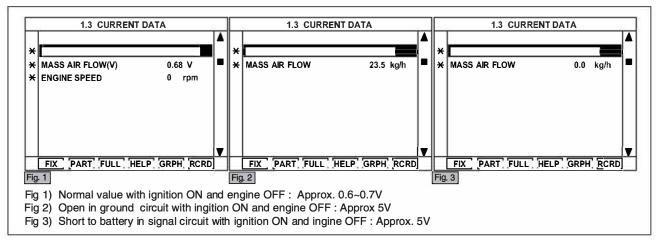
# SPECIFICATION EB5AAFAA

Refer to DTC P0101.

### SCHEMATIC DIAGRAM EA132F88

Refer to DTC P0101.

### SIGNAL WAVEFORM EA23A9A6



K01032

### MONITOR DTC STATUS EEC4BBE6

Refer to DTC P0101.

### TERMINAL AND CONNECTOR INSPECTION E35CC2D9

Refer to DTC P0101.

### GROUND CIRCUIT INSPECTION EC9658D2

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

Specification : Approx.  $0\Omega$ 

4. Is resistance within the specification?



▶ 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 E5CFE52A

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

Specification: Approx. 0V

FLA -108 FUEL SYSTEM

3. Is voltage within the specification?



▶ Go to "Component Inspection" procedure.

## NO

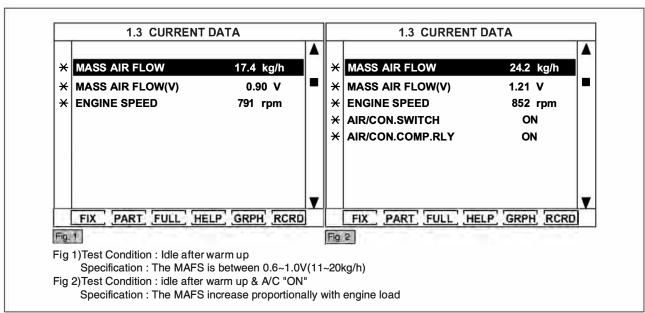
▶ Repair short to battery in harness and go to "Verification of Vehicle Repair" procedure.

### COMPONENT INSPECTION E1FFB57A

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

Specification:

Approx.  $0.6 \sim 1.0 \text{V}$  at idle & No load Approx.  $1.0 \sim 1.3 \text{V}$  at idle & A/C "ON"



K01014

4. Is MAF sensor voltage within the specification?



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

NO

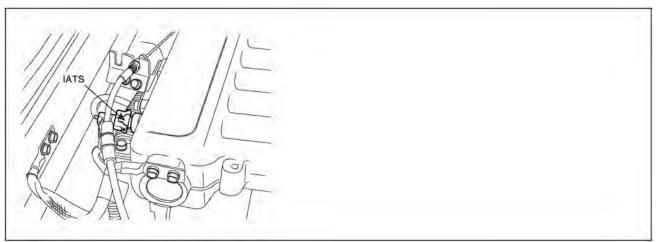
▶ Check MAFS for contamination, deterioration, or damage. Substitute with a known-good MAFS and check for proper operation. If the problem is corrected, replace MAFS and then go to "Verification of Vehicle Repair" procedure.

# **VERIFICATION OF VEHICLE REPAIR** E6750019

FLA -110 FUEL SYSTEM

# DTC P0111 INTAKE AIR TEMPERATURE SENSOR1 CIRCUIT RANGE/PERFORMANCE

## COMPONENT LOCATION EFA656EA



EGOF255A

# GENERAL DESCRIPTION EA7F3B7A

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

# DTC DESCRIPTION E0F6EED2

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

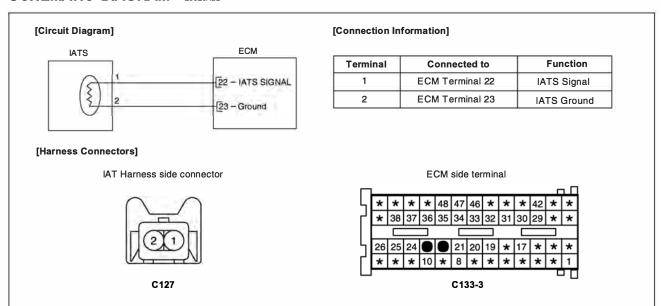
### DTC DETECTING CONDITION E126099F

Item	Detecting Condition	Possible Cause
DTC Strategy	Signal Stuck	
Enable Conditions	<ul> <li>Time after Start &gt; 500 sec.</li> <li>Coolant temperature &gt; 75℃(167°F)</li> <li>Coolant temperature increase after Start &gt; 40℃(104°F)</li> </ul>	Contact resistance in connections.
Threshold Value	• Max. air temperature - Min. air temperature < 2.3 ~ 5.3 ℃(36.1~41.5°F)	Faulty IAT sensor
Diagnostic Time	• 5 sec.	
MIL On Condition	2 Driving Cycles	

#### SPECIFICATION EB3D9C1C

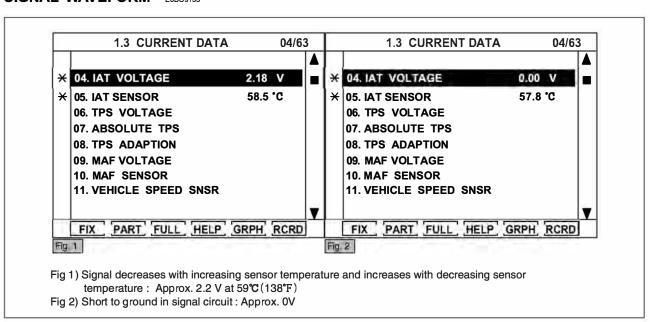
Temperature(℃)	Temperature(°F)	Resistance(kΩ )
20	68	2.22 ~ 2.82
40	104	1.06 ~ 1.31
80	176	0.30 ~ 0.36

# SCHEMATIC DIAGRAM E35E3AB2



K01111

# SIGNAL WAVEFORM E0BC9133



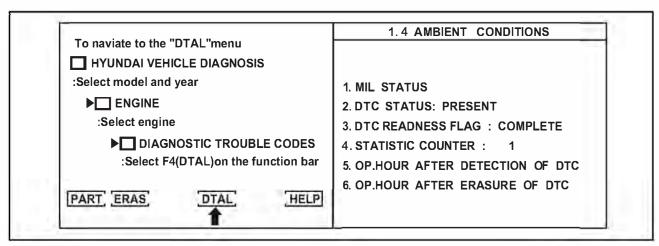
K01112

FLA -112 FUEL SYSTEM

### MONITOR DTC STATUS E7A3BA5A

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



EDTC\_GK

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



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

# YES

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



▶ Go to next step as below

#### TERMINAL AND CONNECTOR INSPECTION E44BF5AI

- 1. Ignition "OFF".
- 2. Disconnect IATS connector.
- 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.
- 4. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
- 5. Has a problem been found?

YES

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

NO

▶ Go to "Component Inspection" procedure.

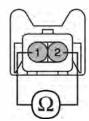
#### COMPONENT INSPECTION E3EDC050

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

### Specification:

Temperature	Resistance(kΩ )
<b>20</b> ℃(68°F)	Approx. 2.22 ~ 2.82
40℃(104°F)	Approx. 1.06 ~ 1.31
80°C(176°F)	Approx. 0.29 ~ 0.36

<C127>



- 1. IATS Signal
- 2. Sensor Ground

K01113

2. Is IAT sensor data within the specification?

YES

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

NO

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

### VERIFICATION OF VEHICLE REPAIR EB934EF9

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.
- Press F4DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.

FLA -114 FUEL SYSTEM

- 3. Read "DTC Status" parameter.
- 4. Is parameter displayed "History(Not Present) fault"?



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



▶ Go to the applicable troubleshooting procedure.

# DTC P0112 INTAKE AIR TEMPERATURE SENSOR1 CIRCUIT LOW INPUT

### COMPONENT LOCATION E29DE7C2

Refer to DTC P0111.

## GENERAL DESCRIPTION EEFFCB9E

Refer to DTC P0111.

### DTC DESCRIPTION ECC9F02D

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

### DTC DETECTING CONDITION ED9FB333

Item	Detecting Condition	Possible Cause
DTC Strategy	Voltage range check	
Enable Conditions	After 250 seconds from engine start	
Threshold Value	• Measured intake air temperature > 117.75 ℃ (243.95°F)	Short to ground in signal harness     Contact resistance in connections.     Faulty IAT sensor
Diagnostic Time	• 5 sec.	adily 111 contact
MIL On Condition	2 Driving Cycles	

### SPECIFICATION E5E6C7B3

Refer to DTC P0111.

# SCHEMATIC DIAGRAM E9D6914E

Refer to DTC P0111.

### SIGNAL WAVEFORM E5D752D9

Refer to DTC P0111.

# MONITOR DTC STATUS ED8BCCBF

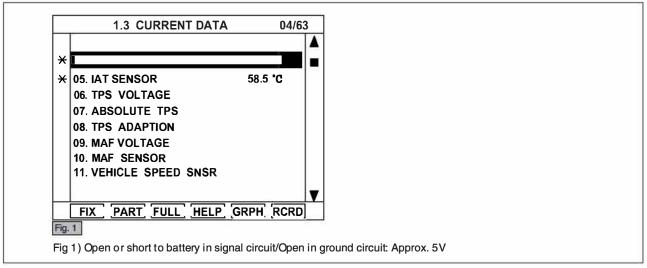
Refer to DTC P0111.

#### MONITOR SCANTOOL DATA E512A81C

- 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

FLA -116 FUEL SYSTEM



K01123

4. Is displayed IAT data within the specification?

# YES

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



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

# SIGNAL CIRCUIT INSPECTION E47FD01C

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

Specification: Infinite

4. Is resistance within the specification?

# YES

▶ Go to "Terminal and Connector Inspection" procedure.

NO

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

# TERMINAL AND CONNECTOR INSPECTION E934DAE6

### COMPONENT INSPECTION

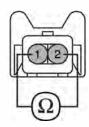
E9A766AD

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

#### Specification :

Temperature	Resistance(kΩ )
<b>20℃(68°</b> F)	Approx. 2.22 ~ 2.82
40°C(104°F)	Approx. 1.06 ~ 1.31
80°C(176°F)	Approx. 0.30 ~ 0.36

<C127>



- 1. IATS Signal
- 2. Sensor Ground

K01113

2. Is IAT sensor data within the specification?



▶ 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.



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

## VERIFICATION OF VEHICLE REPAIR E3CADC5C

FLA -118 FUEL SYSTEM

# DTC P0113 INTAKE AIR TEMPERATURE SENSOR1 CIRCUIT HIGH INPUT

# COMPONENT LOCATION E53DBD0D

Refer to DTC P0111.

### GENERAL DESCRIPTION E5E1C7ED

Refer to DTC P0111.

## DTC DESCRIPTION EF9CC1B0

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

## DTC DETECTING CONDITION EASDE1CE

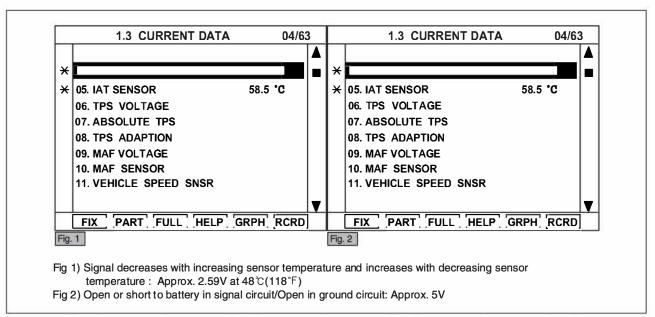
Item	Detecting Condition	Possible Cause	
DTC Strategy	Voltage range check		
Enable Conditions	After 250 seconds from engine start	Short to battery in signal harness	
Threshold Value	• Measured intake air temperature < -38.25 ℃ (-36.85 °F)	<ul><li> Open in signal or ground circuit</li><li> Contact resistance in connections</li></ul>	
Diagnostic Time	• 5 sec.	Faulty IAT sensor	
MIL On Condition	2 Driving Cycles		

SPECIFICATION E8184D89

Refer to DTC P0111.

### SCHEMATIC DIAGRAM EFBB985C

### SIGNAL WAVEFORM EDEAED2F



K01132

## MONITOR DTC STATUS EBABA98F

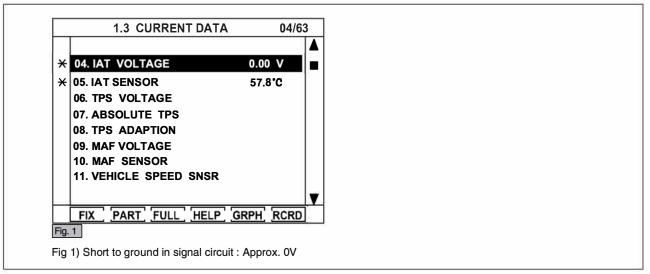
Refer to DTC P0111.

### MONITOR SCANTOOL DATA E9AD697E

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

Specification: Approx. 0V

FLA -120 FUEL SYSTEM



K01133

5. Is IAT data within the specification?

# YES

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

# NO

- ▶ Go to next step as below.
- 6. Jumper the terminal 1 of the IAT sensor harness connector to chassis ground.
- 7. Observe the "IAT SENSOR" parameter on the Scantool.

Specification: Approx. 0V

8. Is IAT data within the specification?

# YES

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

### NO

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

### GROUND CIRCUIT INSPECTION EDFD68E2

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

Specification : Approx.  $0\Omega$ 

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 EGCCC85E

- 1. Check for open in signal circuit
  - Measure resistance between terminals 1 of the IAT sensor harness connector and 22 of the ECM harness connector.

Specification : Approx.  $0\Omega$ 

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

Specification: Approx. 0V

3) Is voltage within the specification?

YES

▶ Go to "Terminal and Connector Inspection" procedure.

NO

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

#### TERMINAL AND CONNECTOR INSPECTION E48EA6BC

Refer to DTC P0111.

### COMPONENT INSPECTION EDFCFFF2

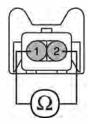
- 1. Ignition "OFF"
- 2. Measure resistance between terminals 1 and 2 of the IAT sensor connector(Component side).

FLA -122 FUEL SYSTEM

#### Specification:

Temperature	Resistance(kΩ )
20℃(68°F)	Approx. 2.22 ~ 2.82
40°C(104°F)	Approx. 1.06 ~ 1.31
80°C(176°F)	Approx. 0.30 ~ 0.36

<C127>



- 1. IATS Signal
- 2. Sensor Ground

K01113

3. Is resistance within the specification?



▶ 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.



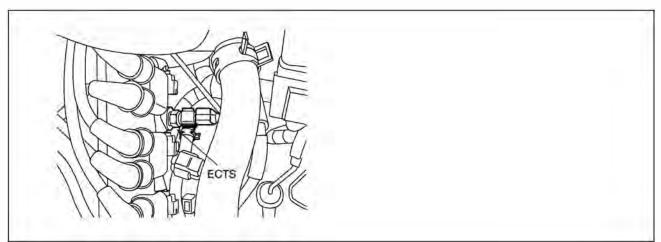
▶ Check IAT sensor for contamination, deterioration, or damage. Substitute with a known-good IAT sensor and check for proper operation. If the problem is corrected, replace IAT sensor and then go to "Verification of Vehicle Repair" procedure.

## VERIFICATION OF VEHICLE REPAIR E4CA502B

# DTC P0116 ENGINE COOLANT TEMPERATURE CIRCUIT RANGE/PERFORMANCE

E7E051FC

## **COMPONENT LOCATION**



EGOF440J

### GENERAL DESCRIPTION EE81FE1F

The Engine Coolant Temperature Sensor (ECTS) is located in the engine coolant passage of the cylinder head for detecting the engine coolant temperature. The ECTS uses a thermistor whose resistance changes with the temperature. The electrical resistance of the ECTS decreases as the temperature increases, and increases as the temperature decreases. The reference 5 V in the ECM is supplied to the ECTS via a resistor in the ECM. That is, the resistor in the ECM and the thermistor in the ECTS are connected in series. When the resistance value of the thermistor in the ECTS changes according to the engine coolant temperature, the output voltage also changes.

During cold engine operation the ECM increases the fuel injection duration and controls the ignition timing using the information of engine coolant temperature to avoid engine stalling and improve drivability.

#### DTC DESCRIPTION EE2B727A

The purpose of this diagnosis is to detect a stuck coolant temperature signal. The diagnostic function checks whether after a variation of the calculated coolant temperature also a variation of the measured coolant temperature is detected. ECM sets DTC P0116 when the variation of measured engine coolant temperature from engine start is smaller than threshold while variation of calculated coolant temperature by ECM is greater than threshold.

FLA -124 FUEL SYSTEM

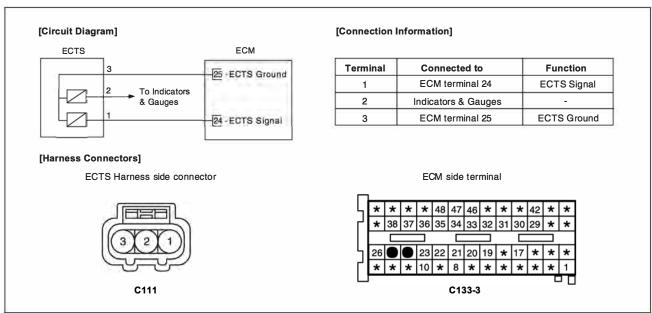
# DTC DETECTING CONDITION EAFE125C

Ite	em	Detecting Condition	Possible Cause	
	DTC Strategy	Signal stuck.		
Case1)	Enable Condi- tions	• 250 seconds after "START" in case of short circuit to B+ or open circuit when temperature of intake air is below -30 °C (-22°F).		
	Thresh- old Value	Modeled coolant temperature increase >     Threshold But Measured coolant temperature increase < Threshold (Threshold depends on Coolant start temperature)		
	Diagnos- tic Time	• 0.5 sec.		
DTC Strategy		Signal Unplausible High with Long Soaking Condition	Contact resistance in	
Case2)	Enable Condi- tions	<ul> <li>No Relevant Failure</li> <li>Engine run Elapse of Previous driving cycle &gt; 500sec. or ECT at Engine Stop of previous driving cycle &gt; 85'C(185°F)</li> <li>IAT Signal Decrease Energy by Air Flow after Start &lt; 50J</li> <li>Cumulative Time for IAT Signal Decrease Check (Air Flow &gt; 60 kg/h) &gt; 70sec.</li> <li>Cumulative Time for IAT Signal Decrease Check (Vehicle Speed &gt; 71km/h(44 mph)) &gt; 100sec.</li> </ul>	connections. • Faulty ECT sensor	
	Thresh- old Value	<ul> <li>Measured coolant temperature with intake air temp. at previous driving cycle-intake air temp. at stat</li> <li>&gt;12 °C (54°F) is higher than 54 °C (129°F)</li> </ul>		
	Diagnos- tic Time	Immediate if Enable Conditions Fulfilled		

# SPECIFICATION E10CA80C

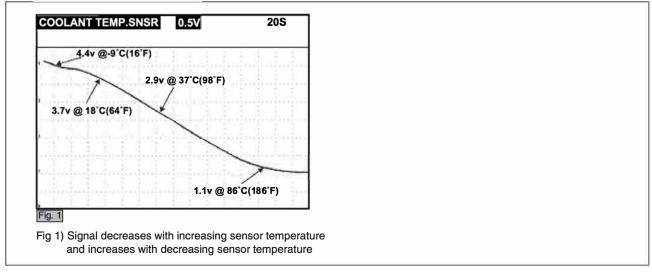
Temperature			Temperature		
(℃)	(°F)	Resistance(kର )	(℃)	(°F)	Resistance(kΩ)
-20	-4	14.13 ~ 16.83	40	104	1.15
0	32	5.79	60	140	0.59
20	68	2.31 ~ 2.59	80	176	0.32

### SCHEMATIC DIAGRAM ECE4



#### K01161

### SIGNAL WAVEFORM EF0132



### K01162

# MONITOR DTC STATUS EE4ECAE7

# NOTE

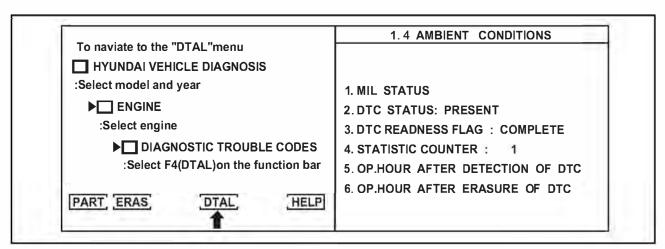
If any codes relating to TPS or MAFS are stored, do ALL REPAIRS associated with those codes before proceeding with further troubleshooting

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

FLA -126 FUEL SYSTEM

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.



EDTC GK

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



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

YES

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



▶ Go to next step as below.

### TERMINAL AND CONNECTOR INSPECTION E252CEC8

- 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 EB971

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

#### Specification:

Temperature	Resistance(kΩ )
20℃(68°F)	Approx. 2.31 ~ 2.59
40°C(104°F)	Approx. 1.15
80°C(176°F)	Approx. 0.32

<C111>



- 1. ECTS Signal
- 2. To Indicators & Gauges
- 3. Ground

K01163

4. Is resistance within the specification?



▶ 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.



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

### VERIFICATION OF VEHICLE REPAIR EF64EA4E

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.
- Press F4DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
- 3. Read "DTC Status" parameter.
- 4. Is parameter displayed "History(Not Present) fault"?

FLA -128 FUEL SYSTEM

# 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 ECF7BBCF

Refer to DTC P0116.

GENERAL DESCRIPTION E8F5FAA0

Refer to DTC P0116.

DTC DESCRIPTION EEFDDD9C

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

## DTC DETECTING CONDITION EOC5CAFB

Item	Detecting Condition	Possible Cause
DTC Strategy	Voltage range check	
Enable Conditions	• 250 seconds after "START" when intake air temperature is below -30 °C (-22°F).	Short to ground in signal harness
Threshold Value	• Measured coolant temperature > 138 ℃(280°F).	Contact resistance in connections.     Faulty ECT sensor
Diagnostic Time	• 0.5 sec.	
MIL On Condition	2 Driving Cycles	

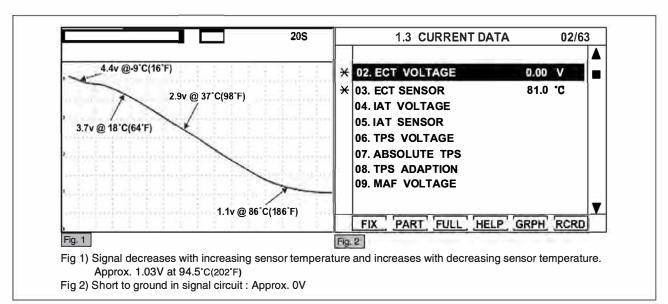
SPECIFICATION E11AA5CB

Refer to DTC P0116.

SCHEMATIC DIAGRAM E191C08F

FLA -130 FUEL SYSTEM

### SIGNAL WAVEFORM EF1BFE38



K01172

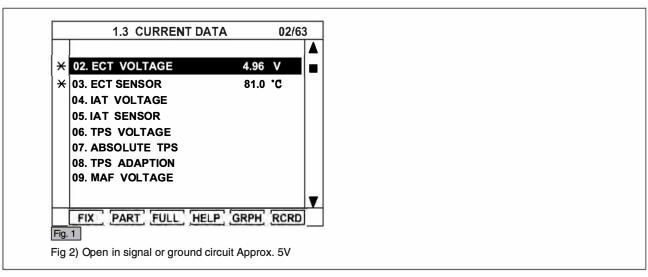
## MONITOR DTC STATUS EF45FCF1

Refer to DTC P0116.

### MONITOR SCANTOOL DATA EA8CA5DF

- 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



K01173

4. Is ECTS parameter within the specification?



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



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

### SIGNAL CIRCUIT INSPECTION EE8EA1FD

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

Specification: Infinite

3. Is resistance within the specification?



▶ Go to "Terminal and Connector Inspection" procedure.



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

## TERMINAL AND CONNECTOR INSPECTION E9467D1B

Refer to DTC P0116.

# COMPONENT INSPECTION E01E4ADD

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

### Specification:

Temperature	Resistance(kΩ )
20℃(68°F)	Approx. 2.31 ~ 2.59
40°C(104°F)	Approx. 1.15
80°C(176°F)	Approx. 0.32

FLA -132 FUEL SYSTEM

<C111>



- 1. ECTS Signal
- 2. To Indicators & Gauges
- 3. Ground

K01163

3. Is resistance within the specification?



▶ 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.



▶ 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 EED740FE

# DTC P0118 ENGINE COOLANT TEMPERATURE CIRCUIT HIGH INPUT

COMPONENT LOCATION EB4171CF

Refer to DTC P0116.

GENERAL DESCRIPTION E9DE6579

Refer to DTC P0116.

DTC DESCRIPTION EF926F55

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

## DTC DETECTING CONDITION E210F57A

Item	Detecting Condition	Possible Cause	
DTC Strategy	Voltage range check		
Enable Conditions	• 250 seconds after "START" when intake air temperature is below -30 ℃ (-22°F).	Short to battery in signal harness	
Threshold Value	Measured coolant temperature < -38.25 ℃(-36.85°F)	<ul><li> Open in signal or ground circuit</li><li> Contact resistance in connections.</li><li> Faulty ECT sensor</li></ul>	
Diagnostic Time	• 5 sec.	and the second s	
MIL On Condition	2 Driving Cycles		

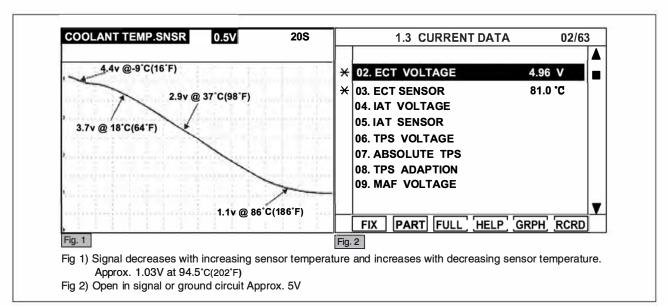
SPECIFICATION E419C626

Refer to DTC P0116.

SCHEMATIC DIAGRAM ED38E2E2

FLA -134 FUEL SYSTEM

### SIGNAL WAVEFORM ED8CABF8



K01182

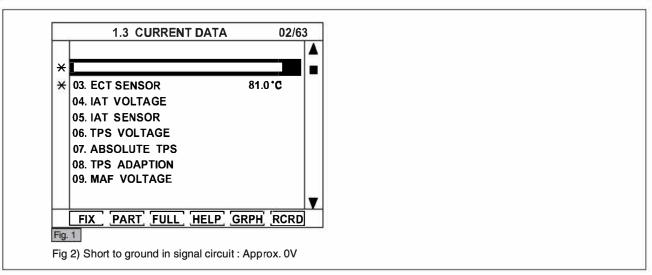
## MONITOR DTC STATUS EC19B163

Refer to DTC P0116.

### MONITOR SCANTOOL DATA EDA93B0C

- 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 ECTS harness connector together.

Specification: Approx. 0V



K01183

5. Is ECTS parameter within the specification?

# YES

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

# NO

- ▶ Go to next step as below.
- 6. Jumper the terminal 1 of the ECT sensor harness connector to chassis ground.
- 7. Observe the "ECT SENSOR" parameter on the Scantool.

Specification: Approx. 0V

8. Is ECT data within the specification?

# YES

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

# NO

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

### GROUND CIRCUIT INSPECTION EFCDD287

- 1. Ignition "OFF".
- 2. Disconnect ECM connector.
- 3. Measure resistance between terminals 3 of the ECT sensor harness connector and 25 of the ECM harness connector

Specification : Approx.  $0\Omega$ 

4. Is resistance within the specification?

FLA -136 FUEL SYSTEM

# YES

▶ Go to "Terminal and connector Inspection" procedure.



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

#### SIGNAL CIRCUIT INSPECTION EADO8486

- 1. Check for open in signal circuit.
  - Measure resistance between terminals 1 of the ECT sensor harness connector and 24 of the ECM harness connector

Specification : Approx.  $0\Omega$ 

2) Is resistance within the specification?



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"
  - Measure voltage between terminals 1 of the ECT sensor harness connector and 24 of the ECM harness connector

Specification: Approx. 0V

3) Is voltage within the specification?

YES

▶ Go to "Terminal and Connector Inspection" procedure.

NO

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

#### TERMINAL AND CONNECTOR INSPECTION EBDE07F4

Refer to DTC P0116.

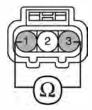
### COMPONENT INSPECTION E44 A4A3A

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

2n	acif	icai	tion	

Temperature	Resistance(kΩ )	
<b>20℃(68</b> °F)	Approx. 2.31 ~ 2.59	
40°C(104°F)	Approx. 1.15	
80°C(176°F)	Approx. 0.32	

<C111>



- 1. ECTS Signal
- 2. To Indicators & Gauges
- 3. Ground

K01163

3. Is resistance within the specification?



▶ 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.



▶ 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 E3F74ED1

FLA -138 FUEL SYSTEM

# DTC P0119 ENGINE COOLANT TEMPERATURE CIRCUIT INTERMITTENT

## COMPONENT LOCATION EE74B34A

Refer to DTC P0116.

### GENERAL DESCRIPTION E8AB307D

Refer to DTC P0116.

### DTC DESCRIPTION E3AD41E1

ECM sets DTC P0119 when the gradient of engine coolant temperature is abnormal.

# DTC DETECTING CONDITION EB4FA104

Item	Detecting Condition	Possible Cause	
DTC Strategy	Signal gradient implausible		
Enable Conditions	• Time after start depending on coolant temperature at start(1000sec. at -48°C(-54°F), 300sec. at -6°C(21°F), 120sec. at 30°C(86°F), 100sec. at 60°C(140°F))	Contact resistance in connections	
Threshold Value	Coolant temperature Gradient > 9.75°C(49.55°F) / 0.5 sec.	Faulty ECT sensor	
Diagnostic Time	• 5 sec.		
MIL On Condition	2 Driving Cycles		

### SPECIFICATION EB82635C

Refer to DTC P0116.

# SCHEMATIC DIAGRAM E486DFDE

Refer to DTC P0116.

# SIGNAL WAVEFORM E4FDD61A

Refer to DTC P0116.

# MONITOR DTC STATUS E6B047CA

Refer to DTC P0116.

# TERMINAL AND CONNECTOR INSPECTION E23DEAE8

Refer to DTC P0116.

# COMPONENT INSPECTION E00E88BA

1. Ignition "OFF"

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

#### Specification :

Temperature	Resistance(kΩ )	
20℃(68°F)	Approx. 2.31 ~ 2.59	
40°C(104°F)	Approx. 1.15	
80°C(176°F)	Approx. 0.32	

<C111>



- 1. ECTS Signal
- 2. To Indicators & Gauges
- 3. Ground

K01163

4. Is resistance within the specification?



▶ 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.



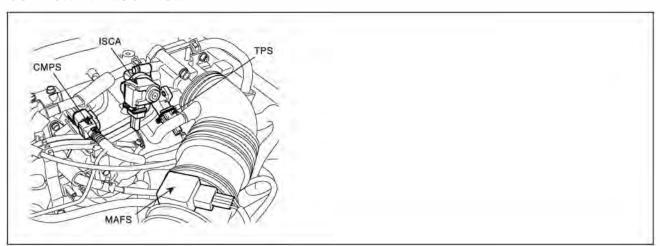
▶ Check ECTS for contamination, deterioration, or damage. Substitute with a known-good ECTS and check for proper operation. If the problem is corrected, replace ECTS and then go to "Verification of Vehicle Repair" procedure.

## VERIFICATION OF VEHICLE REPAIR E3F6938C

FLA -140 FUEL SYSTEM

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

## COMPONENT LOCATION E37CFEB6



EGOF254A

# GENERAL DESCRIPTION E08B59CE

The Throttle Position Sensor (TPS) is mounted on the throttle body and detects the opening angle of the throttle plate. The TPS has a variable resistor (potentiometer) whose characteristic is the resistance changing according to the throttle angle. During acceleration, the TPS resistance between the reference 5V and the signal terminal decreases and output voltage increases; during deceleration, the TPS resistance increases and TPS output voltage decreases. The ECM supplies a reference 5V to the TPS and the output voltage increases directly with the opening of the throttle valve. The TPS output voltage will vary from 0.2~0.8V at closed throttle to 4.3~4.8V at wide-open throttle.

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

### DTC DESCRIPTION EFAB1BA9

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

### DTC DETECTING CONDITION EFF8CDBA

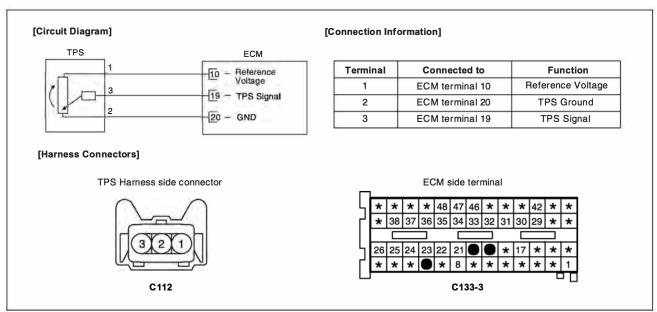
Item	Detecting Condition	Possible Cause	
DTC Strategy	Compare calculated MAF with MAF signal	Contact resistance in connectors	
Enable Conditions	<ul> <li>1500 &lt; Engine speed(RPM) &lt; 3500</li> <li>450 &lt; Measured mass air flow(mg/rev.) &lt; 1050</li> <li>Coolant temp. &gt; 60°C(140°F)</li> </ul>		
Threshold Value	Measured MAF/Calculated MAF < 0.5 or > 1.3	Faulty TP Sensor(TPS)	
Diagnostic Time	• 110 sec.		
MIL On Condition	2 Driving Cycles		

## **SPECIFICATION**

<b>E</b> 51	70661

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

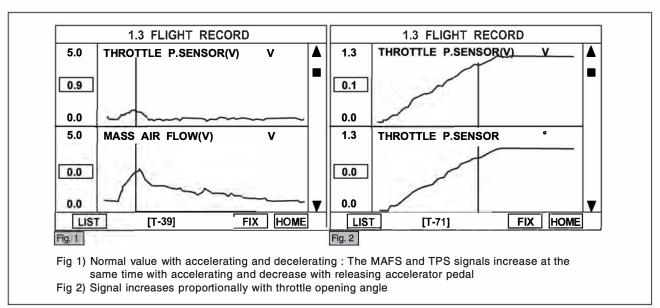
## SCHEMATIC DIAGRAM ECE2BA8E



K01211

FLA -142 FUEL SYSTEM

# SIGNAL WAVEFORM EE4CFF8B



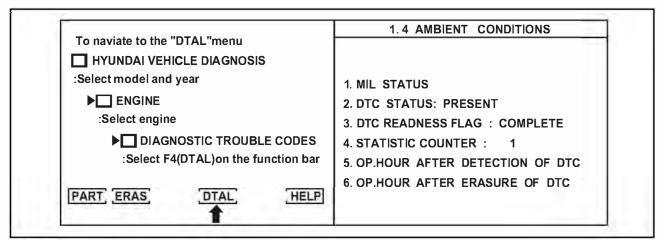
K01212

### MONITOR DTC STATUS E2FE1A50

**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.



EDTC\_GK

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



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

# YES

▶ Fault is intermittent caused by poor contact in the sensor's and/or ECM's connector or was repaired and ECM memory was not cleared. Thoroughly check connectors for loose or poor 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 E1DBFBCA

- 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?



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

# NO

▶ Go to next step as below.

# TERMINAL AND CONNECTOR INSPECTION EFF9DA26

- 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.
- 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 E89C4BCA

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

FLA -144 FUEL SYSTEM

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

<C112>



- 1. Reference Voltage
- 2. Sensor Ground
- 3. TPS Signal

K01213

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

Specification: 0.71 ~ 1.38 kΩ at closed throttle valve, 2.2 ~ 3.4 kΩ at wide open throttle

<C112>



- 1. Reference Voltage
- 2. Sensor Ground
- 3. TPS Signal

K01214

6. Is resistance within the specification?



▶ 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.



▶ 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 E2D1ED2F

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

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

- 2. Press F4DTAL) and confirm that "DTC Readiness Flag" indicates "Complete". If not, drive the vehicle within conditions noted in the freeze frame data or enable conditions.
- 3. Read "DTC Status" parameter.
- 4. Is parameter displayed "History(Not Present) fault"?

# YES

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

# NO

▶ Go to the applicable troubleshooting procedure.

FLA -146 FUEL SYSTEM

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

# COMPONENT LOCATION E2B835A2

Refer to DTC P0121.

#### GENERAL DESCRIPTION E4B97F0E

Refer to DTC P0121.

## DTC DESCRIPTION ECD2D8AE

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

# DTC DETECTING CONDITION EAB4FBDE

Item	Detecting Condition	Possible Cause
DTC Strategy	Voltage range check	
Enable Conditions	• 6 ≤ Battery voltage ≤ 16V	<ul><li>Open in power supply harness</li><li>Short to ground in power supply</li></ul>
Threshold Value	• Voltage < 0.14 V	or signal harness  Contact resistance in connectors
Diagnostic Time	• 1 sec.	Contact resistance in connectors     Faulty TP sensor
MIL On Condition	2 Driving Cycles	,

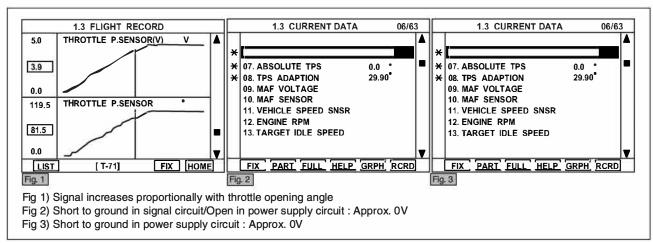
## SPECIFICATION EA1C9EF6

Refer to DTC P0121.

#### SCHEMATIC DIAGRAM E3FF9C4E

Refer to DTC P0121.

# SIGNAL WAVEFORM E73AFC00



## MONITOR DTC STATUS E601BE69

Refer to DTC P0121.

#### TERMINAL AND CONNECTOR INSPECTION E36501A4

Refer to DTC P0121.

#### POWER SUPPLY CIRCUIT INSPECTION E78FE0BF

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

Specification: Approx. 5V

5. Is voltage within the specification?



▶ Go to "Signal Circuit inspection" procedure.

# NO

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

#### SIGNAL CIRCUIT INSPECTION EAGAAGF4

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

Specification: Approx. 5V

3. Is voltage within the specification?



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 E2AB118B

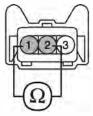
- 1. Ignition "OFF".
- 2. Disconnect TPS connector.

FLA -148 FUEL SYSTEM

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

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

<C112>



- 1. Reference Voltage
- 2. Sensor Ground
- 3. TPS Signal

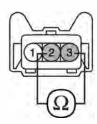
K01213

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

Test Condition: Ignition "OFF"

Specification: 0.71 ~ 1.38 <sup>kℚ</sup> at closed throttle valve, 2.7 <sup>kℚ</sup> at wide open throttle

<C112>



- 1. Reference Voltage
- 2. Sensor Ground
- 3. TPS Signal

K01214

6. Is resistance within the specification?



▶ 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.



▶ 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 EC60B4EA

Refer to DTC P0121.

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

# COMPONENT LOCATION EB1CD11C

Refer to DTC P0121.

# GENERAL DESCRIPTION EC48A8EE

Refer to DTC P0121.

# DTC DESCRIPTION EB1CDDAD

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

# DTC DETECTING CONDITION EBD8F69B

Item	Detecting Condition	Possible Cause
DTC Strategy	Voltage range check	<ul> <li>Open in signal or ground circuit</li> <li>Short to battery in signal circuit</li> <li>Contact resistance in connectors</li> <li>Faulty TP sensor</li> </ul>
Enable Conditions	• 6 ≤ Battery voltage ≤ 16V	
Threshold Value	Voltage > 4.86 V	
Diagnostic Time	• 1 sec.	
MIL On Condition	2 Driving Cycles	

# SPECIFICATION E1AD6BF5

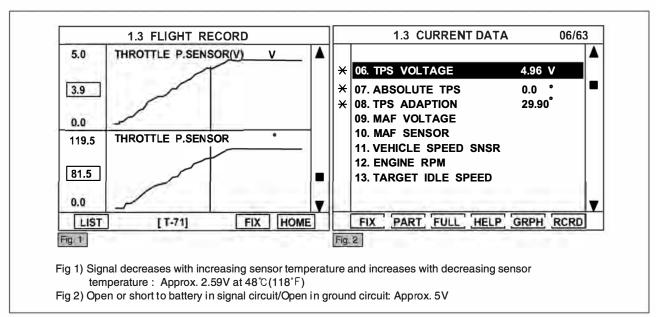
Refer to DTC P0121.

# SCHEMATIC DIAGRAM EA596FB8

Refer to DTC P0121.

FLA -150 FUEL SYSTEM

## SIGNAL WAVEFORM EC185441



K01232

#### MONITOR DTC STATUS E6740FDF

Refer to DTC P0121.

## TERMINAL AND CONNECTOR INSPECTION ED7/D8/C69

Refer to DTC P0121.

## GROUND CIRCUIT INSPECTION E1CD0373

- 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?



▶ 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 E582

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

Specification: Approx. 5V

2. Is voltage within the specification?

# YES

▶ Go to "Component Inspection" procedure.

# NO

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

#### COMPONENT INSPECTION E90DF0C0

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

Specification : Approx. 1.6 ~ 2.4  $\mbox{k}\Omega$  at all throttle position

<C112>



- 1. Reference Voltage
- 2. Sensor Ground
- 3. TPS Signal

K01213

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

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

FLA -152 FUEL SYSTEM

<C112>



- 1. Reference Voltage
- 2. Sensor Ground
- 3. TPS Signal

K01214

6. Is resistance within the specification?



▶ 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.



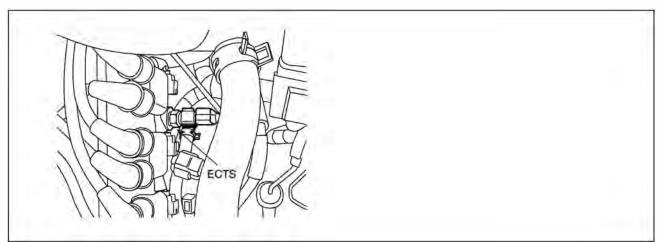
▶ Check TPS for contamination, deterioration, or damage. Substitute with a known-good TPS and check for proper operation. If the problem is corrected, replace TPS and then go to "Verification of Vehicle Repair" procedure.

# VERIFICATION OF VEHICLE REPAIR EF8B9DB9

Refer to DTC P0121.

# DTC P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL

# COMPONENT LOCATION EE854A29



EGOF440J

## GENERAL DESCTIPTION EAFA3034

An Engine Coolant Temperature Sensor (ECTS) monitors the temperature of the coolant. This input is used by the ECM 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 E5CB7BB6

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 ECM sets DTC P0125.

FLA -154 FUEL SYSTEM

# DTC DETECTING CONDITION EA025CFA

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	Engine coolant > 20°C(68°F)     After 100~1000 seconds from engine start	
Threshold Value	Measured coolant temperature < threshold When modeled coolant temperature > threshold	
Diagnostic Time	• 0.5 sec.	
Fail 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	
MIL On Condition	2 Driving Cycles	

# SPECIFICATION EFDC77AA

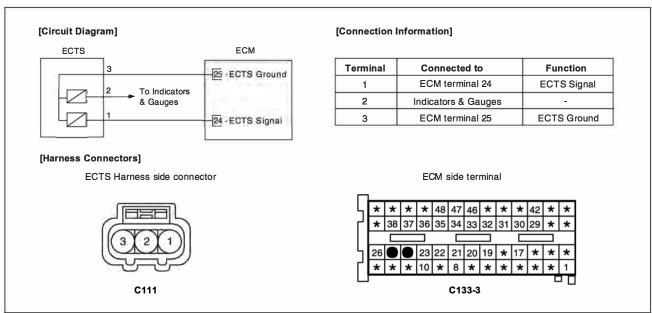
# [ECTS]

Temp.(℃)	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]

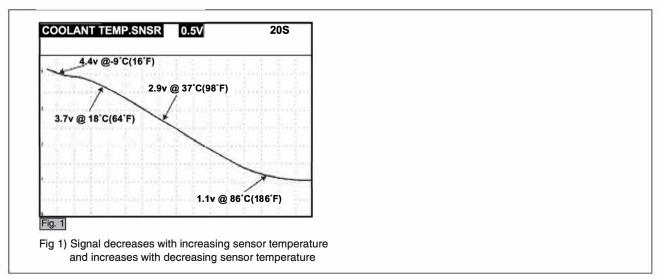
Thermostat	Normal Parameter	
Valve Opening Temp.	80~84 ℃(176~183°F)	
Valve Closing Temp.	77 °C (170.6°F)	
Full Open Lift	Above 8mm at 95 ℃(203°F)	

## SCHEMATIC DIAGRAM E



K01161

## SIGNAL WAVEFORM EDEAEADE



K01162

# MONITOR DTC STATUS EC62C7BA



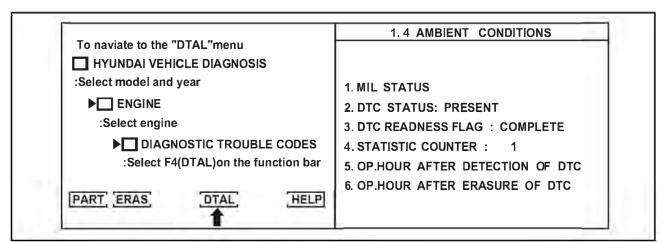
If any codes relating to ECTs are stored, do ALL REPAIRS associated with those codes before proceeding with this troubleshooting.

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

FLA -156 FUEL SYSTEM

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.



EDTC\_GK

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

# **NOTE**

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

YES

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



▶ Go to next step as below.

#### **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 ℃ (203°F)

4. Is a problem found?



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

# NO

▶ Go to next step as below.

# TERMINAL & CONNECTOR INSPECTION E5C0B7CA

- 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 ECB95AD5

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

#### Specification:

Temperature	Resistance(kΩ )	
<b>20</b> ℃(68°F)	Approx. 2.31 ~ 2.59	
40°C(104°F)	Approx. 1.15	
80°C(176°F)	Approx. 0.32	

<C111>



- 1. ECTS Signal
- 2. To Indicators & Gauges
- 3. Ground

FLA -158 FUEL SYSTEM

4. Is resistance within the specification?



▶ 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.



▶ 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 EE81919B

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
- 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"?



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



▶ Go to the applicable troubleshooting procedure.

# DTC P0128 COOLANT THERMOSTAT (COOLANT TEMP. BELOW THERMOSTAT REGULATING TEMP.)

# **COMPONENT LOCATION** E086A700

Refer to DTC P0125.

## GENERAL DESCTIPTION ED10FDC7

Refer to DTC P0125.

## DTC DESCRIPTION E8DE928C

An open stuck thermostat means an increase of the engine warm up time and can cause emission increase as well. To detect open stuck thermostat, the ECM checks measured coolant temperature as soon as calculated coolant temperature reaches threshold (85°C) and sets DTC P0128 when measured coolant temperature is lower than threshold. If same code is set again in the next driving cycle, MIL is illuminated.

# DTC DETECTING CONDITION E6B3E0D2

Item	Detecting Condition	Possible Cause
DTC Strategy	Coolant temp.not reached warm up state	
Enable Conditions	<ul> <li>Percentage of fuel-cut off phase &lt; 20%</li> <li>Percentage of low load phase &lt; 50%</li> <li>Intake air temperature decreases compared to start Intake air temp. &gt; -9℃(16°F)</li> <li>Percentage of low vehicle speed &lt; 78%</li> <li>Percentage of high vehicle speed &lt; 90%</li> <li>-9℃(16°F) &lt; Coolant temperature at start &lt; 54℃(129°F)</li> <li>Intake air temperature at start &gt; -9℃(16°F)</li> </ul>	<ul> <li>Contact resistance in connectors</li> <li>Faulty cooling system</li> </ul>
Threshold Value	Measured coolant temp. < 75 ℃(167*F) When modeled coolant temp. > 85 ℃(185°F)	Faulty thermostat
Diagnostic Time	<ul> <li>10~30 min. depending on coolant temperature at start and driving pattern</li> </ul>	
Fail Safe	<ul> <li>Catalyst monitoring is inhibited</li> <li>Post catalyst fuel trim system monitoring is inhibited</li> </ul>	
MIL On Condition	2 Driving Cycles	

# SPECIFICATION E6C67226

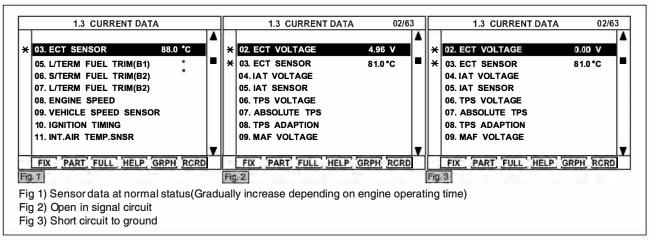
Refer to DTC P0125.

# SCHEMATIC DIAGRAM E8FA4AAB

Refer to DTC P0125.

FLA -160 FUEL SYSTEM

# SIGNAL WAVEFORM EACOGEE



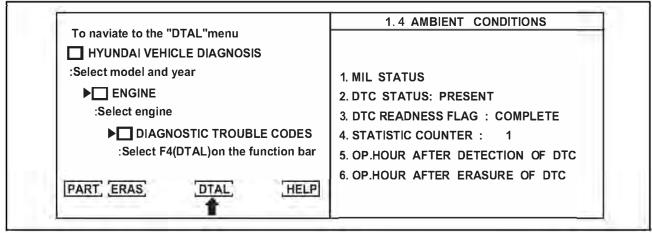
K01282

## MONITOR DTC STATUS E81B3BEA

**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.
- 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.



EDTC\_GK

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.

#### **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?



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



Go to next step as below.

#### TERMINAL & CONNECTOR INSPECTION EF59DB4D

Refer to DTC P0125.

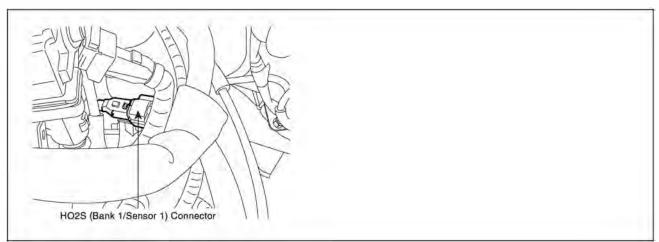
## VERIFICATION OF VEHICLE REPAIR EBFB6C5C

Refer to DTC P0125.

FLA -162 FUEL SYSTEM

# DTC P0130 HO2S CIRCUIT (BANK 1/ SENSOR 1)

## COMPONENT LOCATION E541F800



EGOF250A

# GENERAL DESCRIPTION EFC1F4DE

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

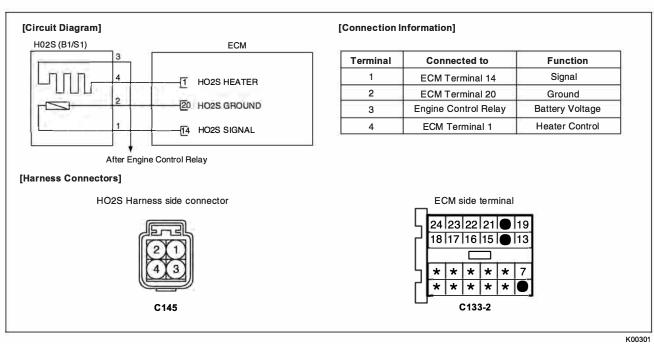
# DTC DESCRIPTION E406D1A3

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

# DTC DETECTING CONDITION E31CDC1A

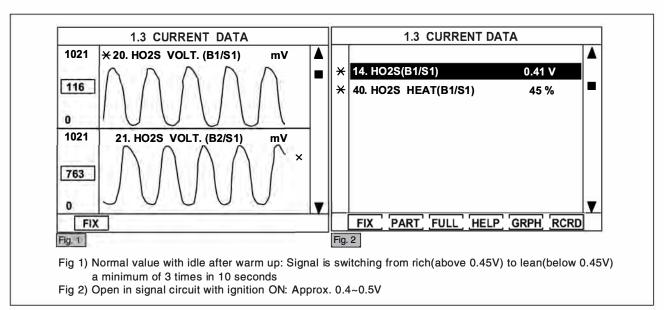
Ite	em	Detecting Condition	Possible Cause
	DTC Strategy	Circuit malfunction	
Case1)	Enable Condi- tions	<ul> <li>Sensor preheating and full heating phases finished</li> <li>Battery voltage &gt; 10V</li> <li>Lambda control active</li> </ul>	
	Thresh- old Value	0.375V < Sensor voltage < 0.482V (during 10 sec.)	
	Diagnos- tic Time	• 1 Sec.	<ul><li> Open in signal harness</li><li> Open in ground harness</li></ul>
	DTC • Check time to closed loop control start with • Col	Contact resistance in connectors	
Coop2)	Enable Condi- tions	Battery voltage > 10V	Faulty Heated O2     Sensor(HO2S)
Case2)	Thresh- old Value	Time to closed loop control not activated when O2 sensor voltage blocked between 0.375~0.482 V (depends on coolant temp. at start)	
	Diagnos- tic Time	Immediate	
MIL On (	Condition	2 Driving Cycles	

# SCHEMATIC DIAGRAM EFF97D2B



FLA -164 FUEL SYSTEM

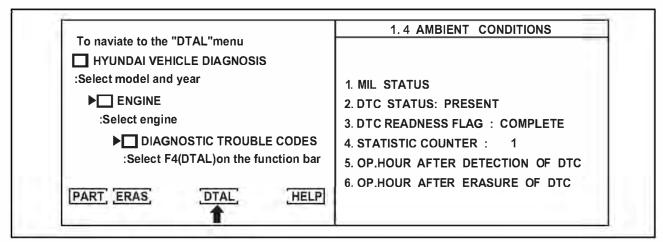
## SIGNAL WAVEFORM E3ECB3E6



K01302

#### MONITOR DTC STATUS ED1FC2BE

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



EDTC\_GK

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.



▶ Go to next step as below.

#### TERMINAL AND CONNECTOR INSPECTION E21A2C87

- 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.
- 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.



▶ Go to "Ground Circuit Inspection" procedure.

## GROUND CIRCUIT INSPECTION ECA5FA82

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

Specification : Approx.  $0\Omega$ 

4. Is resistance within the specification?



▶ Go to "Signal Circuit Inspection" procedure.

NO

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

#### SIGNAL CIRCUIT INSPECTION E9B49FF1

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

Specification: Approx. 0Ω

Is resistance within the specification?

FLA -166 FUEL SYSTEM

# YES

▶ Go to "Component Inspection" procedure.

# NO

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

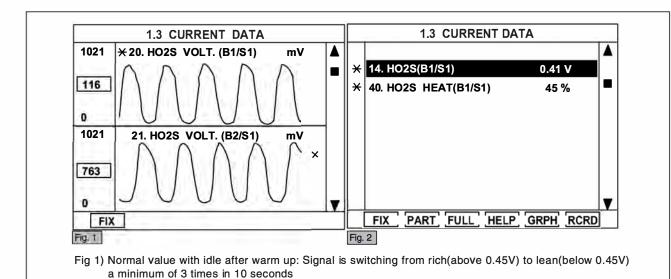
#### COMPONENT INSPECTION E6A2DA9D

- 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.

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

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

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



K01302

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 EDE500E9

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.
- 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"?



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



▶ Go to the applicable troubleshooting procedure.

FLA -168 FUEL SYSTEM

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

# COMPONENT LOCATION E7C6DD14

Refer to DTC P0130.

# GERNERAL DESCRIPTION E98BAF9B

Refer to DTC P0130.

# DTC DESCRIPTION E0B7DAA4

ECM sets DTC P0131 if the ECM detects that the front HO2S signal circuit is short to ground.

## DTC DETECTING CONDITION E01A6DFA

Item	Detecting Condition	Possible Cause
DTC Strategy	Sensor voltage low	Short to ground in signal harness     Contact resistance in connectors     Faulty Heated O2 Sensor(HO2S)
Enable Conditions	<ul> <li>Sensor preheating and full heating phases finished</li> <li>Battery voltage &gt; 10V</li> </ul>	
Threshold Value	• Sensor voltage < 0.02V and element resistance < 10 $\!\Omega$	
Diagnostic Time	• 60 sec.	
MIL On Condition	2 Driving Cycles	

## SCHEMATIC DIGRAM E2FE2632

Refer to DTC P0130.

#### SIGNAL WAVEFORM EFSCDFEF

Refer to DTC P0130.

# MONITOR DTC STATUS EC5AE280

Refer to DTC P0130.

## TERMINAL AND CONNECTOR INSPECTION EA5A547A

Refer to DTC P0130.

# SIGNAL CIRCUIT INSPECTION EAF5CFBE

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

Specification: Infinite

Is resistance within the specification?



▶ Go to "Component Inspection" procedure.

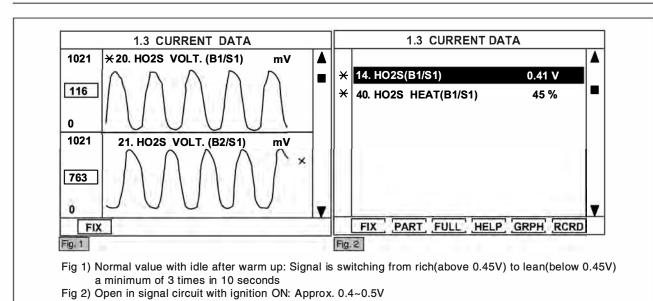
NO

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

#### COMPONENT INSPECTION

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

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



K01302

Is sensor switching properly?



▶ 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.

FLA -170 FUEL SYSTEM



▶ 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 EC86C68C

Refer to DTC P0130.

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

## COMPONENT LOCATION EBB3BEEF

Refer to DTC P0130.

#### GERNERAL DESCRIPTION EDDDDA64

Refer to DTC P0130.

# DTC DESCRIPTION EEC04EEA

ECM sets DTC P0132 if the ECM detects that the front HO2S signal circuit is short to battery.

# DTC DETECTING CONDITION E2AF1D37

Item	Detecting Condition	Possible Cause
DTC Strategy	Sensor voltage high	
Enable Conditions	Battery voltage > 10V	<ul> <li>Short to Battery in signal harness</li> <li>Contact resistance in connectors</li> <li>Faulty Heated O2 Sensor(HO2S)</li> </ul>
Threshold Value	Sensor voltage > 1.2V	
Diagnostic Time	• 1 Sec.	
MIL On Condition	2 Driving Cycles	

# SCHEMATIC DAIGRAM EFD01BEB

Refer to DTC P0130.

## SIGNAL WAVEFORM E6AED6EA

Refer to DTC P0130.

## MONITOR DTC STATUS E8B9F756

Refer to DTC P0130.

## TERMINAL AND CONNECTOR INSPECTION E7E927C6

Refer to DTC P0130.

## SIGNAL CIRCUIT INSPECTION E727EEDC

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

Specification: Approx. 0V

**FLA-172 FUEL SYSTEM** 

Is voltage within the specification?



Go to "Component Inspection" procedure.

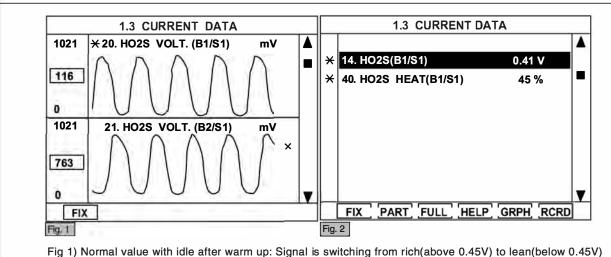


▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

#### COMPONENT INSPECTION EB8FEC25

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

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



a minimum of 3 times in 10 seconds

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

K01302

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 E2F0D6F9

Refer to DTC P0130.

FLA -174 FUEL SYSTEM

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

## COMPONENT LOCATION EAF1C1EC

Refer to DTC P0130.

# GERNERAL DESCRIPTION EDDBC661

Refer to DTC P0130.

#### DTC DESCRIPTION EAGDBBDF

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

## DTC DETECTING CONDITION E6202E99

Item	Detecting Condition	Possible Cause
DTC Strategy	Comparison of O2 sensor lean/rich period with calculated period	
Enable Conditions	<ul> <li>400°C(752°F) &lt; Catalyst Temp.Model &lt; 600°C(1112°F)</li> <li>Coolant temperature &gt; 70°C(158°F)</li> <li>992 &lt; Engine speed(RPM) &lt; 2880</li> <li>Mass air flow(mg/rev.) &lt; 750</li> <li>No misfire detected</li> <li>Engine Speed   Current - Mean   &lt; 350 rpm</li> <li>TPS   Current - Mean   &lt; 4.2° TPS</li> <li>Lambda Correction   Current - Mean   &lt; 4 %</li> </ul>	<ul> <li>Leak in intake or exhaust system</li> <li>Faulty fuel system.</li> <li>Front and rear HO2S connections reversed.</li> <li>Contact resistance in connectors</li> <li>HO2S contamination</li> </ul>
Threshold Value	Sum of O2 sensor lean/rich period > calculated period	
Diagnostic Time	80 lambda controller cycles	
MIL On Condition	2 Driving Cycles	

# SCHEMATIC DIAGRAM E6C35BC6

Refer to DTC P0130.

SIGNAL WAVEFORM EF02CE39

Refer to DTC P0130.

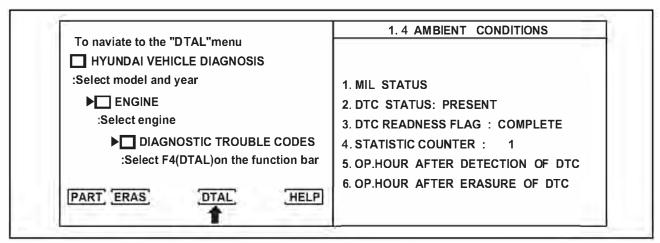
# MONITOR DTC STATUS E5B09F4D



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.
- 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.



EDTC\_GK

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 E9653CCF

- 1. Visually/physically inspect the following items:
  - Ensure that the HO2S is securely installed.
  - Check for corrosion on terminals.
  - Check for terminal tension ( at the HO2S and at the ECM).
  - Check for damaged wiring.
  - Check the HO2S ground circuit for a good connection.
- 2. Check front and rear HO2S for connections being reversed. If HO2S connections reversed, switch connections properly.
- 3. Was a problem found in any of the above areas?

# YES

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

FLA -176 FUEL SYSTEM

NO

▶ Go to "Air Leakage Inspection" procedure

## AIR LEAKAGE INSPECTION E70E6073

- 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**

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

Test Condition: Engine "ON" & Vacuum hose disconnected at Idle.

Specification: 320~340kPa(3.26~3.47 kg/cm², 46~49 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.

## **FUEL INJECOTR INSPECTION**

- 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

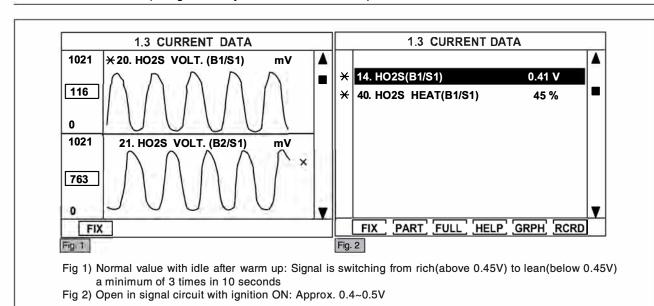
## COMPONENT INSPECTION ED121F7E

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

Test Condition: Engine "ON"

Specification: Verify signal is switching from rich(above 0.45V) to lean(below 0.45V) a minimum of

3 times in 10 seconds (voltage will vary between 0.1 and 0.9V).



K01302

4. Is sensor switching properly?



▶ 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.



▶ 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 EE56 AAF7

Refer to DTC P0130.

FLA -178 FUEL SYSTEM

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

# COMPONENT LOCATION EA850EAC

Refer to DTC P0130.

## GERNERAL DESCRIPTION EA91E67C

Refer to DTC P0130.

## DTC DESCRIPTION EE68C2FB

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 E52622EE

Ite	em	Detecting Condition	Possible Cause
	DTC Strategy	Signal plausibility during fuel cut off	
Case1)	Enable Condi- tions	<ul> <li>Sensor preheating and full heating phases finished</li> <li>Fuel Cut Off active</li> <li>Integrated Mass Air Flow since begin fuel cut-off &gt; 20g</li> </ul>	
	Thresh- old Value	Voltage with fuel cut off > 0.2V	
	Diagnos- tic Time	• 5 Sec.	Related fuse blown or
	DTC Strategy	Sensor voltage excursion	missing Contact resistance in connectors
Case2)	Enable Condi- tions	<ul> <li>Sensor preheating and full heating phases finished</li> <li>5 Cycles of A/F Closed Loop passed after lambda control active.</li> <li>Lambda controller is not on the limit</li> <li>Battery voltage &gt; 10V</li> </ul>	HO2S contamination
	Thresh- old Value	Sensor voltage < 0.25V	
	Diagnos- tic Time	• 2 min.	
MIL On	Condition	2 Driving Cycles	

# SCHEMATIC DIGRAM E5E32039

Refer to DTC P0130.

# SIGNAL WAVEFORM E9DA0BDB

Refer to DTC P0130.

#### MONITOR DTC STATUS E79D1EC8

Refer to DTC P0133.

#### TERMINAL AND CONNECTOR INSPECTION EACAB63D

Refer to DTC P0130.

#### **HO2S FUSE INSPECTION**

- 1. Ignition "OFF" & Engine "OFF"
- 2. Verify "10A Sensor fuse" is installed and not blown.
- 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 EA04B603

- 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.

Test Condition: Engine "ON".

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

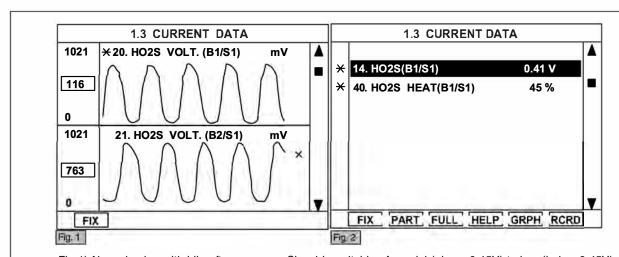


Fig 1) Normal value with idle after warm up: Signal is switching from rich(above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10 seconds

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

FLA -180 FUEL SYSTEM

4. Is sensor switching properly?



▶ 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.



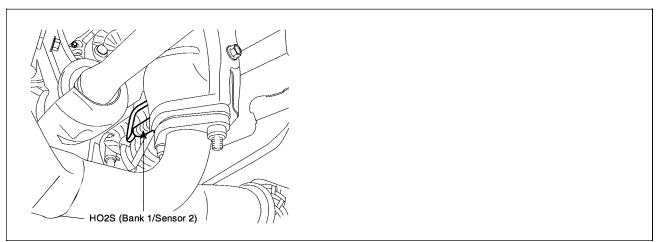
▶ Check HO2S for contamination, deterioration, or damage. Substitute with a known-good HO2S and check for proper operation. If the problem is corrected, replace HO2S and then go to "Verification of Vehicle Repair" procedure.

# VERIFICATION OF VEHICLE REPAIR EB42B1EA

Refer to DTC P0130.

# DTC P0136 HO2S CIRCUIT (BANK 1/ SENSOR 2)

## COMPONENT LOCATION E1DDA9E4



EGOF251A

## GERNERAL DESCRIPTION E7A7B3B4

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 E29D841E

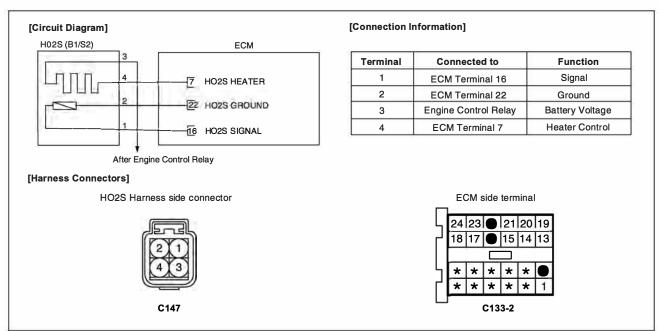
ECM sets DTC P0136 if the ECM detects that the rear HO2S signal circuit is open.

## DTC DETECTING CONDITION EAA46ADB

Item	Detecting Condition	Possible Cause
DTC Strategy	Circuit malfunction	<ul> <li>Open in signal harness</li> <li>Open in ground harness</li> <li>Contact resistance in connectors</li> <li>Faulty Heated O2 Sensor(HO2S)</li> </ul>
Enable Conditions	Sensor preheating and full heating phases finished     Battery voltage > 10V	
Threshold Value	• Sensor element resistance > 60kΩ	
Diagnostic Time	• 30 sec.	
MIL On Condition	2 Driving Cycles	

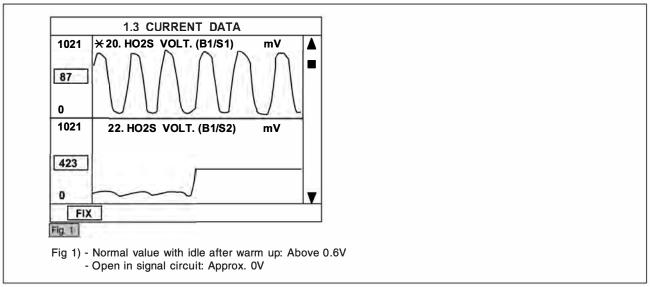
FLA -182 FUEL SYSTEM

## SCHEMATIC DIGRAM E02D7AF6



K00361

#### SIGNAL WAVEFORM EEEE99A0

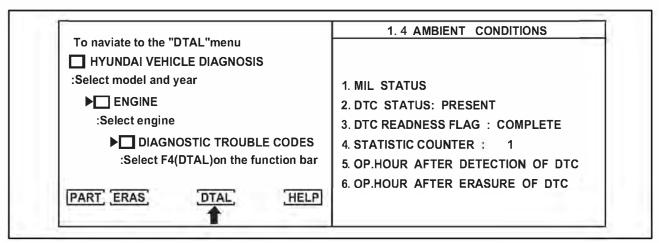


K01362

# MONITOR DTC STATUS E7A854BF

- 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.



EDTC GK

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.

# ИО

▶ Go to next step as below.

## TERMINAL AND CONNECTOR INSPECTION E662ED6C

- 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.
- 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 EBDA7C4C

1. Ignition "OFF"

FLA -184 FUEL SYSTEM

- Disconnect HO2S and ECM connectors.
- 3. Measure resistance between terminals 2 of the HO2S harness connector and 22 of the ECM harness connector.

Specification : Approx.  $0\Omega$ 

4. Is resistance within the specification?



▶ Go to "Signal circuit inspection" procedure.



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

## SIGNAL CIRCUIT INSPECTION E2B8A89E

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

Specification : Approx.  $0\Omega$ 

Is resistance within the specification?

YES

▶ Go to "Component Inspection" procedure.

NO

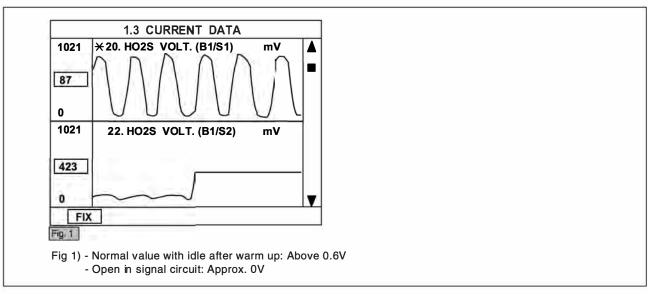
▶ Repair open in the ground circuit and go to "Verification of Vehicle Repair" procedure.

## COMPONENT INSPECTION EEA33C27

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

Test Condition: Engine "ON" & In Idle("Closed Loop")condition

Specification: Above 0.6V



K01362

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

# YES

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

# NO

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

## VERIFICATION OF VEHICLE REPAIR E4803D8B

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.
- 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.

FLA -186 FUEL SYSTEM

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

## COMPONENT LOCATION E2AFCFCC

Refer to DTC P0136.

## GERNERAL DESCRIPTION EEF22D99

Refer to DTC P0136.

# DTC DESCRIPTION EBF7AF52

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

## DTC DETECTING CONDITION E8E1C4B8

Item	Detecting Condition	Possible Cause
DTC Strategy	Sensor voltage low	<ul> <li>Short to ground in signal harness</li> <li>Contact resistance in connectors</li> <li>Faulty Heated O2 Sensor(HO2S)</li> </ul>
Enable Conditions	Sensor preheating and full heating phases finished     Battery voltage > 10V	
Threshold Value	• Sensor voltage $<$ 0.02V and element resistance $<$ 10 $\Omega$	
Diagnostic Time	• 30 sec.	
MIL On Condition	2 Driving Cycles	

#### SCHEMATIC DIAGRAM E305B8A7

Refer to DTC P0136.

## SIGNAL WAVEFORM E1C1A022

Refer to DTC P0136.

#### MONITOR DTC STATUS E76DB6F9

Refer to DTC P0136.

## TERMINAL AND CONNECTOR INSPECTION E2EE97D3

Refer to DTC P0136.

## SIGNAL CIRCUIT INSPECTION E4AAA34E

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

## COMPONENT INSPECTION EOEDS

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

Test Condition: Engine "ON" & In Idle("Closed Loop")condition

Specification: Above 0.6V

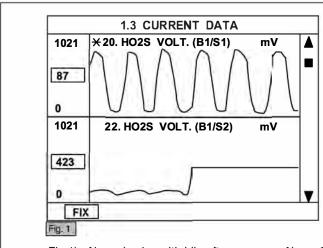


Fig 1) - Normal value with idle after warm up: Above 0.6V

- Open in signal circuit: Approx. 0V

K01362

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

# YES

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

## NO

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

FLA -188 FUEL SYSTEM

## VERIFICATION OF VEHICLE REPAIR E080E826

Refer to DTC P0136.

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

## COMPONENT LOCATION EF85C0FD

Refer to DTC P0136.

## GERNERAL DESCRIPTION E912063E

Refer to DTC P0136.

## DTC DESCRIPTION E0F7FEED

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

## DTC DETECTING CONDITION EECE7B34

Item	Detecting Condition	Possible Cause
DTC Strategy	Sensor voltage high	
Enable Conditions	Battery voltage > 10V	Short to Battery in signal harness     Contact resistance in connectors     Faulty Heated O2 Sensor(HO2S)
Threshold Value	Sensor voltage > 1.2V	
Diagnostic Time	• 1 Sec.	
MIL On Condition	2 Driving Cycles	

## SCHEMATIC DIAGRAM ED44FDEA

Refer to DTC P0136.

## SIGNAL WAVEFORM E9DD561E

Refer to DTC P0136.

## MONITOR DTC STATUS E4FBE916

Refer to DTC P0136.

## TERMINAL AND CONNECTOR INSPECTION EFCC7D4A

Refer to DTC P0136.

## SIGNAL CIRCUIT INSPECTION EB23E641

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

**FLA-190 FUEL SYSTEM** 

Specification: Approx. 0V

Is voltage within the specification?



▶ Go to "Component Inspection" procedure.



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

## COMPONENT INSPECTION EC8647DC

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

Test Condition: Engine "ON" & In Idle("Closed Loop")condition

Specification: Above 0.6V

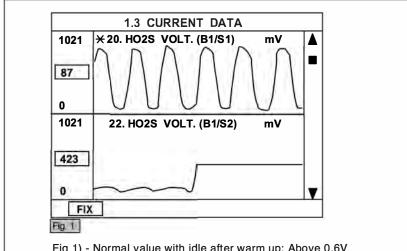


Fig 1) - Normal value with idle after warm up: Above 0.6V

- Open in signal circuit: Approx. 0V

K01362

Is sensor display within the specification?



▶ 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 EB59CBA8

Refer to DTC P0136.

FLA -192 FUEL SYSTEM

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

## COMPONENT LOCATION EC6D0D55

Refer to DTC P0136.

## GERNERAL DESCRIPTION E83EBAB2

Refer to DTC P0136.

#### DTC DESCRIPTION EBB7BC1F

The ECM monitors rich-lean switching time of rear heated oxygen sensor (HO2S) after fuel cut-off to validate dynamic behaviour of rear heated oxygen sensor (HO2S). After detection of fuel cut-off engine operating state, the ECM 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. If same error code is set in the next driving cycle, the ECM illuminates the MIL.

## DTC DETECTING CONDITION E5D05E05

Item	Detecting Condition	Possible Cause
DTC Strategy	Slow response(Switching time check at entry in Fuel cut off)	<ul> <li>Leak in intake or exhaust system</li> <li>Faulty fuel system.</li> <li>Front and rear HO2S connections reversed.</li> <li>Contact resistance in connectors</li> <li>HO2S contamination</li> </ul>
Enable Conditions	<ul> <li>Fuel cut-off phase</li> <li>Sensor preheating and full phase finished</li> <li>Catalyst temp.model &gt; 350 ℃ (662 ° F)</li> <li>Coolant temp &gt; 70 ℃ (158 ° F)</li> <li>Downstream O2 Sensor Signal &gt; 0.55V at Entry in Fuel Cut-Off</li> </ul>	
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	
MIL On Condition	2 Driving Cycles	

## SCHEMATIC DIAGRAM EE5387CE

Refer to DTC P0136.

SIGNAL WAVEFORM E9805A51

Refer to DTC P0136.

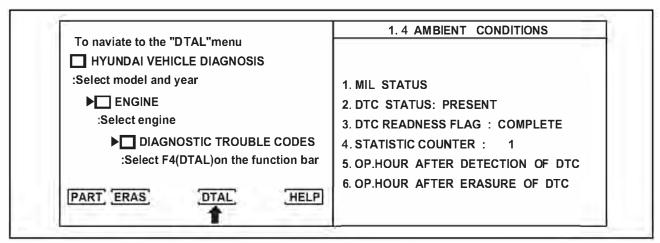
## MONITOR DTC STATUS E432A97A



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.
- 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.



EDTC\_GK

- 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 EA86BF3B

- 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.

FLA -194 FUEL SYSTEM



▶ Go to "Exhaust System Inspection" procedure.

## EXHAUST SYSTEM INSPECTION E8FB1DCB

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

2. Was an exhaust leak found?



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



▶ Go to "Air Leakage Inspection " procedure.

## AIR LEAKAGE INSPECTION E86D2BEB

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

Test Condition: Ignition "ON" & Engine "ON" & Vacuum hose disconnected at Idle Specification: 320~340kPa(3.26~3.47 kg/cm², 46~49 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.

#### **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?



▶ Go to "Component Inspection" procedure.



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

## COMPONENT INSPECTION EFADBBEA

- 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.

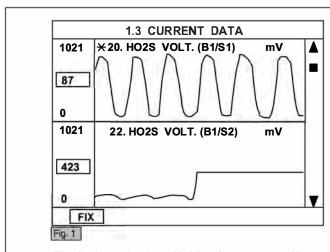


Fig 1) - Normal value with idle after warm up: Above 0.6V

- Open in signal circuit: Approx. 0V

FLA -196 FUEL SYSTEM

4. Is sensor data near the specified value?



▶ 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.



▶ 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 E32FB3BA

Refer to DTC P0136.

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

## COMPINENT LOCATION EFBFB352

Refer to DTC P0136.

## GERNERAL DESCRIPTION EE1D6EDE

Refer to DTC P0136.

## DTC DESCRIPTION E82AFA00

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 3 cases which DTC P0140 sets.

- (I) Signal monitoring during fuel cut-off: The ECM 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 ECM 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.
- (III) Signal monitoring during full load: The ECM monitors rear O2 sensor signal during full load which applies rich air-fuel mixture and sets DTC P0140 when rear O2 sensor signal is too low.

If same error code is set in the next driving cycle, the ECM illuminates the MIL.

FLA -198 FUEL SYSTEM

## DTC DETECTING CONDITION E1C1EDF8

Ite	em	Detecting Condition & Fail Safe	Possible Cause
	DTC Strategy	Signal Plausibility with Rich Mixture (During Catalyst Purge after Fuel Cut Off)	
Case1)	Enable Condi- tions	<ul> <li>Coolant Temperature &gt; 70 °C (158°F)</li> <li>Sensor preheating and full heating phases finished</li> <li>Integrated MAF in last fuel cut-off &gt; 18g</li> <li>Sensor signal at End of Last Fuel cut-off &lt; 0.2V</li> <li>Integrated Air Mass Flow after Fuel Cut Off &gt; 1000g</li> <li>Maximum Upstream O2 Sensor Voltage during Catalyst Purge &gt; 0.7V</li> <li>Catalyst Temperature Model &gt; 350 °C (662°F)</li> </ul>	
	Thresh- old Value	<ul> <li>Max Downstream O2 sensor voltage during Catalyst purge after fuel cut-off &lt; 0.55V</li> </ul>	Related fuse blown or missing     Contact resistance in connectors     HO2S contamination
	Diagnos- tic Time	2 Valid Fuel Cut Off by Catalyst Enrichment	
Case2)	DTC Strategy	Sensor voltage excursion for Lean and Rich mixture	
	Enable Condi- tions	Sensor preheating and full heating phases finished     Fuel cut-off phase     Integrated MAF after starting fuel cut-off > 20g	
	Thresh- old Value	Voltage with fuel cut off > 0.2V	
	Diagnos- tic Time	• 5 sec.	

## SCHEMATIC DIAGRAM ED15B596

Refer to DTC P0136.

## SIGNAL WAVEFORM E3B5889A

Refer to DTC P0136.

## MONITOR DTC STATUS E4FBFEC9

Refer to DTC P0139.

## TERMINAL & CONNECTOR INSPECTION EE9CD74F

Refer to DTC P0136.

## **HO2S FUSE INSPECTION**

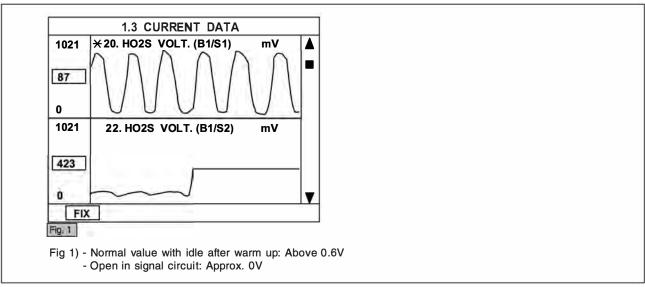
- 1. Ignition "OFF" & Engine "OFF".
- 2. Verify "10A Sensor fuse" is installed and not blown.
- If OK, go to "Component Inspection" procedure.
   If NG, replace fuse and repair any shorts as necessary and go to "Verification of Vehicle Repair" procedure.

#### COMPONENT INSPECTION E

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

Test Condition: Ignition "ON" & Engine "ON" & In Idle("Closed Loop")condition

Specification: Above 0.6V



K01362

3. Is sensor display within the specification?



▶ 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.



▶ 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.

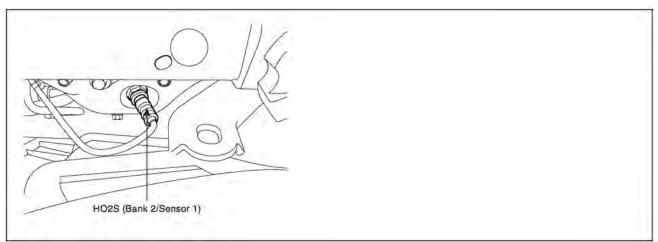
## VERIFICATION OF VEHICLE REPAIR E6C5DB29

Refer to DTC P0136.

FLA -200 FUEL SYSTEM

# DTC P0150 HO2S CIRCUIT (BANK 2/ SENSOR 1)

## COMPONENT LOCATION E9AC9173



EGOF252A

## GENERAL DESCRIPTION E9AC1EAE

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

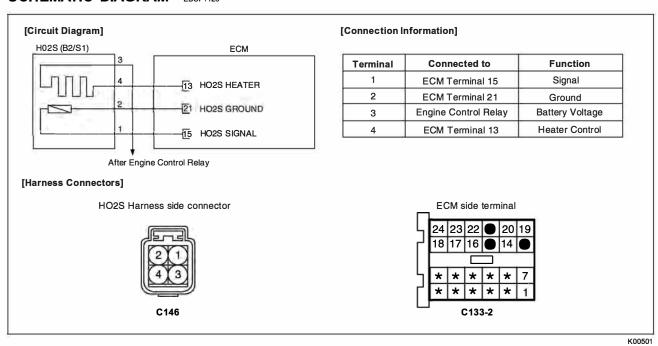
#### DTC DESCRIPTION E59692EA

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

## DTC DETECTING CONDITION E4FA1F41

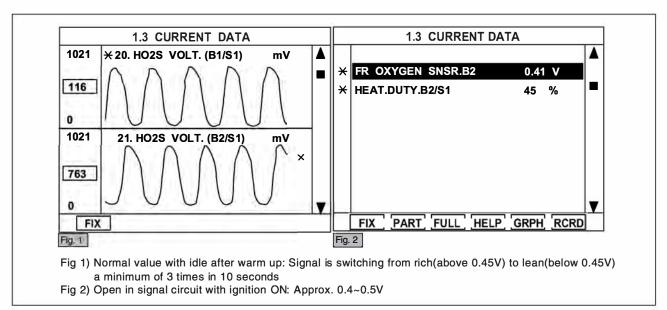
Ite	em	Detecting Condition	Possible Cause
	DTC Strategy	Circuit malfunction	
Case1)	Enable Condi- tions	<ul> <li>Sensor preheating and full heating phases finished</li> <li>Battery voltage &gt; 10V</li> <li>Lambda control active</li> </ul>	Open in signal harness     Open in ground harness     Contact resistance in connectors     Faulty Heated O2     Sensor(HO2S)
	Thresh- old Value	0.375V < Sensor voltage < 0.482V (during 10 sec.)	
	Diagnos- tic Time	• 1 Sec.	
	DTC Strategy	Check time to closed loop control start with O2 sensor voltage	
Case2)	Enable Condi- tions	Battery voltage > 10V	
	Thresh- old Value	Time to closed loop control not activated when O2 sensor voltage blocked between 0.375~0.482 V (depends on coolant temp. at start)	
	Diagnos- tic Time	Immediate	
MIL On (	Condition	2 Driving Cycles	

## SCHEMATIC DIAGRAM EBCF1128



FLA -202 FUEL SYSTEM

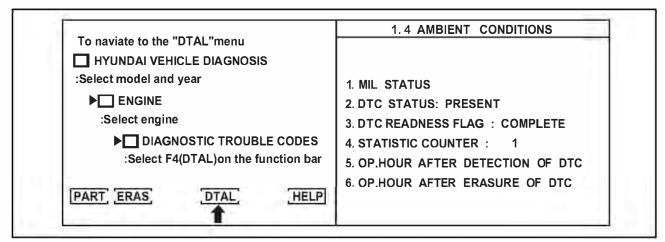
## SIGNAL WAVEFORM ED3F5830



K01502

## MONITOR DTC STATUS E02FD3C6

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



EDTC\_GK

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.



▶ Go to next step as below.

#### TERMINAL AND CONNECTOR INSPECTION FD2782DE

- 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.
- 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 E5A9BFE9

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

Specification : Approx.  $0\Omega$ 

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 EFD7939E

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

Specification : Approx.  $0\Omega$ 

2. Is resistance within the specification?

FLA -204 FUEL SYSTEM

## YES

▶ Go to "Component Inspection" procedure.

## NO

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

#### COMPONENT INSPECTION EEBB152C

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

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

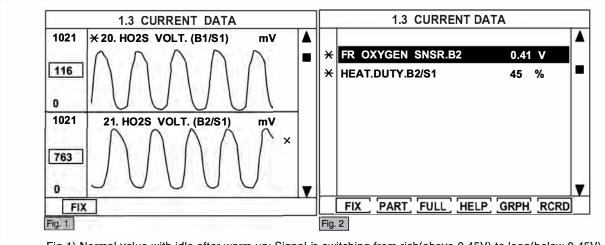


Fig 1) Normal value with idle after warm up: Signal is switching from rich(above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10 seconds

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

K01502

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 EA13B4EC

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.
- 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"?



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



▶ Go to the applicable troubleshooting procedure.

FLA -206 FUEL SYSTEM

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

## COMPONENT LOCATION EB8B40C6

Refer to DTC P0150.

## GERNERAL DESCRIPTION E69788B3

Refer to DTC P0150.

## DTC DESCRIPTION E45BFC06

ECM sets DTC P0151 if the ECM detects that the front HO2S signal circuit is short to ground.

## DTC DETECTING CONDITION EBE88DD5

Item	Detecting Condition	Possible Cause
DTC Strategy	Sensor voltage low	Short to ground in signal harness     Contact resistance in connectors     Faulty Heated O2 Sensor(HO2S)
Enable Conditions	<ul> <li>Sensor preheating and full heating phases finished</li> <li>Battery voltage &gt; 10V</li> </ul>	
Threshold Value	• Sensor voltage < 0.02V and element resistance < 10Ω	
Diagnostic Time	• 60 sec.	
Fail Safe	<ul> <li>Reset lambda adaptation and fuel trim adaptation</li> <li>Front HO2S heater is controlled in open loop control</li> <li>EVAP. Emission control function is controlled in minimum operation mode</li> </ul>	
MIL On Condition	2 Driving Cycles	

## SCHEMATIC DIAGRAM EEEC3A1D

Refer to DTC P0150.

SIGNAL WAVEFORM EC08FEE4

Refer to DTC P0150.

MONITOR DTC STATUS E18159FA

Refer to DTC P0150.

TERMINAL AND CONNECTOR INSPECTION EFFAC4BA

Refer to DTC P0150.

#### SIGNAL CIRCUIT INSPECTION EE9773A0

- 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?



▶ Go to "Component Inspection" procedure.



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

## COMPONENT INSPECTION E44AF8F0

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

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

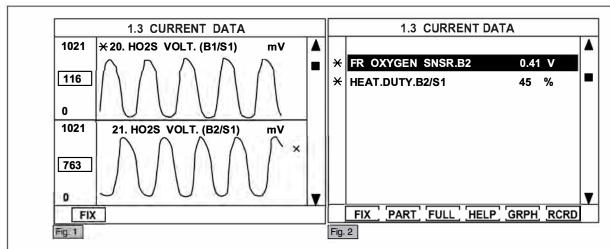


Fig 1) Normal value with idle after warm up: Signal is switching from rich(above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10 seconds

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

FLA -208 FUEL SYSTEM

4. Is sensor switching properly?



▶ 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.



▶ 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 EC48BECE

Refer to DTC P0150.

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

## COMPONENT LOCATION E6127DAC

Refer to DTC P0150.

#### GERNERAL DESCRIPTION E9593BFD

Refer to DTC P0150.

## DTC DESCRIPTION EE65FACD

ECM sets DTC P0152 if the ECM detects that the front HO2S signal circuit is short to battery.

#### DTC DETECTING CONDITION EF56B94B

Item	Detecting Condition	Possible Cause
DTC Strategy	Sensor voltage high	
Enable Conditions	Battery voltage > 10V	Short to Battery in signal harness     Contact resistance in connectors     Faulty Heated O2 Sensor(HO2S)
Threshold Value	Sensor voltage > 1.2V	
Diagnostic Time	• 1 Sec.	
MIL On Condition	2 Driving Cycles	

## SCHEMATIC DIAGRAM EAGBAFD8

Refer to DTC P0150.

#### SIGNAL WAVEFORM EODEFECD

Refer to DTC P0150.

## MONITOR DTC STATUS EBCEE0C9

Refer to DTC P0150.

#### TERMINAL AND CONNECTOR INSPECTION E7BDE1CD

Refer to DTC P0150.

## SIGNAL CIRCUIT INSPECTION EBC3FFDC

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

Specification: Approx. 0V

FLA -210 FUEL SYSTEM

5. Is voltage within the specification?



▶ Go to "Component Circuit Inspection" procedure.



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

#### COMPONENT INSPECTION EAOD636F

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

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

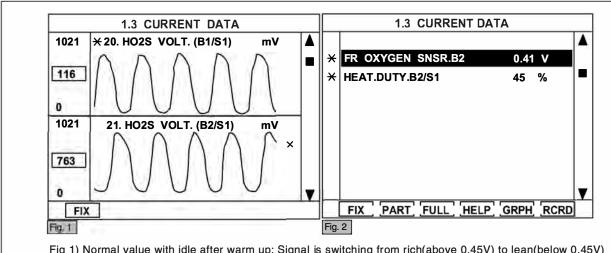


Fig 1) Normal value with idle after warm up: Signal is switching from rich(above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10 seconds

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

K01502

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 E1DFC523

Refer to DTC P0150.

FLA -212 FUEL SYSTEM

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

## COMPONENT LOCATION E69F8C7D

Refer to DTC P0150.

## GERNERAL DESCRIPTION EEBC4DEE

Refer to DTC P0150.

#### DTC DESCRIPTION EA2E75AB

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

## DTC DETECTING CONDITION E1FC3D54

Item	Detecting Condition	Possible Cause
DTC Strategy	Comparison of O2 sensor lean/rich period with calculated period	<ul> <li>Leak in intake or exhaust system</li> <li>Faulty fuel system.</li> <li>Front and rear HO2S connections reversed.</li> <li>Contact resistance in connectors</li> <li>HO2S contamination</li> </ul>
Enable Conditions	<ul> <li>400°C(752°F) &lt; Catalyst Temp.Model &lt; 600°C(1112°F)</li> <li>Coolant temperature &gt; 70°C(158°F)</li> <li>992 &lt; Engine speed(RPM) &lt; 2880</li> <li>Mass air flow(mg/rev.) &lt; 750</li> <li>No misfire detected</li> <li>Engine Speed   Current - Mean   &lt; 350 rpm</li> <li>TPS   Current - Mean   &lt; 4.2° TPS</li> <li>Lambda Correction   Current - Mean   &lt; 4 %</li> </ul>	
Threshold Value	Sum of O2 sensor lean/rich period > calculated period	
Diagnostic Time	80 lambda controller cycles	
MIL On Condition	2 Driving Cycles	

## SCHEMATIC DIAGRAM E5B7A2EE

Refer to DTC P0150.

SIGNAL WAVEFORM E1CA6A6C

Refer to DTC P0150.

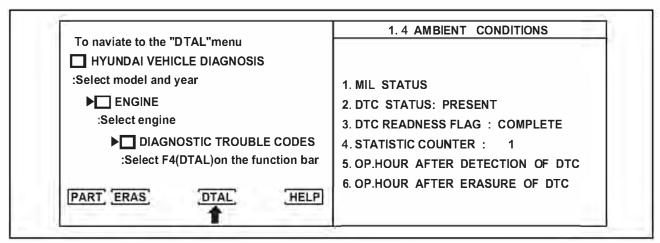
## MONITOR DTC STATUS E61AF4DE



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.



EDTC\_GK

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 E98F9C9F

- 1. Visually/physically inspect the following items:
  - Ensure that the HO2S is securely installed.
  - Check for corrosion on terminals.
  - Check for terminal tension ( at the HO2S and at the ECM).
  - Check for damaged wiring.
  - Check the HO2S ground circuit for a good connection.
- 2. Check front and rear HO2S for connections being reversed. If HO2S connections reversed, switch connections properly.
- 3. Was a problem found in any of the above areas?

# YES

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

FLA -214 FUEL SYSTEM



▶ Go to "Exhaust System Inspection" procedure.

## EXHAUST SYSTEM INSPECTION EBC5EF81

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

2. Was an exhaust leak found?



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



▶ Go to "Air Leakage Inspection " procedure.

## AIR LEAKAGE INSPECTION E215CCF8

- 1. Visually/physically inspect the following items:
  - Vacuum hoses for splits, kinks and improper connections.
  - Exhaust system between HO2S and Three way catalyst for air leakage.
  - EVAP system for leakage.
  - PCV hose for proper installation.
- 2. Was a problem found in any of the above areas?

YES

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

NO

▶ Go to "Fuel Pressure Inspection" procedure

## **FUEL PRESSURE INSPECTION**

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

Test Condition: Engine "ON" & Vacuum hose disconnected at Idle.

Specification: 320~340kPa(3.26~3.47 kg/cm², 46~49 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.

#### **FUEL INJECOTR INSPECTION**

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

Specification: No clogging and restriction

3. Is the fuel injector OK?



▶ Go to "Component Inspection" procedure



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

#### COMPONENT INSPECTION EAE12BAD

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

Test Condition: Ignition "ON" & Engine "ON".

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

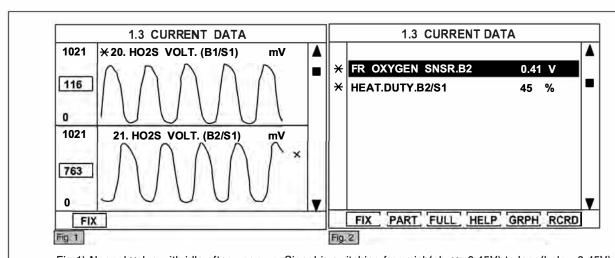


Fig 1) Normal value with idle after warm up: Signal is switching from rich(above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10 seconds

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

FLA -216 FUEL SYSTEM

4. Is sensor switching properly?



▶ 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.



▶ 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 EBA9EDF6

Refer to DTC P0150.

# DTC P0154 HO2S CIRCUIT NO ACTIVITY DETECTED (BANK 2 / SENSOR 1)

## COMPONENT LOCATION E9E35ED9

Refer to DTC P0150.

#### GERNERAL DESCRIPTION EFA83EBF

Refer to DTC P0150.

#### DTC DESCRIPTION E2E7FF2D

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 EC7C6A17

Item		Detecting Condition	Possible Cause
	DTC Strategy	Signal plausibility during fuel cut off	
Case1)	Enable Condi- tions	<ul> <li>Sensor preheating and full heating phases finished</li> <li>Fuel Cut Off active</li> <li>Integrated Mass Air Flow since begin fuel cut-off &gt; 20g</li> </ul>	
	Thresh- old Value	Voltage with fuel cut off > 0.2V	<ul> <li>Related fuse blown or missing</li> <li>Contact resistance in connectors</li> </ul>
	Diagnos- tic Time	• 5 Sec.	
	DTC Strategy	Sensor voltage excursion	
Case2)	Enable Condi- tions	<ul> <li>Sensor preheating and full heating phases finished</li> <li>5 Cycles of A/F Closed Loop passed after lambda control active.</li> <li>Lambda controller is not on the limit</li> <li>Battery voltage &gt; 10V</li> </ul>	HO2S contamination
	Thresh- old Value	Sensor voltage < 0.25V	
	Diagnos- tic Time	• 2 min.	
MIL On	Condition	2 Driving Cycles	

#### SCHEMATIC DIAGRAM E3479F97

Refer to DTC P0150.

## SIGNAL WAVEFORM E94AFAB0

Refer to DTC P0150.

FLA -218 FUEL SYSTEM

#### MONITOR DTC STATUS E365CB89

Refer to DTC P0153.

#### TERMINAL AND CONNECTOR INSPECTION E98DF69C

Refer to DTC P0150.

#### **HO2S FUSE INSPECTION**

1. Ignition "OFF" & Engine "OFF"

- 2. Verify "10A Sensor fuse" is installed and not blown.
- 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 E643E723

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

Test Condition: Engine "ON".

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

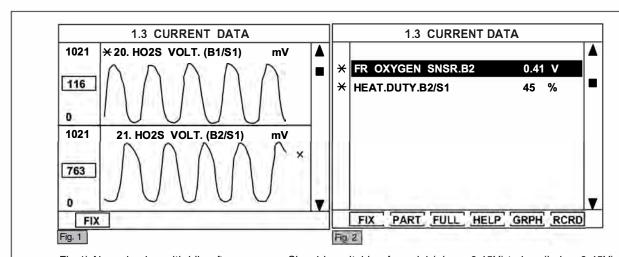


Fig 1) Normal value with idle after warm up: Signal is switching from rich(above 0.45V) to lean(below 0.45V) a minimum of 3 times in 10 seconds

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

K01502

4. Is sensor switching properly?



▶ 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.



▶ 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.

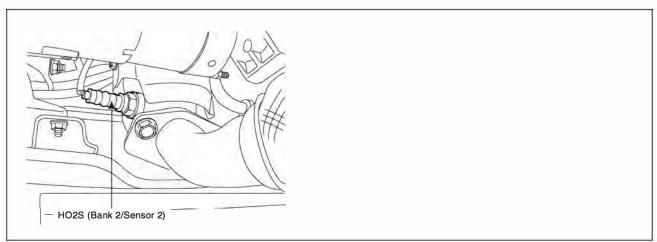
## VERIFICATION OF VEHICLE REPAIR E5E2B0BC

Refer to DTC P0150.

FLA -220 FUEL SYSTEM

# DTC P0156 HO2S CIRCUIT (BANK 2 / SENSOR 2)

## COMPONENT LOCATION E23FEA29



EGOF253A

## GERNERAL DESCRIPTION EDFA5E38

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.

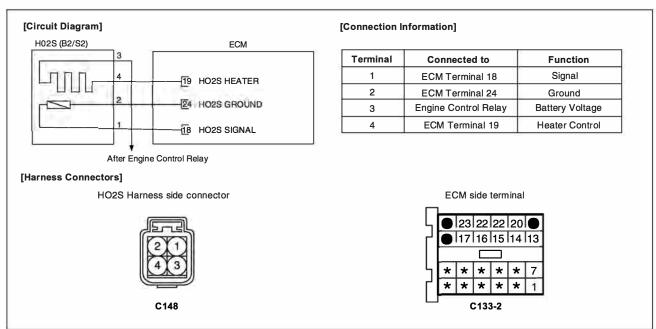
## DTC DESCRIPTION E2277DB4

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

# DTC DETECTING CONDITION E924D2F5

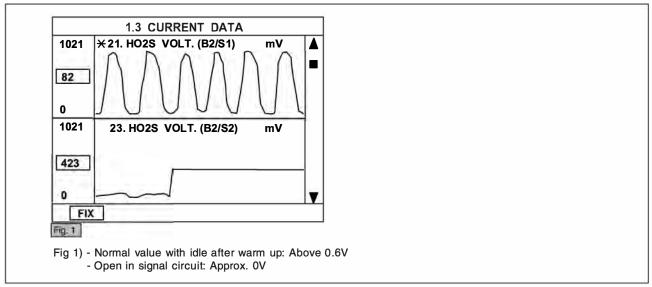
Item	Detecting Condition	Possible Cause	
DTC Strategy	Circuit malfunction		
Enable Conditions	Sensor preheating and full heating phases finished     Battery voltage > 10V	<ul> <li>Open in signal harness</li> <li>Open in ground harness</li> <li>Contact resistance in connectors</li> <li>Faulty Heated O2 Sensor(HO2S)</li> </ul>	
Threshold Value	• Sensor element resistance > 60kΩ		
Diagnostic Time	• 30 sec.		
MIL On Condition	2 Driving Cycles		

#### SCHEMATIC DIAGRAM E5C6DF3B



#### K00561

#### SIGNAL WAVEFORM EDFD06AS



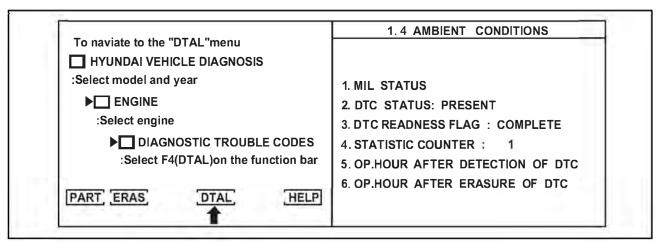
K01562

## MONITOR DTC STATUS ECDAB8C5

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

FLA -222 FUEL SYSTEM

4. Read "DTC Status" parameter.



EDTC GK

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 EDF1C577

- 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.
- 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 EF988DC0

1. Ignition "OFF"

- 2. Disconnect HO2S and ECM connectors.
- 3. Measure resistance between terminal 2 of the sensor harness connector and 24 of the ECM harness connector.

Specification : Approx.  $0\Omega$ 

4. Is resistance within the specification?



▶ Go to "Signal circuit inspection" procedure.



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

## SIGNAL CIRCUIT INSPECTION EEC4D186

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

Specification : Approx.  $0\Omega$ 

2. Is resistance within the specification?



▶ Go to "Component Inspection" procedure.

NO

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

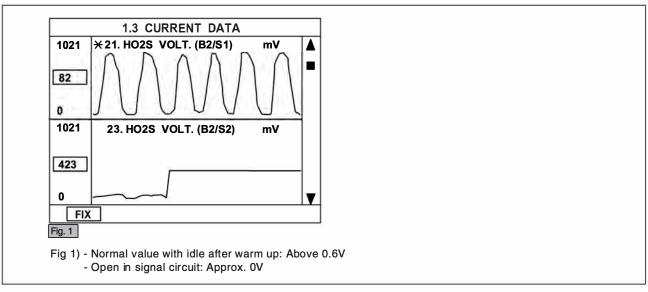
## COMPONENT INSPECTION E9DCC149

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

Test Condition: Engine "ON" & In Idle("Closed Loop")condition.

Specification: Above 0.6V.

FLA -224 FUEL SYSTEM



K01562

3. Is sensor data within the specification?

# YES

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

# NO

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

#### VERIFICATION OF VEHICLE REPAIR ECCEP55E

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.
- 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 P0157 HO2S CIRCUIT LOW VOLTAGE (BANK 2 / SENSOR 2)

#### COMPONENT LOCATION E56765E6

Refer to DTC P0156.

#### GERNERAL DESCRIPTION E0986957

Refer to DTC P0156.

## DTC DESCRIPTION E83A9605

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

## DTC DETECTING CONDITION EEOEB076

Item	Detecting Condition	Possible Cause	
DTC Strategy	Sensor voltage low		
Enable Conditions	<ul> <li>Sensor preheating and full heating phases finished</li> <li>Battery voltage &gt; 10V</li> </ul>	Short to ground in signal harness	
Threshold Value	• Sensor voltage $<$ 0.02V and element resistance $<$ 10 $\Omega$	Contact resistance in connectors     Faulty Heated O2 Sensor(HO2S)	
Diagnostic Time	• 30 sec.		
MIL On Condition	2 Driving Cycles		

#### SCHEMATIC DIGRAM EA0481C6

Refer to DTC P0156.

## SIGNAL WAVEFORM E450B160

Refer to DTC P0156.

#### MONITOR DTC STATUS ECOE5C6A

Refer to DTC P0156.

## TERMINAL AND CONNECTOR INSECTION E7336C01

Refer to DTC P0156.

## SIGNAL CIRCUIT INSPECTION E4AA84AC

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

FLA -226 FUEL SYSTEM

Specification: Infinite

4. Is resistance within the specification?



▶ Go to "Component Inspection" procedure.



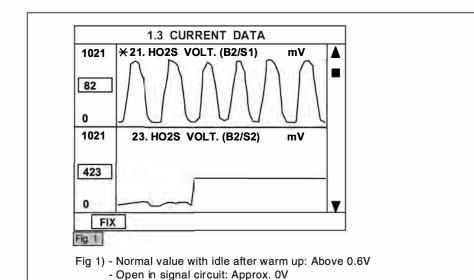
▶ Repair open or short to ground in signal circuit and go to "Verification of Vehicle Repair" procedure.

#### COMPONENT INSPECTION EFC7C052

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

Test Condition: Engine "ON" & In Idle("Closed Loop")condition.

Specification: Above 0.6V.



K01562

3. Is sensor data within the specification?



▶ 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 E9C261FA

Refer to DTC P0156.

FLA -228 FUEL SYSTEM

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

#### COMPONENT LOCATION E60BFFE0

Refer to DTC P0156.

## GERNERAL DESCRIPTION E9BC7A63

Refer to DTC P0156.

#### DTC DESCRIPTION E30B6CC2

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

## DTC DETECTING CONDITION EDFE1A93

Item	Detecting Condition	Possible Cause	
DTC Strategy	Sensor voltage high	Short to Battery in signal harness     Contact resistance in connectors	
Enable Conditions	Battery voltage > 10V		
Threshold Value	Sensor voltage > 1.2V		
Diagnostic Time	• 1 Sec.	Faulty Heated O2 Sensor(HO2S)	
MIL On Condition	2 Driving Cycles		

#### SCHEMATIC DIAGRAM EADESEAD

Refer to DTC P0156.

## SIGNAL WAVEFORM E89D255A

Refer to DTC P0156.

# MONITOR DTC STATUS E38849BE

Refer to DTC P0156.

#### TERMINAL AND CONNECTOR INSECTION EAC24743

Refer to DTC P0156.

#### SIGNAL CIRCUIT INSPECTION E9B95D61

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

Specification: Approx. 0V

5. Is voltage within the specification?

# YES

▶ Go to "Component Inspection" procedure.

# NO

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

## COMPONENT INSPECTION EFC10FCA

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

Test Condition: Engine "ON" & In Idle("Closed Loop")condition.

Specification: Above 0.6V.

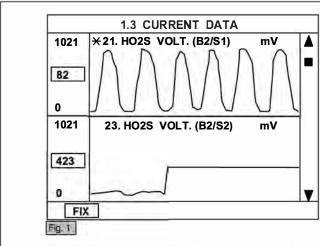


Fig 1) - Normal value with idle after warm up: Above 0.6V

- Open in signal circuit: Approx. 0V

K01562

3. Is sensor data within the specification?

# YES

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

# NO

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

FLA -230 FUEL SYSTEM

# VERIFICATION OF VEHICLE REPAIR EAA027DA

Refer to DTC P0156.

# DTC P0159 HO2S CIRCUIT SLOW RESPONSE (BANK 2 / SENSOR 2)

#### COMPONENT LOCATION EAA36B3D

Refer to DTC P0156.

#### GERNERAL DESCRIPTION EB9E22DD

Refer to DTC P0156.

### DTC DESCRIPTION EF345E13

The ECM monitors rich-lean switching time of rear heated oxygen sensor (HO2S) after fuel cut-off to validate dynamic behaviour of rear heated oxygen sensor (HO2S). After detection of fuel cut-off engine operating state, the ECM measures rich-lean switching time of the rear heated oxygen sensor (HO2S) signal and compares it to the predetermined limit value. DTC P0159 is set when the switching time is bigger than the limit value. If same error code is set in the next driving cycle, the ECM illuminates the MIL.

## DTC DETECTING CONDITION EDBCDBAE

Item	Detecting Condition	Possible Cause
DTC Strategy	Slow response(Switching time check at entry in Fuel cut off)	
Enable Conditions	<ul> <li>Fuel cut-off phase</li> <li>Sensor preheating and full phase finished</li> <li>Catalyst temp.model &gt; 350°C (662°F)</li> <li>Coolant temp &gt; 70°C (158°F)</li> <li>Downstream O2 Sensor Signal &gt; 0.55V at Entry in Fuel Cut-Off</li> </ul>	<ul> <li>Leak in intake or exhaust system</li> <li>Faulty fuel system.</li> <li>Front and rear HO2S connections reversed.</li> </ul>
Threshold Value	Average ratio(between measured and maximum allowed switching time at entry in fuel cut-off) > 1	Contact resistance in connectors     HO2S contamination
Diagnostic Time	5 fuel cut-off phases	
MIL On Condition	2 Driving Cycles	

## SCHEMATIC DIAGRAM E51DA0EF

Refer to DTC P0156.

SIGNAL WAVEFORM E4A1BC3C

Refer to DTC P0156.

## MONITOR DTC STATUS E3BAAA2F



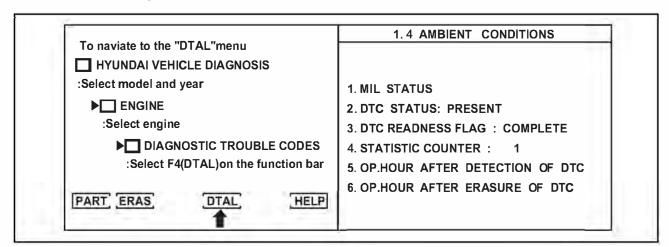
If any misfire, Purge Solenoid Valve, Mass Air Flow Sensor or O2 Sensor heater codes are present, DO ALL REPAIRS associated with those codes before proceeding with this troubleshooting tree.

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

FLA -232 FUEL SYSTEM

- 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.



EDTC\_GK

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 E311C9D0

- 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 E413DADD

- 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 E7E615CB

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

Test Condition: Ignition "ON" & Engine "ON" & Vacuum hose disconnected at Idle

Specification: 320~340kPa(3.26~3.47 kg/cm², 46~49 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.

FLA -234 **FUEL SYSTEM** 

#### **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?



▶ Go to "Component Inspection" procedure.



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

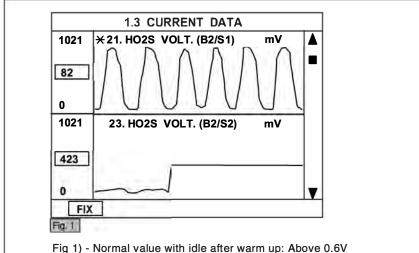
#### COMPONENT INSPECTION E54F3330

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

2. Connect Scantool and monitor the "RR OXYGEN SNSR-B1" parameter on the Scantool data list.

Test Condition: Ignition "ON" & Engine "ON" & In Idle("Closed Loop")condition.

Specification: Above 0.6V.



- Open in signal circuit: Approx. 0V

K01562

Is sensor data near the specified value?



▶ 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 EAC7E16F

Refer to DTC P0156.

FLA -236 FUEL SYSTEM

# DTC P0160 HO2S CIRCUIT NO ACTIVITY DETECTED (BANK 2 / SENSOR 2)

#### COMPINENT LOCATION E55E54AC

Refer to DTC P0156.

#### GERNERAL DESCRIPTION EC6D8F3D

Refer to DTC P0156.

#### DTC DESCRIPTION ED4ADDAD

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 3 cases which DTC P0160 sets.

- (I) Signal monitoring during fuel cut-off: The ECM monitors rear O2 sensor signal level during fuel cut-off which normally shows near 0V and sets DTC P0160 when signal level is too high.
- (II) Signal monitoring after fuel cut-off: The ECM monitors rear O2 sensor signal level for a certain time after leaving fuel cut-off and sets DTC P0160 when signal variation during checked period is too small.
- (III) Signal monitoring during full load: The ECM monitors rear O2 sensor signal during full load which applies rich air-fuel mixture and sets DTC P0160 when rear O2 sensor signal is too low.

If same error code is set in the next driving cycle, the ECM illuminates the MIL.

## DTC DETECTING CONDITION E975E5E5

Item		Detecting Condition	Possible Cause	
	DTC Strategy	Signal Plausibility with Rich Mixture (During Catalyst Purge after Fuel Cut Off)		
Case1)	Enable Condi- tions	<ul> <li>Coolant Temperature &gt; 70 ℃ (158°F)</li> <li>Sensor preheating and full heating phases finished</li> <li>Integrated MAF in last fuel cut-off &gt; 18g</li> <li>Sensor signal at End of Last Fuel cut-off &lt; 0.2V</li> <li>Integrated Air Mass Flow after Fuel Cut Off &gt; 1000g</li> <li>Maximum Upstream O2 Sensor Voltage during Catalyst Purge &gt; 0.7V</li> <li>Catalyst Temperature Model &gt; 350 ℃ (662°F)</li> </ul>		
	Thresh- old Value	Max Downstream O2 sensor voltage during Catalyst purge after fuel cut-off < 0.55V	Open in signal harness     Open in ground harness	
	Diagnos- tic Time	2 Valid Fuel Cut Off by Catalyst Enrichment	Contact resistance in connectors	
	DTC Strategy	Sensor voltage excursion for Lean and Rich mixture	Faulty Heated O2     Sensor(HO2S)	
Case2)	Enable Condi- tions	Battery voltage > 10V		
	Thresh- old Value	Time to closed loop control not activated when O2 sensor voltage blocked between 0.37~0.54 V > 90~ 200 sec (depends on coolant temp. at start)		
	Diagnos- tic Time	Immediate		
MIL On Condition		2 Driving Cycles		

## SCHEMATIC DIAGRAM E02BFD97

Refer to DTC P0156.

## SIGNAL WAVEFORM EBF2F184

Refer to DTC P0156.

## MONITOR DTC STATUS E8B0A0D4

Refer to DTC P0159.

## TERMINAL & CONNECTOR INSPECTION E586014B

Refer to DTC P0156.

## **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.

FLA -238 FUEL SYSTEM

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

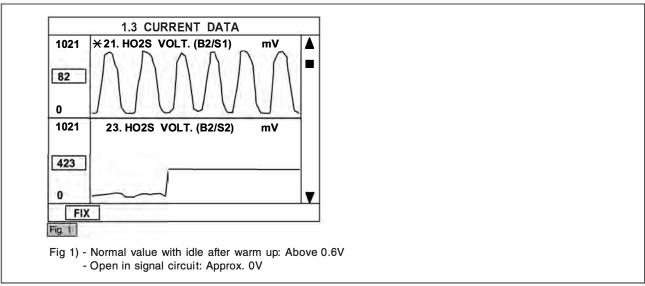
#### COMPONENT INSPECTION EA46 AA91

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

2. Connect Scantool and monitor the "RR OXYGEN SNSR-B1" parameter on the Scantool data list.

Test Condition: Ignition "ON" & Engine "ON" & In Idle("Closed Loop")condition.

Specification: Above 0.6V.



K01562

3. Is sensor display within the specification?

# YES

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



▶ 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 ETEB81CD

Refer to DTC P0156.

# DTC P0170 FUEL TRIM (BANK 1) DTC P0173 FUEL TRIM (BANK 2)

#### GENERAL DESCRIPTION E3B1BC6

The Lambda closed-loop control system is included in the engine s control system. The control system regulates the lambda upstream with the HO2S signal. Rich mixtures generate high concentrations of CO, H2, and HC. Lean mixtures generate the high concentrations of NOx, and free oxygen.

#### DTC DESCRIPTION EFAF7ABC

If the lambda controller reaches the maximum or minimum threshold, then feedback control is no longer possible and emissions will be increased. The ECM sets DTC P0170/P0173 if no proportional fuel adaptation occurs for a defined time after the lambda controller has reached its minimum or maximum threshold.

## DTC DETECTING CONDITION EF7FAACD

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

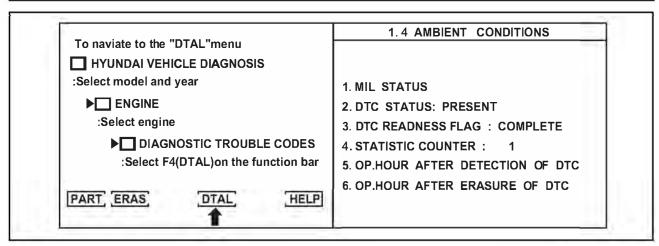
## MONITOR DTC STATUS E3401A4A



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

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

FLA -240 FUEL SYSTEM



EDTC\_GK

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

# NOTE

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

# YES

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

# NO

▶ Go to "Monitor Actuation Test" procedure.

#### MONITOR ACTUATION TEST E3D6F55D

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.



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

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

Specification: All cylinders should show an even RPM drop.

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	

K01702

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.

FLA -242 FUEL SYSTEM

#### 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 or B2" parameter on the Scantool data list.
- 4. Disconnect and plug the positive crankcase ventilation.
- 5. Monitor the "SHORT TERM FUEL-B1 or B2" parameter on the Scantool data list once again.

Specification: The value should remain more or less unchanged.

6. Is the displayed value within the specified value?



▶ Go to "Sensor Contamination Inspection" procedure.



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

#### SENSOR CONTAMINATION INSPECTION

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

#### 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 E7EB3318

- 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: 320~340kPa(3.26~3.47 kg/cm², 46~49 psi)

5. Is fuel pressure within the specification?

# YES

▶ Go to "Fuel Injector Inspection" procedure as below

# NO

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

#### **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 EEF2507D

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.
- 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.

FLA -244 FUEL SYSTEM

# DTC P0171 SYSTEM TOO LEAN (BANK 1) DTC P0174 SYSTEM TOO LEAN (BANK 2)

#### GENERAL DESCRIPTION E295E010

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

#### DTC DESCRIPTION E03BDA12

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

#### DTC DETECTING CONDITION E8DDC2A1

Item	Detecting Condition	Possible Cause
DTC Strategy	Monitoring deviation of fuel control	
Enable Conditions	<ul> <li>Estimated canister loading &gt; -11%</li> <li>Estimated altitude &lt; 8000ft</li> <li>Coolant temp. &gt; 60 ℃ (140 °F)</li> <li>Fueling adaptation &gt; 23% or &lt; -23%</li> </ul>	Air leakage     Leaking EVAP system
Threshold Value	Lambda controller+Trim value > 22% more than 60sec within 400sec.	Low fuel pressure     Faulty sensor signals
Diagnostic Time	• 400 sec.	
MIL On Condition	2 Driving Cycles	

#### MONITOR DTC STATUS ECSDCCBE



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.

To naviate to the "DTAL"menu	1.4 AMBIENT CONDITIONS
☐ HYUNDAI VEHICLE DIAGNOSIS	
:Select model and year	1. MIL STATUS
► ENGINE	2. DTC STATUS: PRESENT
:Select engine	3. DTC READNESS FLAG : COMPLETE
▶ DIAGNOSTIC TROUBLE CODES	4. STATISTIC COUNTER: 1
:Select F4(DTAL)on the function bar	5. OP.HOUR AFTER DETECTION OF DTC
PART ERAS DTAL HELP	6. OP.HOUR AFTER ERASURE OF DTC

EDTC\_GK

- 5. Is parameter displayed "History(Not Present) fault"?
  - **NOTE**
  - History (Not Present) fault: DTC occurred but has been cleared.
  - Present fault : DTC is occurring at present time.

# YES

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

# NO

▶ Go to "Monitor Actuation Test" procedure.

#### MONITOR ACTUATION TEST E69B9F79

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.



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

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

Specification: All cylinders should show an even RPM drop.

FLA -246 FUEL SYSTEM

1.	6 ACTUATION TEST
NO.1 INJEC	TOR
DURATION UNTIL STOP KEY	
METHOD	DEACTIVATION
CONDITION	IG.KEY ON ENGINE RUNNING
	[RT], IF YOU ARE READY! SST ITEM USING UP/DOWN KEY
[STRT] [STO	P]

K01702

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



▶ 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.



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 EC2EACC7

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?



▶ Go to "Fuel System Inspection" procedure.

NO

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

## FUEL SYSTEM INSPECTION EB2AEEBA

- 1. Check the fuel for excessive water, alcohol, or other contaminants. Replace contaminated fuel as necessary.
- 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: 320~340kPa(3.26~3.47 kg/cm², 46~49 psi)

5. Is fuel pressure within the specification?

YES

▶ Go to "Fuel Injector Inspection" procedure as below

NO

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

#### **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 E3CF867E

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.
- 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.

FLA -248 FUEL SYSTEM

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



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



▶ Go to the applicable troubleshooting procedure.

# DTC P0172 SYSTEM TOO RICH (BANK 1) DTC P0175 SYSTEM TOO RICH (BANK 2)

#### GENERAL DESCRIPTION E2EF4CB8

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

#### DTC DESCRIPTION EEA6A37F

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

## DTC DETECTING CONDITION EOBEADIC

Item	Detecting Condition	Possible Cause
DTC Strategy	Monitoring deviation of fuel control	
Enable Conditions	<ul> <li>Estimated canister loading &gt; -11%</li> <li>Estimated altitude &lt; 8000ft</li> <li>Coolant temp. &gt; 60℃(140℃)</li> <li>Fueling adaptation &gt; 23% or &lt; -23%</li> </ul>	Restricted intake or exhaust system     Dirty engine oil or oil level too high     Front HO2S or MAFS     contamination
Threshold Value	Lambda controller+Trim value < -27% more than 60sec within 400sec.	<ul> <li>Over purging of the EVAP system</li> <li>High fuel pressure</li> <li>Foulty conserving plan</li> </ul>
Diagnostic Time	• 400 sec.	Faulty sensor signals
MIL On Condition	2 Driving Cycles	

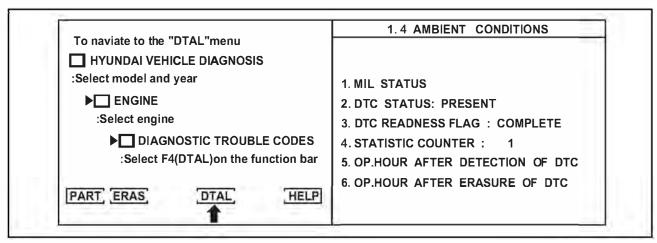
## MONITOR DTC STATUS E2AE626E



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

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

FLA -250 FUEL SYSTEM



EDTC\_GK

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

# NOTE

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

# YES

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

# NO

▶ Go to "Monitor Actuation Test" procedure.

#### MONITOR ACTUATION TEST ED7A2A0F

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.



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

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

K01702

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.



If the RPM loss between cylinders is quite large(200RPM or more) and engine has high mileage, there is possibility of engine wear. Perform compression test with pressure gauge to check the engine wear.

## CHECK FOR RESTRICTED INTAKE OR EXHAUST SYSTEM

- 1. Visually/physically inspect the following items:
  - Air cleaner filter element for excessive dirt or for any foreign objects.
  - Throttle body inlet for damage or for any foreign objects.
  - Throttle bore, throttle plate and the ICA passages for chocking and for any foreign objects.
  - Restricted exhaust system.
- 2. Was a problem found in any of the above areas?

# YES

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

# NO

▶ Go to "Engine oil contamination Inspection" procedure.

#### **ENGINE OIL CONTAMINATION INSPECTION**

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

FLA -252 FUEL SYSTEM

- 4. Disconnect and plug the positive crankcase ventilation.
- 5. Monitor the "SHORT TERM FUEL-B1" parameter on the Scantool data list once again.

Specification: 320~340kPa(3.26~3.47 kg/cm², 46~49 psi)

6. Is the displayed value within the specification?

YES

▶ Go to "Sensor Contamination Inspection" procedure.

NO

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

#### SENSOR CONTAMINATION INSPECTION

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

#### OVER PURGING OF THE EVAP SYSTEM

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

YES

▶ Go to "Fuel System Inspection" procedure.

NO

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

#### FUEL SYSTEM INSPECTION EFB85E32

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

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

5. Is fuel pressure within the specification?

# YES

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

## NO

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

### **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 EDFFFDF6

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.
- 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.

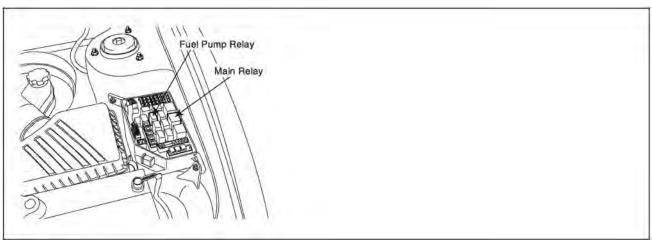
### NO

▶ Go to the applicable troubleshooting procedure.

FLA -254 FUEL SYSTEM

# DTC P0230 FUEL PUMP PRIMARY CIRCUIT

### COMPONENT LOCATION EFC4E49E



EGOF256A

### GENERAL DESCRIPTION E4FB2F6

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

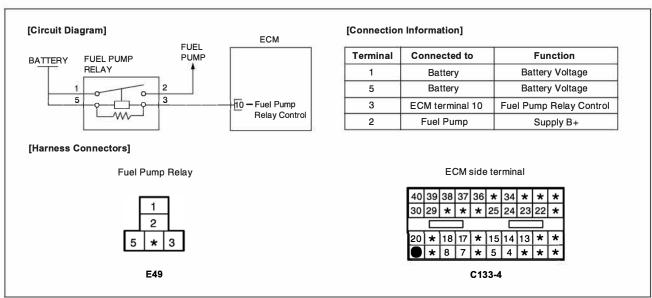
### DTC DESCRIPTION EDEF635E

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

### DTC DETECTING CONDITION E1E5C33D

Item	Detecting Condition	Possible Cause
DTC Strategy	Driver Stage Check	
Enable Conditions	Battery voltage > 10V	Open or short in harness
Threshold Value	Short to ground, line break or Short to Battery	Contact resistance in connectors
Diagnostic Time	• 1.5 sec.	Faulty relay
MIL On Condition	• -	

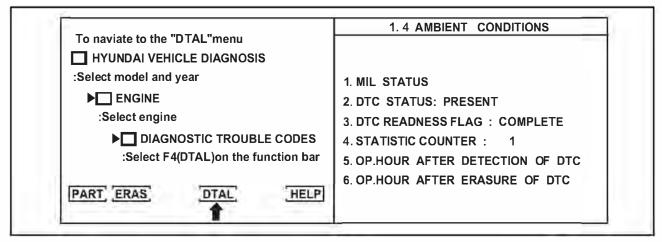
#### SCHEMATIC DIAGRAM EFEF2BA0



K02301

### MONITOR DTC STATUS EBBC4E

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



EDTC\_GK

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.

FLA -256 FUEL SYSTEM



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



▶ Go to "Component Inspection" procedure.

#### COMPONENT INSPECTION FRECDERE

- 1. Ignition "OFF".
- 2. Remove the fuel pump relay.
- 3. Apply 12V and a ground to 5 and 3 terminals of the fuel pump relay
- 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?



▶ Go to next step as below.



▶ 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 EB5DFB4

- 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.
- Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?



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



▶ Go to "Power Supply Circuit Inspection" procedure.

### POWER SUPPLY CIRCUIT INSPECTION E41BBE99

- 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.

#### CONTROL CIRCUIT INSPECTION E5D34BD8

- 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 ECM connector.
  - 2) Ignition "ON" and 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.

FLA -258 FUEL SYSTEM

1) Measure resistance between terminals 3 of the relay harness connector and 10 of the ECM harness connector

Specification : Approx  $0\Omega$ 

2) Is resistance within the specification?

YES

▶ Thoroughly check connectors for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

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

### VERIFICATION OF VEHICLE REPAIR E119883A

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

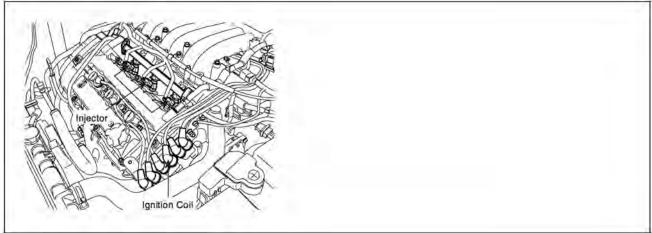
▶ System performing to specification at this time. Clear the DTC.

NO

▶ Go to the applicable troubleshooting procedure.

DTC P0261 CYLINDER 1-INJECTOR	CIRCUIT LOW
DTC P0264 CYLINDER 2-INJECTOR	CIRCUIT LOW
DTC P0267 CYLINDER 3-INJECTOR	CIRCUIT LOW
DTC P0270 CYLINDER 4-INJECTOR	CIRCUIT LOW
DTC P0273 CYLINDER 5-INJECTOR	CIRCUIT LOW
DTC P0276 CYLINDER 6-INJECTOR	CIRCUIT LOW

#### COMPONENT LOCATION EEDCEADS



EGOF257A

### GENERAL DESCRIPTION E9E59D2D

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

## DTC DESCRIPTION E3546844

[P0261]ECM sets DTC P0261 if the ECM detects that injector (Cylinder #1) control circuit is shorted to ground. [P0264]ECM sets DTC P0264 if the ECM detects that injector (Cylinder #2) control circuit is shorted to ground. [P0267]ECM sets DTC P0267 if the ECM detects that injector (Cylinder #3) control circuit is shorted to ground. [P0270]ECM sets DTC P0270 if the ECM detects that injector (Cylinder #4) control circuit is shorted to ground. [P0273]ECM sets DTC P0273 if the ECM detects that injector (Cylinder #5) control circuit is shorted to ground. [P0276]ECM sets DTC P0276 if the ECM detects that injector (Cylinder #6) control circuit is shorted to ground.

FLA -260 FUEL SYSTEM

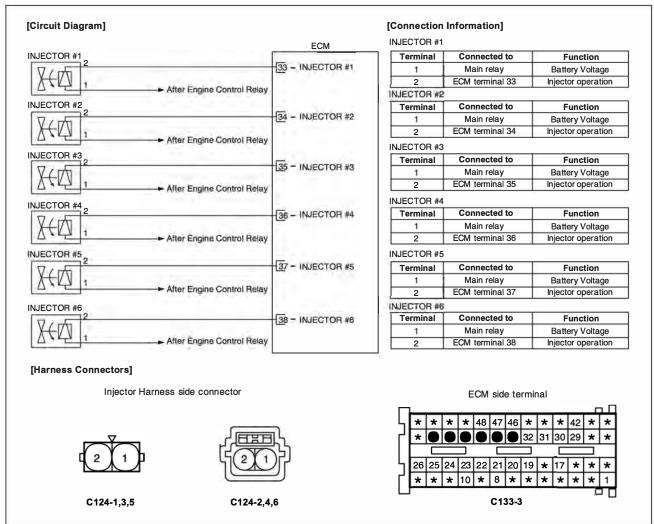
# DTC DETECTING CONDITION EB9D4513

Item	Detecting Condition	Possible Cause
DTC Strategy	Driver Stage Check	
Enable Conditions	<ul><li>10 &lt; Battery voltage(V) &lt; 16</li><li>Engine speed(rpm) &gt; 30</li></ul>	Open in power supply harness     Short to ground in control harness
Threshold Value	Short to ground	<ul> <li>Contact resistance in connectors</li> </ul>
Diagnostic Time	• 1.5 sec.	Faulty injector
MIL On Condition	2 Driving Cycles	

# SPECIFICATION EFFC2ACF

Temperature		<b>5</b> 11 (6)
(°C)	(°F)	Resistance (ఏ )
20	68	13.8 ~ 15.2

#### SCHEMATIC DIAGRAM

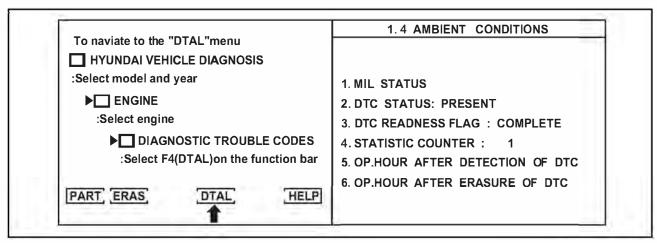


#### K02611

### MONITOR DTC STATUS E6D7B46

- 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.

FLA -262 FUEL SYSTEM



EDTC\_GK

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

# NOTE

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

# YES

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

# NO

▶ Go to "Component Inspection" procedure.

### COMPONENT INSPECTION EC3E4D67

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

**NOTE** 

P0261: Injector #1 P0264: Injector #2 P0267: Injector #3 P0270: Injector #4 P0273: Injector #5 P0276: Injector #6

Specification : Approx. 13.8 ~15.2 $\Omega$  at 20 °C(68°F)

4. Is resistance within the specification?



▶ Check for intermittent fault. Observe the data parameter for a sudden change while wiggling the wiring and tapping lightly on the suspect component.



### / CAUTION

Be careful not to damage wires or components during the test. Repair as necessary and go to next step as below.



▶ 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 E21EE1DF

- 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.
- Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
- 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 EA59CAE2

- Ignition "ON" & Engine "OFF"
- Measure voltage between terminal 1 of the injector harness connector and chassis ground



P0261: Injector #1 P0264: Injector #2 P0267: Injector #3 P0270: Injector #4 P0273: Injector #5 P0276: Injector #6

Specification: Approx.

3. Is voltage within the specification?



▶ Go to "Control Circuit Inspection" procedure.

FLA -264 FUEL SYSTEM

### NO

▶ Check for a open in the power supply circuit between the main relay and the Injector.

- ▶ Check for open or blown "15A INJ fuse".
- ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

### CONTROL CIRCUIT INSPECTION E48879F6

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



P0261: Injector #1 P0264: Injector #2 P0267: Injector #3 P0270: Injector #4 P0273: Injector #5 P0276: Injector #6

Specification: Infinite

2. Is resistance within the specification?

# YES

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



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

### VERIFICATION OF VEHICLE REPAIR E9EE597E

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	
DTC P0265 CYLINDER 2-INJECTOR CIRCUIT HIGH	
DTC P0268 CYLINDER 3-INJECTOR CIRCUIT HIGH	
DTC P0271 CYLINDER 4-INJECTOR CIRCUIT HIGH	
DTC P0274 CYLINDER 5-INJECTOR CIRCUIT HIGH	
DTC P0277 CYLINDER 6-INJECTOR CIRCUIT HIGH	

#### COMPONENT LOCATION E3C09F0D

Refer to DTC P0261.

#### GENERAL DESCRIPTION E24CFEC4

Refer to DTC P0261.

### DTC DESCRIPTION E92AE5BC

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

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

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

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

[P0274]ECM sets DTC P0274 if the ECM detects that injector (Cylinder #5) control circuit is open or shorted to battery voltage.

[P0277]ECM sets DTC P0277 if the ECM detects that injector (Cylinder #6) control circuit is open or shorted to battery voltage.

### DTC DETECTING CONDITION EFEBDBBE

Item	Detecting Condition	Possible Cause
DTC Strategy	Driver Stage Check	
Enable Conditions	<ul><li>10 &lt; Battery voltage(V) &lt; 16</li><li>Engine speed(rpm) &gt; 30</li></ul>	Open or short to battery in control harness.
Threshold Value	Short to battery or Line break	Contact resistance in connectors
Diagnostic Time	• 1.5 sec.	Faulty injector
MIL On Condition	2 Driving Cycles	

### SPECIFICATION ED428DFE

Refer to DTC P0261.

#### SCHEMATIC DIAGRAM E5E54D1F

Refer to DTC P0261.

**FLA -266 FUEL SYSTEM** 

#### MONITOR DTC STATUS

Refer to DTC P0261.

#### COMPONENT INSPECTION EF74FA4C

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



P0262: Injector #1 P0265: Injector #2 P0268: Injector #3 P0271: Injector #4 P0274: Injector #5 P0277: Injector #6

Specification : Approx. 13.8 ~15.2 $\Omega$  at 20 $^{\circ}$ C(68 $^{\circ}$ F)

4. Is resistance within the specification?



▶ Check for intermittent fault. Observe the data parameter for a sudden change while wiggling the wiring and tapping lightly on the suspect component.



### / CAUTION

Be careful not to damage wires or components during the test. Repair as necessary and go to next step as below.



▶ 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

Refer to DTC P0261.

#### POWER SUPPLY CIRCUIT INSPECTION

- Ignition "ON" & Engine "OFF"
- Measure voltage between terminal 1 of the injector harness connector and chassis ground

**NOTE** 

P0262: Injector #1 P0265: Injector #2 P0268: Injector #3 P0271: Injector #4 P0274: Injector #5 P0277: Injector #6

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

### CONTROL CIRCUIT INSPECTION E1EF1B5D

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

P0262: Injector #1 P0265: Injector #2 P0268: Injector #3 P0271: Injector #4 P0274: Injector #5 P0277: Injector #6

Specification: Approx. 0V

5) Is voltage within the specification?

### YES

▶ Go to next step as below.

### NO

- ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.
- 2. Check for Open in Control Circuit.
  - 1) Ignition "OFF".
  - 2) Measure resistance between terminals 2 of the injector harness connector and 33 of the ECM harness connector.

Specification : Approx.  $0\Omega$ 

FLA -268 FUEL SYSTEM

3) Is resistance within the specification?



▶ 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

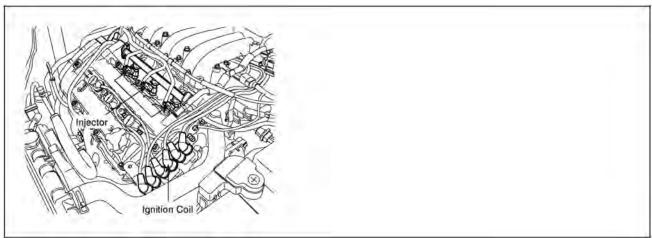
▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

### VERIFICATION OF VEHICLE REPAIR ED384028

Refer to DTC P0261.

# DTC P0300 RANDOM/MULTIPLE CYLINDER MISFIRE DETECTED

#### COMPONENT LOCATION EDD8A2AC



EGOF257A

#### GENERAL DESCRIPTION EAE2F92D

The Misfire monitor diagnostic is based on crankshaft rotation velocity variation. The ECM determines crankshaft rotational velocity using the crankshaft position sensor and camshaft position sensor. When a cylinder misfires the crankshaft slows down momentarily. By monitoring the crankshaft and camshaft position sensor signals, the ECM can calculate when a misfire occurs. For a non-catalyst damaging misfire, the diagnostic will be required to report a misfire present within 1000-3200 engine revolutions. For catalyst damaging misfire, the diagnostic will respond to monitor 200 engine revolutions. Rough roads may cause false misfire detection. The rough road(acceleration)sensor consists of a piezoelectric vibration pick up which detects vertical acceleration of the vehicle. The sensor signal is used by the ECM to determine the degree of vertical movement of the car, for example, on a bumpy road. Since this may also cause uneven engine running, the ECM uses the signal to distinguish the phenomenon from actual misfiring.

### DTC DESCRIPTION E6E1D3B1

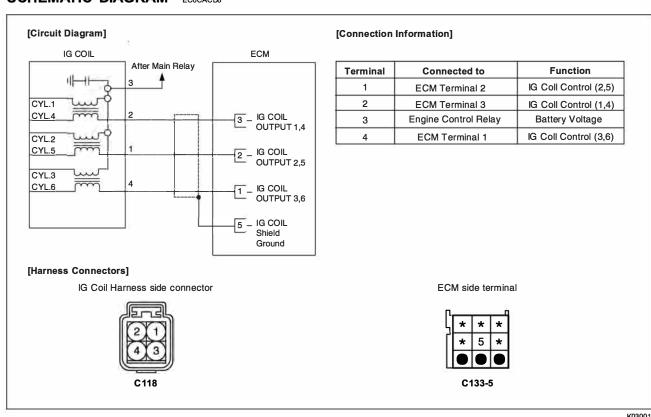
The ECM must monitor the engine for misfiring possibly caused by ignition coil defects or injector fails. If misfiring is detected, the ECM will identify the cylinder(s) that has(have) misfired and then calculate misfiring rate for a given duration. The DTC for Misfire (P0301 to 0306) is set as soon as the misfiring rate exceeds the limit which may result in damage to the catalyst or increase emissions. The ECM stores the individual DTC for a cylinder which has more than a 10% total misfire rate. With a more than two cylinder misfire detection, the ECM sets P0300.

FLA -270 **FUEL SYSTEM** 

#### DTC DETECTING CONDITION EE4ACC0B

lte	em	Detecting Condition	Possible Cause	
DTC S	Strategy	Misfire is detected on 2 or more cylinder		
Enable Conditions		<ul> <li>480 &lt; Engine speed(RPM) &lt; 6500</li> <li>Intake air mass gradient is in predetermined range</li> <li>No injector shut off</li> <li>No rough road</li> </ul>	• Faulty spark plugs,	
	Thresh- old Value	• Misfire= 2.8~17% within 200 rev.	high-tension lead, or Ignition coil	
Case1)	Diagno- sis Time	200 revolution: 3*200 revolution	Incorrect valve timing     Uneven compression     Air leakage	
	MIL On Condition	Immediate	Improper Fuel pressure     or dirty fuel.	
	Thresh- old Value	<ul> <li>First 1000 rev.: Misfire &gt; 2%</li> <li>After first 1000 rev.: Misfire &gt; 2%</li> </ul>	Blocked/Leaking injectors     Leakage between cooling     system and cylinder	
Case2)	Diagno- sis Time	1000 revolution: 4*1000 revolution		
	MIL On Condition	2 Driving Cycle		

# SCHEMATIC DIAGRAM EC6CACD8



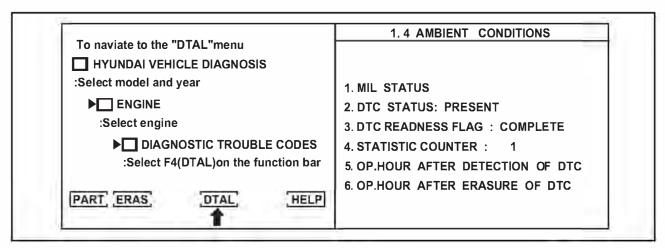
K03001

#### MONITOR DTC STATUS FURDERSO



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.



EDTC\_GK

- 5. Is parameter displayed "History(Not Present) fault"?
  - History (Not Present) fault : DTC occurred but has been cleared.
  - Present fault : DTC is occurring at present time.

# YES

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



▶ Go to "Monitor Actuation Test" procedure.

### MONITOR ACTUATION TEST EA3EF0BE



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.



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

FLA -272 FUEL SYSTEM

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

Specification: All cylinders should show an even RPM drop.

1.6 ACTUATION TEST		
NO.1 INJEC	TOR	
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		

K01702

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.



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, crack and flashover
- 3. Measure the resistance of the spark plug cable referring to specification.

Specification : Spark plug cable(k $\Omega$  ) : 5.6k $\Omega$  /m ± 20%



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

4. Is resistance within the specification?

## YES

▶ Go to "Spark Plug Inspection " procedure.

# NO

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

#### SPARK PLUG INSPECTION

- 1. Remove suspect cylinder's spark plugs.
- 2. Visually/physically inspect the following items:
  - Damaged insulation, Worn electrodes, Oil or fuel fouled, Loose terminals and cracks.
  - Check for plug gap: 1.0 1.1 mm (0.039 0.043 in.).
  - Check if the spark plug for the relevant cylinder is lighter in color than the other plugs.
- 3. Was a problem found in any of the above areas?

# YES

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

# NO

▶ Go to "Fuel Injector Inspection" procedure.

#### **FUEL INJECTOR INSPECTION**

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

Test Condition: Ignition "OFF".

Specification: No clogging and restriction.

2. Is the fuel injector OK?

# YES

- ▶ Visually/physically inspect the engine mechanical problem as below:
- Bent push rods.
- Leaky or sticky valves or rings.
- Excessive valve deposits.
- Weak valve spring.
- Leaking head gasket.

If NG, repair as necessary and go to "Verification of Vehicle Repair" procedure. If OK, go to "Ignition Coil Inspection" procedure.

# NO

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

### **IGNITION COIL INSPECTION**

- 1. Ignition "OFF"
- 2. Disconnect ignition coil connector

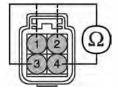
FLA -274 FUEL SYSTEM

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

4. Measure the resistance in each primary coil, referring to specification.(Component side).

Specification : Approx.  $0.65 \sim 0.82~\Omega$  No.1 & 4 cyl. : terminals 3 & 2 No.2 & 5 cyl. : terminals 3 & 1 No.3 & 6 cyl. : terminals 3 & 4

<C118>



- 1. IG Coil Control(2.5)
- 2. IG Coil Control(1.4)
- 3. Battery Voltage
- 4. IG Coil Control(3.6)

K03003

5. Is resistance within the specification?



▶ Go to "Timing Inspection" procedure.



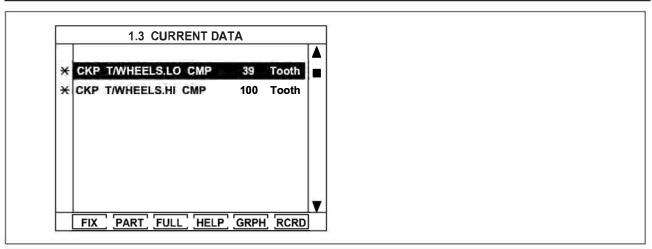
▶ Test with a new ignition coil and check for proper operation. If problem is corrected, replace ignition coil and go to "Verification of Vehicle Repair" procedure.

#### **TIMING INSPECTION**

- 1. Start engine and let vehicle idle
- 2. Connect scantool and select "Current Data" mode
- 3. Monitor "CKP T/WHEELS-LO CMP" & "CKP T/WHEELS-HI CMP" parameters on the Scantool data list.

Specification:

"CKP T/WHEELS-LO CMP": 38 +/- 4 tooth "CKP T/WHEELS-HI CMP": 98 +/- 4 tooth



K03004

4. Are "CKP T/WHEELS-LO CMP" & "CKP T/WHEELS-HI CMP" parameters within the specification?

# YES

▶ Go to " Air Leakage Inspection " procedure.

# NO

▶ Remove Crankshaft Position Sensor(CKPS) and calculate air gap between sensor and flywheel/torque converter. Readjust as necessary and go to next step.

# **NOTE**

- Air gap [0.3~1.7 mm [0.012~0.067 in] = measure distance from housing 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 EEABDDAG

 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?



▶ Go to "Fuel System Inspection" procedure.

# NO

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

FLA -276 FUEL SYSTEM

### FUEL SYSTEM INSPECTION EAB672BE

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

- 2. Install a fuel pressure gauge.
- 3. Start engine and let it idle. Inspect fuel pressure with vacuum hose disconnected.

Test Condition: Engine "ON" at Idle.

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

4. Is fuel pressure within the specification?



▶ 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.



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

### VERIFICATION OF VEHICLE REPAIR E5EDED8F

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.
- 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	
DTC P0302 CYLINDER 2-MISFIRE DETECTED	
DTC P0303 CYLINDER 3-MISFIRE DETECTED	
DTC P0304 CYLINDER 4-MISFIRE DETECTED	
DTC P0305 CYLINDER 5-MISFIRE DETECTED	
DTC P0306 CYLINDER 6-MISFIRE DETECTED	

### COMPONENT LOCATION ED243B06

Refer to DTC P0300.

### GENERAL DESCRIPTION E26ECD57

Refer to DTC P0300.

# DTC DESCRIPTION E37CF97C

The ECM must monitor the engine for misfiring possibly caused by ignition coil defects or injector fails. If misfiring is detected, the ECM will identify the cylinder(s) that has(have) misfired and then calculate misfiring rate for a given duration. The DTC for Misfire (P0301 to 0306) is set as soon as the misfiring rate exceeds the limit which may result in damage to the catalyst or increase emissions. The ECM stores the individual DTC for a cylinder which has more than a 10% total misfire rate.

### DTC DETECTING CONDITION E3CAD170

Item Detecting Condition Possible Caus		Possible Cause		
DTC S	Strategy	Calculation of engine roughness		
Enable Conditions		<ul> <li>544 &lt; Engine speed(RPM) &lt; 6500</li> <li>Mass Air Flow above zero load : 150 ~ 564 mg/rev (depends on rpm)</li> <li>No injector shut off</li> <li>No rough road</li> </ul>	Faulty spark plugs,     bigh tonsion load, or	
	Thresh- old Value	• Misfire = 6 ~ 17% within 200 rev.	high-tension lead, or Ignition coil Incorrect valve timing	
Case1)	Diagno- sis Time	3*200 revolution in FTP Area Else 200 revolution	Uneven compression     Air leakage	
	MIL On Condition	Immediate	<ul> <li>Improper Fuel pressure or dirty fuel.</li> <li>Blocked/Leaking injectors</li> </ul>	
	Thresh- old Value	<ul><li>First 1000 rev. : Misfire &gt; 2.3%</li><li>After first 1000 rev. : Misfire &gt; 2.3%</li></ul>	Leakage between cooling system and cylinder	
Case2)	Diagno- sis Time	1000 revolution or 4*1000 revolution		
	MIL On Condition	2 Driving Cycle		

#### SCHEMATIC DIAGRAM EAA6D08F

Refer to DTC P0300.

FLA -278 FUEL SYSTEM

### MONITOR DTC STATUS EFA146AC

Refer to DTC P0300.

### MONITOR ACTUATION TEST E07FA326



The main purpose of this test is to identify potential engine mechanical condition problems and fuel and ignition systems problems that are not common to all cylinders. For best results, perform this test while maintaining as steady an rpm reading as possible. Caution! Before beginning tests; set the parking brake, place gear selector in P or N and block drive wheels for safety.

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

Specification: All cylinders should show an even RPM drop.

NO.1 INJEC	TOR	
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		

K01702

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, crack and flashover
- 3. Measure the resistance of the spark plug cable referring to specification.

Specification : Spark plug cable( $k\Omega$ ) : 5.6 $k\Omega$  /m ± 20%



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

4. Is resistance within the specification?

YES

▶ Go to "Spark Plug Inspection " procedure.

NO

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

#### **SPARK PLUG INSPECTION**

- 1. Remove suspect cylinder's spark plugs.
- 2. Visually/physically inspect the following items:
  - Damaged insulation, Worn electrodes, Oil or fuel fouled, Loose terminals and cracks.
  - Check for plug gap: 1.0 1.1 mm (0.039 0.043 in.).
  - Check if the spark plug for the relevant cylinder is lighter in color than the other plugs.
- 3. Was a problem found in any of the above areas?

YES

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

NO

▶ Go to "Fuel Injector Inspection" procedure.

#### **FUEL INJECTOR INSPECTION**

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

Test Condition: Ignition "OFF".

Specification: No clogging and restriction.

2. Is the fuel injector OK?

YES

- ▶ Visually/physically inspect the engine mechanical problem as below:
- Bent push rods.
- Leaky or sticky valves or rings.

FLA -280 FUEL SYSTEM

- 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**

- Ignition "OFF"
- 2. Disconnect ignition coil connector
- Visually/physically inspect the following items:
  - Damage, cracks and flashover.
- 4. [P0301 & P0304]Measure the resistance between terminals 2 and 3 of the primary ignition coil. (Component side) [P0302 & P0305]Measure the resistance between terminals 1 and 3 of the primary ignition coil. (Component side) [P0303 & P0306]Measure the resistance between terminals 4 and 3 of the primary ignition coil. (Component side)

Specification : Approx.  $0.65 \sim 0.82 \Omega$ 

5. Is resistance within the specification?

YES

▶ Go to "Timing Inspection" procedure.

NO

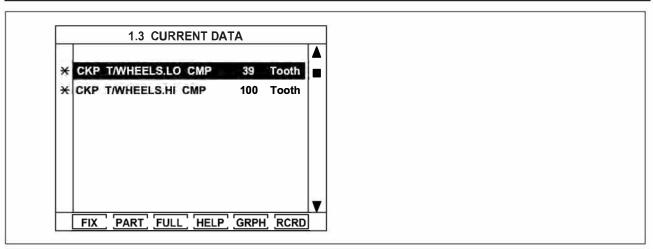
▶ Test with a new ignition coil and check for proper operation. If problem is corrected, replace ignition coil and go to "Verification of Vehicle Repair" procedure.

#### TIMING INSPECTION

- 1. Start engine and let vehicle idle
- 2. Connect scantool and select "Current Data" mode
- 3. Monitor "CKP T/WHEELS-LO CMP" & "CKP T/WHEELS-HI CMP" parameters on the Scantool data list.

Specification:

"CKP T/WHEELS-LO CMP": 38 +/- 4 tooth
"CKP T/WHEELS-HI CMP": 98 +/- 4 tooth



K03004

4. Are "CKP T/WHEELS-LO CMP" & "CKP T/WHEELS-HI CMP" parameters within the specification?

# YES

▶ Go to " Air Leakage Inspection " procedure.

# NO

▶ Remove Crankshaft Position Sensor(CKPS) and calculate air gap between sensor and flywheel/torque converter. Readjust as necessary and go to next step.

# **NOTE**

- Air gap [0.3~1.7 mm [0.012~0.067 in] = measure distance from housing 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 E5BFDA40

 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?



▶ Go to "Fuel System Inspection" procedure

# NO

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

FLA -282 FUEL SYSTEM

### FUEL SYSTEM INSPECTION EAGE8F5F

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

- 2. Install a fuel pressure gage.
- 3. Start engine and let it idle. Inspect fuel pressure with vacuum hose disconnected.

Test Condition: Engine "ON" at Idle.

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

4. Is fuel pressure within the specification?



▶ 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.



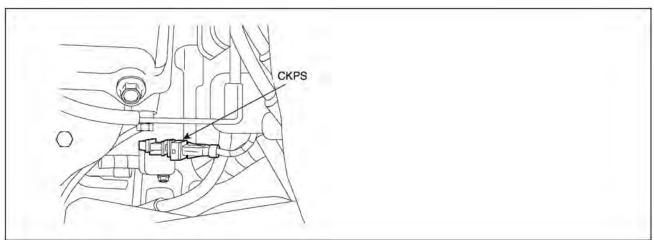
▶ Repair as necessary refer to inspection noted as below and go to "Verification of Vehicle Repair" procedure.

### VERIFICATION OF VEHICLE REPAIR EECTCBBF

Refer to DTC P0300.

# DTC P0315 SEGMENT TIME ACQUISITION INCORRECT

### COMPONENT LOCATION E5BE889D



EGOF440G

#### GENERAL DESCRIPTION EEA9B3D4

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 E569A538

Because of the tolerance in mechanical machining and assembling process of the target wheel, the duration of each segment are not always same but differ from segment to segment on the same engine. And this irregular segment duration can disturb misfiring detection which is based on the difference of engine rotational speed between the firing and the misfiring cylinder. The ECM compares segment duration of 4 cylinders during fuel cut-off and deceleration period. With this comparison ECM perform segment adaptation to adapt the difference of each segment duration. The ECM sets DTC P0315 if any of segment adaptation value is on the limit.

### DTC DETECTING CONDITION E7E61197

12.4	January 1980	V.
Item	Detecting Condition	Possible Cause
DTC Strategy	Monitor sensor wheel adaptation	
Enable Conditions	<ul> <li>544 &lt; Engine speed(RPM) &lt; 6500</li> <li>Mass Air Flow above zero load : 150 ~ 564 mg/rev (depends on rpm)</li> <li>No injector shut off</li> <li>No rough road</li> </ul>	Improperly installed target wheel     Contact resistance in connectors
Threshold Value	Segment adaptation value is at the limit: 5 / 1000	
Diagnostic Time	• -	
MIL On Condition	• -	

FLA -284 FUEL SYSTEM

#### SIGNAL WAVEFORM EC443BA

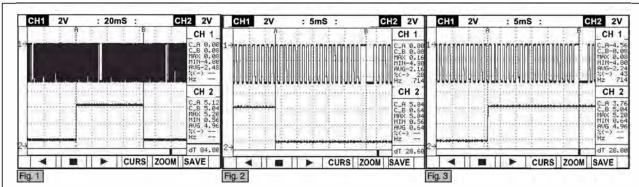


Fig 1) Normal waveform with idle: The square wave signal should be smooth and without any distortion.

Fig 2,3) Normal waveform with engine running: The CMP falling edge is coincided with 38+/-4 tooth of the CKP from one longer signal(missing tooth)

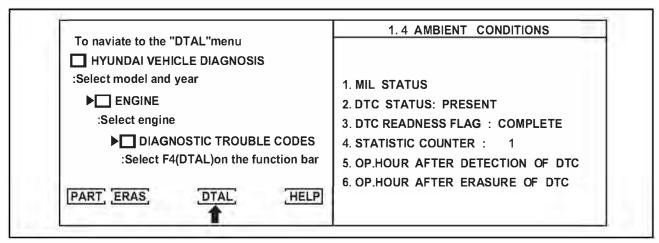
K03152

#### MONITOR DTC STATUS EAD77E72

# **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.



EDTC\_GK

- 5. Is parameter displayed "History(Not Present) fault"?
  - History (Not Present) fault: DTC occurred but has been cleared.
  - Present fault : DTC is occurring at present time.

## YES

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

## NO

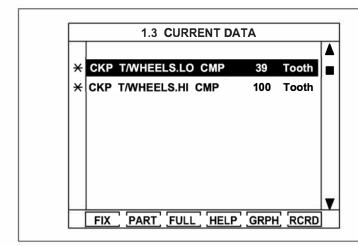
▶ Go to "Component Inspection" procedure.

#### COMPONENT INSPECTION F32B38AF

- 1. Start engine and let vehicle idle.
- Connect scantool and select "Current Data" mode.
- 3. Monitor "CKP T/WHEELS-LO CMP" & "CKP T/WHEELS-HI CMP" parameters on the Scantool data list.

Specification:

"CKP T/WHEELS-LO CMP": 38 +/- 4 tooth "CKP T/WHEELS-HI CMP": 98 +/- 4 tooth



K03004

4. Are "CKP T/WHEELS-LO CMP" & "CKP T/WHEELS-HI CMP" parameters within the specification?

# YES

▶ Thoroughly check connectors between CKPS and ECM for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

# NO

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

# **NOTE**

Air gap [0.3~1.7 mm [0.012~0.067 in] = measure distance from housing to teeth on flywheel/torque converter (measurement "A") and from mounting surface on sensor to sensor tip (measurement "B") subtract "B" from "A".

If failure to synchronize with CMP sensor, readjust timing system and go to next step.

FLA -286 FUEL SYSTEM

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

### VERIFICATION OF VEHICLE REPAIR EDC4E72E

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.
- 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"?



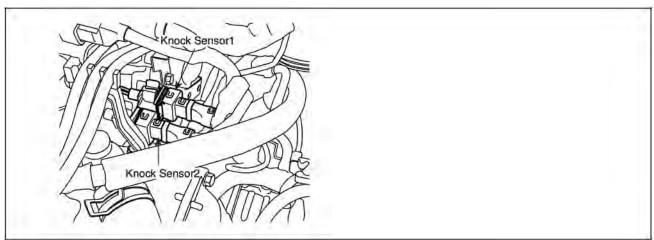
▶ System performing to specification at this time. Clear the DTC.



▶ Go to the applicable troubleshooting procedure.

# DTC P0325 KNOCK SENSOR 1 CIRCUIT

### COMPONENT LOCATION EF48068A



EGOF440M

#### GENERAL DESCRIPTION EEAD1C4C

The knock sensor is attached to the cylinder block and senses engine knocking. The sensor contains a piezoelectric element that converts vibration (or noise) into voltage signal and sends this signal to ECM. With input signals from camshaft position and crankshaft position sensor, ECM can identify which cylinder is knocking. ECM filters vibrations and determines if the vibrations are knocking signal. The Engine Control Module (ECM) uses this signal to suppress knocking by retarding ignition timing. The ECM will set a code (Malfunction Indicator Lamp will Not turn on) if during two driving cycles the Knock sensor's output voltage falls below minimum threshold. This code indicates an unexpected vibration is being read by the Knock sensor or ECM under normal engine operation.

### DTC DESCRIPTION EC8445C9

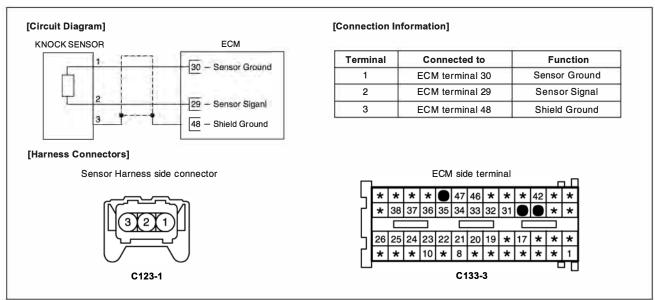
The ECM monitors the range of the analog input signal from knock sensor to check sensor failure that is short circuit or open circuit. If the difference between knock signal and noise level is smaller than the threshold during defined time period, the DTC P0325 is set. In case the noise level is higher than the upper threshold or lower than the lower threshold, the DTC P0325 is set too.

### DTC DETECTING CONDITION EFDA939E

Item	Detecting Condition	Possible Cause
DTC Strategy	Voltage Range Check	Open/short in signal or ground circuit     Contact resistance in connectors     Faulty knock sensor
Enable Conditions	Knock control enabled     Engine speed > 1800 rpm	
Threshold Value	Mean value of sensor signal < 0.1V	
Diagnostic Time	20 revolutions	
MIL On Condition	• -	

FLA -288 FUEL SYSTEM

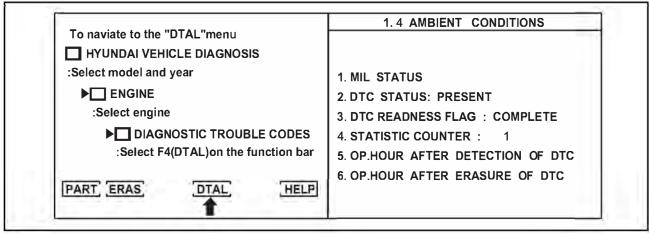
#### SCHEMATIC DIAGRAM EEC330AF



K03251

### MONITOR DTC STATUS EB97FDEF

- 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.



EDTC\_GK

- 5. Is parameter displayed "History(Not Present) fault"?
  - History (Not Present) fault: DTC occurred but has been cleared.
  - Present fault : DTC is occurring at present time.

YES

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



▶ Go to next step as below.

#### TERMINAL AND CONNECTOR INSPECTION EC16B4FE

- 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.
- Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?



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



▶ Go to "Ground Circuit Inspection" procedure.

#### GROUND CIRCUIT INSPECTION E7A96DFD

- 1. Ignition "OFF".
- 2. Disconnect Knock sensor connector.
- 3. Measure resistance between terminals 1 of the sensor harness connector and 30 of the ECM harness connector.

Specification : Approx.  $0\Omega$ 

4. Is resistance within the specification?



▶ 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 EB9AF4DE

- 1. Check for open in signal harness.
  - 1) Ignition "OFF".
  - 2) Measure resistance between terminals 2 of the sensor harness connector and 29 of the ECM harness connector.

FLA -290 FUEL SYSTEM

Specification : Approx.  $0\Omega$ 

3) Is resistance within the specification?

YES

▶ Go to next step as below.

NO

- ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.
- 2. Check for short to ground in signal harness.
  - 1) Ignition "OFF".
  - 2) Measure resistance between terminal 2 of the sensor harness connector and chassis ground.

Specification: Infinite

3) Is resistance within the specification?

YES

▶ Go to next step as below.

NO

- ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.
- 3. Check for short to power in signal harness.
  - 1) Ignition "OFF".
  - 2) Disconnect ECM connector.
  - 3) Ignition "ON" & Engine "OFF".
  - 4) Measure voltage between terminal 2 of the sensor harness connector and chassis ground.

Specification: Approx. 0V

5) Is voltage within the specification?

YES

▶ Go to "Component Inspection" procedure.

NO

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

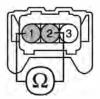
#### COMPONENT INSPECTION EB7ADDEF

- 1. Component resistance inspection.
  - 1) Ignition "OFF".

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

Specification: Approx. 5<sup>MQ</sup> at 20 °C(68°F)

<C123-1>



- 1. Sensor Ground
- 2. Sensor Signal
- 3. Shield Ground

K03257

- 2. Output signal inspection
  - 1) Remove knock sensor from vehicle and secure (across mounting boss) in a shop vise.
  - Set up an oscilloscope as follows : Channel A (+): terminal 2 (-): terminal 1.
  - 3) Rap on vise with a ball peen hammer while monitoring oscilloscope screen (there should be a spike of less than 1 volt with each hammer strike).

Specification: knock sensor send a voltage spike with hammer strikes.

- 3. Installation torque inspection.
  - 1) Check the installation torque of the knock sensor.

Specification: Approx. 16 ~ 28N·m(160~250 kg·cm,11.8~18.4 lb·ft).

4. Has a problem been found?



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



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

#### VERIFICATION OF VEHICLE REPAIR E4D657A2

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.

FLA -292 FUEL SYSTEM

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 P0330 KNOCK SENSOR 2 CIRCUIT**

#### COMPONENT LOCATION EB00D2C7

Refer to DTC P0325.

#### GENERAL DESCRIPTION EB5707A7

Refer to DTC P0325.

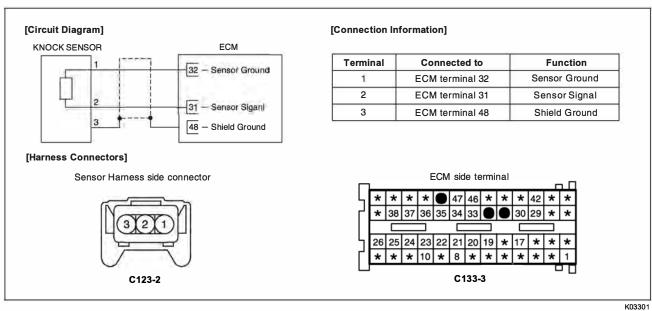
#### DTC DESCRIPTION E6645ED1

The ECM monitors the range of the analog input signal from knock sensor to check sensor failure that is short circuit or open circuit. If the difference between knock signal and noise level is smaller than the threshold during defined time period, the DTC P0330 is set. In case the noise level is higher than the upper threshold or lower than the lower threshold, the DTC P0330 is set too.

### DTC DETECTING CONDITION E59B2FEF

Item	Detecting Condition	Possible Cause	
DTC Strategy	Voltage Range Check	Open/short in signal or ground circuit	
Enable Conditions	Knock control enabled     Engine speed > 1800 rpm		
Threshold Value	Mean value of sensor signal < 0.1V	Contact resistance in connectors	
Diagnostic Time	• 20 revolutions	Faulty knock sensor	
MIL On Condition	• -		

#### SCHEMATIC DIAGRAM E21C8661



FLA -294 FUEL SYSTEM

#### MONITOR DTC STATUS E0565979

Refer to DTC P0325.

#### TERMINAL AND CONNECTOR INSPECTION E08DCB48

Refer to DTC P0325.

#### GROUND CIRCUIT INSPECTION EB719FD9

- 1. Ignition "OFF".
- 2. Disconnect Knock sensor connector.
- 3. Measure resistance between terminals 1 of the sensor harness connector and 32 of the ECM harness connector.

Specification : Approx.  $0\Omega$ 

4. Is resistance within the specification?



▶ Go to "Signal Circuit Inspection" procedure.



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

#### SIGNAL CIRCUIT INSPECTION E643B526

- 1. Check for open in signal harness.
  - 1) Ignition "OFF".
  - 2) Measure resistance between terminals 2 of the sensor harness connector and 31 of the ECM harness connector.

Specification : Approx.  $0\Omega$ 

3) Is resistance within the specification?



▶ Go to next step as below.

NO

- ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.
- 2. Check for short to ground in signal harness.
  - 1) Ignition "OFF".
  - 2) Measure resistance between terminal 2 of the sensor harness connector and chassis ground.

Specification: Infinite

3) Is resistance within the specification?



▶ Go to next step as below.



- ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.
- 3. Check for short to power in signal harness.
  - 1) Ignition "OFF".
  - 2) Disconnect ECM connector.
  - 3) Ignition "ON" & amp; amp; 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?



▶ Go to "Component Inspection" procedure.



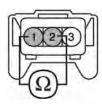
▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

#### COMPONENT INSPECTION E9COAE60

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

Specification : Approx. 5<sup>MΩ</sup> at 20°C (68°F).

<C123-2>



- 1. Sensor Ground
- 2. Sensor Signal
- 3. Shield Ground

FLA -296 FUEL SYSTEM

- 2. Output signal inspection
  - 1) Remove knock sensor from vehicle and secure (across mounting boss) in a shop vise.
  - Set up an oscilloscope as follows : Channel A (+): terminal 2 (-): terminal 1.
  - 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?



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



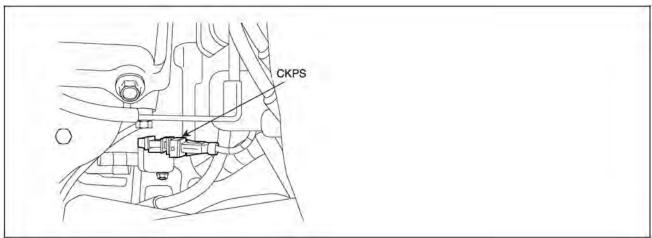
▶ Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks or poor terminal to wire connection. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

#### VERIFICATION OF VEHICLE REPAIR E1BEC9CB

Refer to DTC P0325.

## DTC P0335 CRANKSHAFT POSITION SENSOR A CIRCUIT

#### COMPONENT LOCATION EA22114D



FGOF440G

#### GENERAL DESCRIPTION E57A78C6

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

## DTC DESCRIPTION E7DBD75E

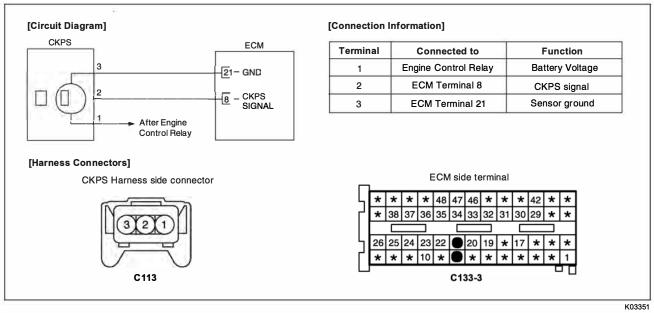
The ECM sets DTC P0335 when the number of crankshaft teeth during one revolution is incorrect or crankshaft signal is missing while camshaft signal is detected.

FLA -298 **FUEL SYSTEM** 

## DTC DETECTING CONDITION EC2BED13

Item		Detecting Condition & Fail Safe	Possible Cause	
DTC Strategy		Check Crankshaft Signal Switching		
Case1)	Enable Condi- tions	Before Synchronization	Open or short in signal, ground or power supply circuit     Contact resistance in connectors     Damage to the connecting	
	Thresh- old Value	<ul> <li>Valid Crankshaft Teeth not yet detected with Camshaft Signal</li> <li>Can not detect TDC with valid Crankshaft Teeth and Camshaft Signal</li> </ul>		
	Diagnos- tic Time	4 revolutions		
Case2)	Enable Condi- tions	After Synchronization	flange/flywheel  Misadjust crankshaft and camshaft pulley position	
	Thresh- old Value	Number of Crankshaft Teeth is not correct	Faulty CKP sensor	
	Diagnos- tic Time	• 5 revolutions		
MIL On Condition		2 Driving Cycles		

#### SCHEMATIC DIAGRAM EAD152DC



#### SINGAL WAVEFORM EA9B2A89

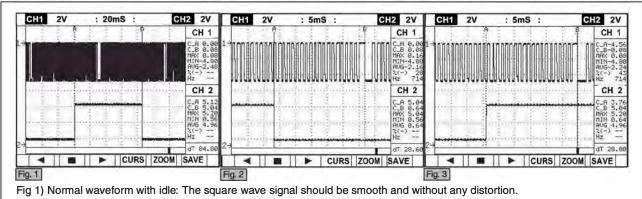
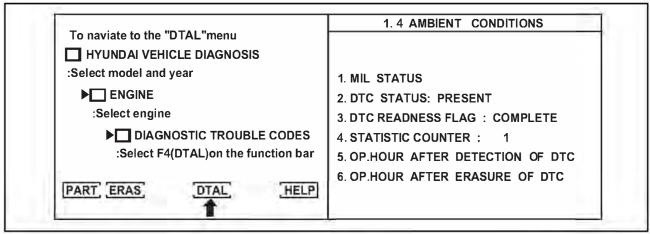


Fig 2,3) Normal waveform with engine running: The CMP falling edge is coincided with 38+/-4 tooth of the CKP from one longer signal (missing tooth)

K03152

#### MONITOR DTC STATUS E018

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



EDTC\_GK

- Is parameter displayed "History(Not Present) fault"?
  - History (Not Present) fault : DTC occurred but has been cleared.
  - Present fault : DTC is occurring at present time.

## YES

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

FLA -300 FUEL SYSTEM



▶ Go to next step as below.

#### TERMINAL AND CONNECTOR INSPECTION EBA0AB47

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.

- Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?



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



▶ Go to "Power Supply Circuit Inspection" procedure.

## POWER SUPPLY CIRCUIT INSPECTION E38C4FA2

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

Specification: Approx. B+

5. Is voltage within the specification?



▶ Go to "Ground Circuit Inspection" procedure.



- ▶ Check for a open in the power supply circuit between the main relay and the crankshaft position sensor.
- ▶ Especially check for open or blown 10A Sensor fuse.
- ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

#### GROUND CIRCUIT INSPECTION E3C53CFB

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

Specification : Approx.  $0\Omega$ 

3. Is resistance within the specification?

YES

▶ Go to "Signal Circuit Inspection" procedure.

NO

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

#### SIGNAL CIRCUIT INSPECTION EBA500D3

- 1. Check for open in signal harness.
  - 1) Disconnect ECM connector.
  - 2) Measure resistance between terminals 2 of the sensor harness connector and 8 of the ECM harness connector.

Specification: Approx. 0Ω

3) Is resistance within the specification?

YES

▶ Go to next step as below.

NO

- ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.
- 2. Check for short to ground in signal harness.
  - 1) Measure resistance between terminal 2 of the sensor harness connector and chassis ground

Specification: Infinite

2) Is resistance within the specification?

YES

▶ Go to next step as below.

NO

- ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.
- 3. Check for short to power in signal harness.
  - 1) Ignition "ON" & Engine "OFF".
  - 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.

FLA -302 FUEL SYSTEM



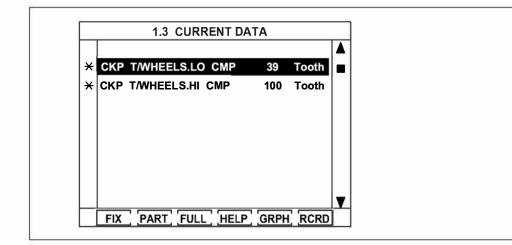
▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

#### COMPONENT INSPECTION F67F969C

- 1. Start engine and let vehicle idle
- Connect scantool and select "Current Data" mode
- 3. Monitor "CKP T/WHEELS-LO CMP" & "CKP T/WHEELS-HI CMP" parameters on the Scantool data list.

Specification:

"CKP T/WHEELS-LO CMP": 38 +/- 4 tooth "CKP T/WHEELS-HI CMP": 98 +/- 4 tooth



K03004

4. Are "CKP T/WHEELS-LO CMP" & "CKP T/WHEELS-HI CMP" parameters within the specification?

## YES

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

#### NO

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

# **NOTE**

Air gap [0.3~1.7 mm [0.012~0.067 in] = measure distance from hosing to teeth on flywheel/torque converter (measurement "A") and from mounting surface on sensor to sensor tip (measurement "B") subtract "B" from "A".

If fail to synchronize with CMP sensor, readjust timing system and go to next step.

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

### VERIFICATION OF VEHICLE REPAIR EF8D242B

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.
- 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"?



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

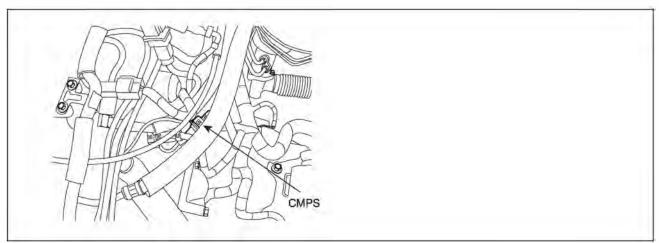


▶ Go to the applicable troubleshooting procedure.

FLA -304 FUEL SYSTEM

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

### COMPONENT LOCATION E021223A



EGOF440H

#### GENERAL DESCRIPTION EFFE270A

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

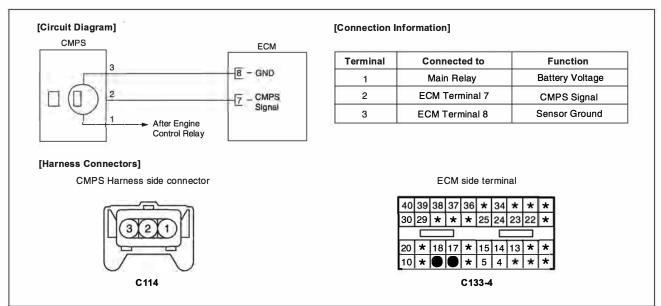
## DTC DESCRIPTION ECD2B42B

The ECM monitors the camshaft sensor signal transition position which must change only once per crankshaft revolution. If no camshaft signal is detected while crankshaft signal is detected, the ECM sets DTC P0340.

#### DTC DETECTING CONDITION E96596FC

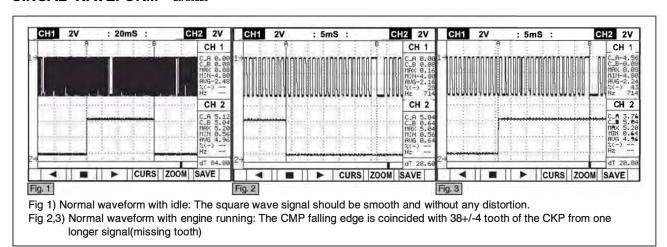
Item	Detecting Condition	Possible Cause	
DTC Strategy	Check camshaft signal switching		
Enable Conditions	No Crankshaft Position Sensor signal error	Open or short in signal, ground	
Threshold Value	<ul> <li>No signal switching</li> <li>Rising/falling camshaft edge not within defined window: -5 ~ +5 teeth</li> </ul>	or power supply circuit     Contact resistance in connectors     Misadjust crankshaft and camshaft pulley position	
Diagnostic Time	80 revolutions	Faulty CMP sensor	
MIL On Condition • 2 Driving Cycles			

#### SCHEMATIC DIAGRAM EF05C20D



K03401

#### SINGAL WAVEFORM E8A36EB5

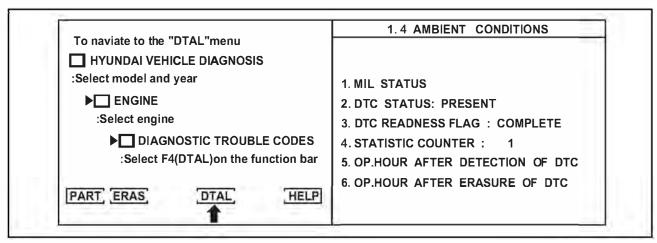


K03152

### MONITOR DTC STATUS E01A6E5F

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

FLA -306 FUEL SYSTEM



EDTC\_GK

- 5. Is parameter displayed "History(Not Present) fault"?
  - History (Not Present) fault: DTC occurred but has been cleared.
  - Present fault : DTC is occurring at present time.



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



▶ Go to next step as below.

#### TERMINAL AND CONNECTOR INSPECTION FOARBREE

- 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.
- Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?



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



Go to "Power Supply Circuit Inspection" procedure.

### POWER SUPPLY CIRCUIT INSPECTION EDATED19

- 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?



▶ Go to "Ground Circuit Inspection" procedure.

## NO

- ▶ Check for a open in the power supply circuit between the main relay and the crankshaft position sensor,
- ▶ Especially check for open or blown 10A Sensor fuse refer to "Component Circuit"
- ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

#### GROUND CIRCUIT INSPECTION E3FB75EB

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

Specification : Approx.  $0\Omega$ 

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 ECF23FE7

- 1. Check for open in signal harness.
  - 1) Disconnect ECM connector.
  - 2) Measure resistance between terminals 2 of the sensor harness connector and 7 of the ECM harness connector.

Specification: Approx. 0Ω

3) Is resistance within the specification?

#### YES

▶ Go to next step as below.

## NO

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

FLA -308 FUEL SYSTEM

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

Specification: Infinite

2) Is resistance within the specification?

YES

▶ Go to next step as below.

NO

- ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.
- 3. Check for short to power in signal harness.
  - 1) Ignition "ON" & Engine "OFF"
  - 2) Measure voltage between terminal 2 of the sensor harness connector and chassis ground

Specification: Approx. 0V.

3) Is voltage within the specification?

YES

▶ Go to "Component Inspection" procedure.

NO

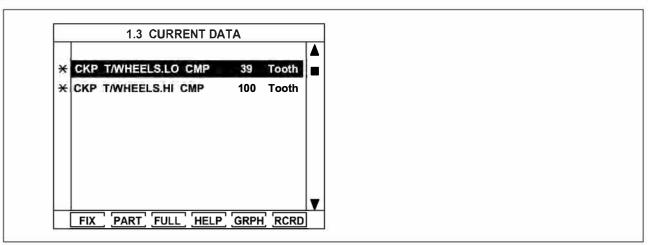
▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

### COMPONENT INSPECTION EC8FDC4E

- 1. Start engine and let vehicle idle.
- 2. Connect scantool and select "Current Data" mode.
- 3. Monitor "CKP T/WHEELS-LO CMP" & "CKP T/WHEELS-HI CMP" parameters on the Scantool data list.

Specification:

"CKP T/WHEELS-LO CMP": 38 +/- 4 tooth "CKP T/WHEELS-HI CMP": 98 +/- 4 tooth



K03004

4. Are "CKP T/WHEELS-LO CMP" & "CKP T/WHEELS-HI CMP" parameters within the specification?

## YES

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

## NO

- Remove CKP and calculate air gap.
- If fail to synchronize with CMP sensor, readjust timing system and go to next step.

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

#### VERIFICATION OF VEHICLE REPAIR E0249BED

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.

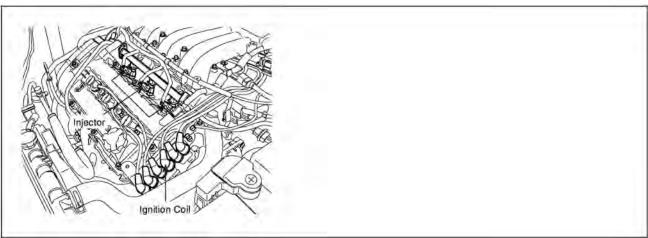
# NO

▶ Go to the applicable troubleshooting procedure.

FLA -310 FUEL SYSTEM

## DTC P0350 IGNITION COIL PRIMARY / SECONDARY CIRCUIT

#### COMPONENT LOCATION ED387EF6



EGOF257A

#### GENERAL DESCRIPTION E85BE 141

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

## DTC DESCRIPTION E762C44D

The ECM monitors the peak voltage duration of the ignition primary circuit. If abnormal signal is detected on three cylinders or more, the ECM sets DTC P0350.

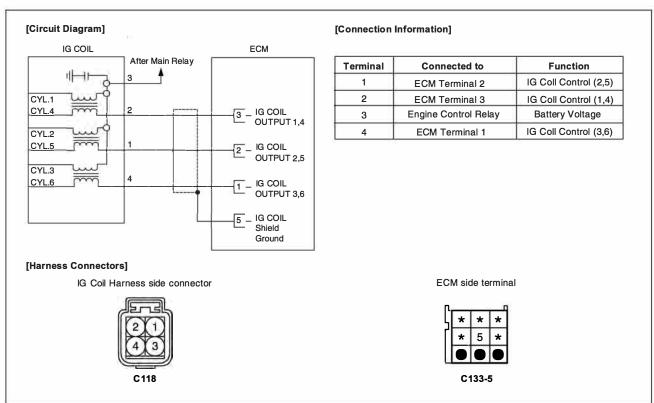
#### DTC DETECTING CONDITION E31F59DF

Item	Detecting Condition	Possible Cause
DTC Strategy	Monitoring ignition coil primary voltage	
Enable Conditions	Coolant temperature > 75℃(167°F)	Open or short in power supply circuit
Threshold Value	Failure on 3 cylinder or more	Open or short in control circuit
Diagnostic Time	85 revolutions	<ul><li>Contact resistance in connectors</li><li>Faulty ignition coil</li></ul>
MIL On Condition	• -	

#### SPECIFICATION EEACA5CD

Ignition Coil	Normal Parameter at 20℃(68°F)
Resistance(Primary)	Approx. 0.65 ~ 0.82 Ω
Resistance(Secondary)	Approx. 11.3 ~ 15.3 kΩ

### SCHEMATIC DIAGRAM E687E518

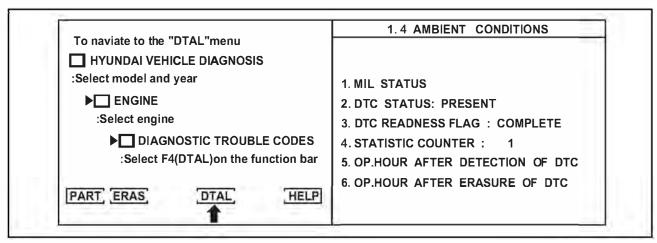


K03001

### MONITOR DTC STATUS E5CD4F8

- 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.

FLA -312 FUEL SYSTEM



EDTC\_GK

- 5. Is parameter displayed "History(Not Present) fault"?
  - History (Not Present) fault : DTC occurred but has been cleared.
  - Present fault : DTC is occurring at present time.



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



▶ Go to next step as below.

#### TERMINAL AND CONNECTOR INSPECTION FAR36537

- 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.
- Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?



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



▶ Go to "Power Supply Circuit Inspection" procedure.

### POWER SUPPLY CIRCUIT INSPECTION EC4BB071

- 1. Ignition "OFF".
- 2. Disconnect ignition coil connector.
- 3. Ignition "ON" & Engine "OFF".

4. Measure voltage between terminal 3 of the coil harness connector and chassis ground.

Specification: Approx. B+

5. Is voltage within the specification?



▶ Go to "Control Circuit Inspection" procedure.

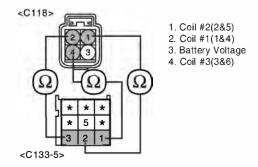


▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.

### CONTROL CIRCUIT INSPECTION EBCOAFFC

- 1. Check for open in signal harness.
  - 1) Ignition "OFF".
  - 2) Measure resistance from each ignition coil control circuit to ECM.

Specification : Approx.  $0\Omega$ 



K03504

3) Is resistance within the specification?



▶ Go to next step as below.

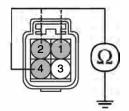


- ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.
- 2. Check for short to ground in signal harness.
  - 1) Measure resistance from each ignition coil control circuit to chassis ground

Specification: Infinite

FLA -314 FUEL SYSTEM

<C118>



- 1. Coil #2(2&5)
- 2. Coil #1(1&4)
- 3. Battery Voltage
- 4. Coil #3(3&6)

K03505

2) Is resistance within the specification?



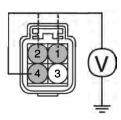
▶ Go to next step as below.

NO

- ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.
- 3. Check for short to battery in signal harness.
  - 1) Disconnect ECM connector.
  - 2) Ignition "ON" & Engine "OFF".
  - 3) Measure voltage from each ignition coil control circuit to chassis ground

Specification: Approx. 0V

<C118>



- 1. Coil #2(2&5)
- 2. Coil #1(1&4)
- 3. Battery Voltage
- 4. Coil #3(3&6)

K03506

4) Is voltage within the specification?

YES

▶ Go to "Component Inspection" procedure.

NO

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

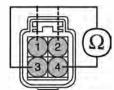
#### **IGNITION COIL INSPECTION**

- Ignition "OFF".
- Disconnect ignition coil connector.
- Visually/physically inspect the following items:
  - Damage, cracks and flashover.
- 4. Measure the resistance in each primary coil, referring to specification.(Component side)

Specification: Approx. Approx.  $0.65 \sim 0.82 \Omega$ 

- No.1 & 4 cyl. : terminals 3 & 2 - No.2 & 5 cyl. : terminals 3 & 1 - No.3 & 6 cyl. : terminals 3 & 4

<C118>



- 1. IG Coil Control(2.5)
- 2. IG Coil Control(1.4)
- 3. Battery Voltage
- 4. IG Coil Control(3.6)

K03003

5. Measure the secondary coil resistance.

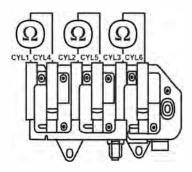
Measure the resistance between the high-voltage terminal for the No. 3 and No. 6 cylinders, between the high-voltage terminals for the No. 1 and No. 4 cylinders and between the high-voltage terminals for the No.2 and No.5 cylinders.



### / CAUTION

Be sure, when measuring the resistance of the secondary coil, to disconnect the connector of the ignition

Specification: Approx. 11.3 ~ 15.3 kΩ



K03507

FLA -316 FUEL SYSTEM

6. Is resistance within the specification?



▶ 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.



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

### VERIFICATION OF VEHICLE REPAIR E7DAB1C5

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.
- 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"?



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



▶ Go to the applicable troubleshooting procedure.

DTC	P0351	<b>IGNITION</b>	COIL 'A'	PRIMARY /	SECONDARY	CIRCUIT	
DTC	P0352	<b>IGNITION</b>	COIL 'B'	PRIMARY /	SECONDARY	CIRCUIT	
DTC	P0353	<b>IGNITION</b>	COIL 'C'	PRIMARY /	SECONDARY	CIRCUIT	
_					SECONDARY		
DTC	P0355	<b>IGNITION</b>	COIL 'E'	PRIMARY /	SECONDARY	CIRCUIT	
DTC	P0356	IGNITION	COIL 'F'	PRIMARY /	<b>SECONDARY</b>	CIRCUIT	

#### COMPONENT LOCATION E1EE907B

Refer to DTC P0350.

#### GENERAL DESCRIPTION E8C69FC7

Refer to DTC P0350.

### DTC DESCRIPTION E760CB8B

The ECM monitors the peak voltage duration of the ignition primary circuit. If abnormal signal is detected, the ECM sets DTC P0351.

## DTC DETECTING CONDITION ECF31D19

Item	Detecting Condition	Possible Cause		
DTC Strategy	Monitoring ignition coil primary voltage			
Enable Conditions	Over Voltage Duration Depend on engine speed and air mass flow	Open or short in power		
Threshold Value	<ul> <li>Over voltage duration =0</li> <li>Over voltage duration &lt; α</li> <li>Over voltage duration of each ignition output overlapping below 4500 rpm</li> </ul>	supply circuit  Open or short in control circuit  Contact resistance in connectors Faulty ignition coil		
Diagnostic Time	85 revolutions			
MIL On Condition • -				

#### SPECIFICATION EA2EA65A

Refer to DTC P0350.

#### SCHEMATIC DIAGRAM ED35B2E1

Refer to DTC P0350.

## MONITOR DTC STATUS EFFDFB25

Refer to DTC P0350.

### TERMINAL AND CONNECTOR INSPECTION ECCDAOFD

Refer to DTC P0350.

FLA -318 FUEL SYSTEM

#### POWER SUPPLY CIRCUIT INSPECTION E7B213FD

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

Specification: Approx. B+

5. Is voltage within the specification?



▶ Go to "Control Circuit Inspection" procedure.

NO

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

### CONTROL CIRCUIT INSPECTION E8DE8F94

- 1. Check for open in signal harness.
  - 1) Ignition "OFF".
  - [P0351 & P0354]Measure resistance between terminals 2 of the coil harness connector and 3 of the ECM harness connector.

[P0352 & P0355]Measure resistance between terminals 1 of the coil harness connector and 3 of the ECM harness connector.

[P0353 & P0356]Measure resistance between terminals 4 of the coil harness connector and 3 of the ECM harness connector.

Specification: Approx. 0Ω

3) Is resistance within the specification?

YES

▶ Go to next step as below.

NO

- ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.
- 2. Check for short to ground in signal harness.
  - 1) [P0351 & P0354]Measure resistance between terminal 2 of the coil harness connector and chassis ground.
    - [P0352 & P0355]Measure resistance between terminal 1 of the coil harness connector and chassis ground.
    - [P0353 & P0356]Measure resistance between terminal 4 of the coil 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) Disconnect ECM connector.
  - 2) Ignition "ON" & Engine "OFF".
  - 3) [P0351  $\,\&\,$  P0354]Measure voltage between terminal 2 of the coil harness connector and chassis ground.
    - [P0352 & P0355]Measure voltage between terminal 1 of the coil harness connector and chassis ground.
    - [P0353 & P0356]Measure voltage between terminal 4 of the coil harness connector and chassis ground.

Specification: Approx. 0V

4) Is voltage within the specification?

## YES

▶ Go to next step as below.



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

### IGNITION COIL INSPECTION EDD4CA8F

- 1. Ignition "OFF".
- 2. Disconnect ignition coil connector.
- 3. Visually/physically inspect the following items:
  - Damage, cracks and flashover.
- 4. [P0351 & P0354]Measure the resistance between terminals 2 and 3 of the primary ignition coil. (Component side)
  - [P0352 & P0355]Measure the resistance between terminals 1 and 3 of the primary ignition coil. (Component side)
  - [P0353 & P0356]Measure the resistance between terminals 4 and 3 of the primary ignition coil. (Component side)

Specification : Approx.  $0.65 \sim 0.82 \Omega$ 

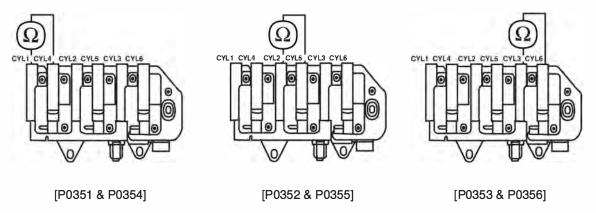
Measure the secondary coil resistance.Measure the resistance between the high-voltage terminal to following diagram.



Be sure, when measuring the resistance of the secondary coil, to disconnect the connector of the ignition coil.

Specification : Approx. 11.3 ~ 15.3  $k\Omega$ 

FLA -320 FUEL SYSTEM



EGOF262A

6. Is resistance within the specification?



▶ 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.



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

### VERIFICATION OF VEHICLE REPAIR E5E0CEC0

Refer to DTC P0350.

# DTC P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD(BANK 1) DTC P0430 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD(BANK 2)

#### GENERAL DESCRIPTION E10BEC04

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

#### DTC DESCRIPTION E58EF581

The ECM calculates oscillation size of rear HO2S signal which represents catalyst conversion properties. This oscillation size will determine if catalyst conversion is low due to aging or poisoning from leaded fuel or misfiring. The ECM sets P0420/P0430 if the average of calculated oscillation size of rear HO2S signal during predetermined duration is higher than the predetermined threshold.

#### DTC DETECTING CONDITION E812BCDB

Item	Detecting Condition	Possible Cause
DTC Strategy	<ul> <li>Comparison of the signal ratio of upstream and downstream O2 sensor in a load and speed range</li> </ul>	
Enable Conditions	<ul> <li>400(752°F) &lt; Catalyst model temperature &lt; 600°C(1112°F)</li> <li>Coolant temperature &gt; 70°C(158)</li> <li>Lambda control within limit</li> <li>992 &lt; Engine speed(rpm) &lt; 2880</li> <li>Air mass flow(mg/rev.) &lt; 750</li> <li>No misfire is detected</li> <li>not Transient Condition as Below</li> <li>1) Engine Speed   Current - Mean   &lt; 350 rpm</li> <li>2) TPS   Current - Mean   &lt; 4.2° TPS</li> <li>3) Lambda Correction   Current - Mean   &lt; 4%</li> </ul>	Exhaust gas leaks     Rear HO2S malfunction     Three way catalyst converter malfunction
Threshold Value	<ul> <li>Averaged malfunction index &gt; 0.7</li> </ul>	
Diagnostic Time	120 lambda controller cycles	
MIL On Condition • 2 Driving Cycles		

#### MONITOR DTC STATUS EA2A3EF9



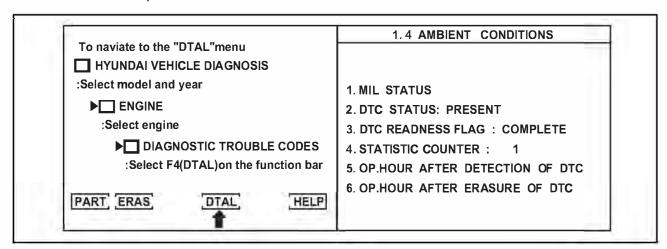
If any codes relating to injectors, HO2S, ECT(Engine Coolant Temperature)Sensor, Throttle Position sensor or Mass Air Flow Sensor are stored, do ALL REPAIRS associated with those codes before proceeding with this troubleshooting tree

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

FLA -322 FUEL SYSTEM

- 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.



EDTC\_GK

- 5. Is parameter displayed "History(Not Present) fault"?
  - History (Not Present) fault : DTC occurred but has been cleared.
  - Present fault : DTC is occurring at present time.

YES

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

NO

▶ Go to next step as below.

#### EXHAUST SYSTEM INSPECTION ECAACEB9

- 1. Visually/physically inspect the rear HO2S for the following conditions:
  - Exhaust system between HO2S and Three way catalyst for air leakage.
  - Damage, and for loose or missing hardware.
- 2. Was a problem found in any of the above areas?

YES

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

NO

▶ Go to "Rear HO2S Inspection " procedure.

#### **REAR HO2S INSPECTION**

- 1. Visually/physically inspect the rear HO2S for the following conditions:
  - Ensure that the HO2S is securely installed (Pigtail and wiring harness not making contact with the exhaust pipe)

- Check for corrosion on terminals.
- Check for terminal tension. ( at the HO2S and at the ECM)
- Any road damage.
- 2. Was a problem found in any of the above areas?



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



▶ Go to "TWC Inspection " procedure.

#### TWC INSPECTIOON

- 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?



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



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

#### VERIFICATION OF VEHICLE REPAIR E52A707F

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.

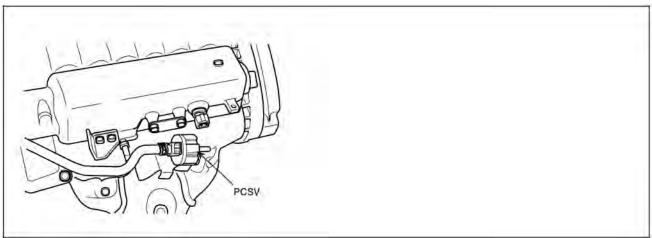
### NO

▶ Go to the applicable troubleshooting procedure.

FLA -324 FUEL SYSTEM

## DTC P0441 EVAP. EMISSION SYSTEM INCORRECT PURGE FLOW

#### COMPONENT LOCATION ECB22023



FGOF258A

#### GENERAL DESCRIPTION E5BCCD2B

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

#### DTC DESCRIPTION E8B7098C

During "test of vapour generation" a new value from the tank pressure sensor is measured and compared with the start pressure at beginning of "test of vapour generation".

The ECM sets DTC P0441 if the pressure signal decrease occurs and the difference is below the predetermined threshold. If same error code is set in the next driving cycle, the ECM illuminates the MIL.

#### DTC DETECTING CONDITION E7D510CF

Item	Detecting Condition	Possible Cause
DTC Strategy	<ul> <li>Monitoring the tank pressure sensor(DTP) signal with underpressure</li> </ul>	
Enable Conditions	<ul> <li>Idle state (TPS &lt; 1.4° TPS)</li> <li>Minimum modeled ambient temperature &gt; -10 ℃ (14°F)</li> <li>Coolant temperature &gt; 75 ℃ (167°F)</li> <li>Vehicle speed &lt; 5km/h(3mph)</li> <li>Estimated altitude &lt; 2.4km(8000ft)</li> <li>Differential fuel tank pressure : -11 ~ 5.5hPa</li> <li>Limited canister saturation &gt; -22%</li> <li>Minimum purge time : 250sec.</li> </ul>	Leakage on hose to PCSV     Faulty PCSV
Threshold Value	Pressure fluctuation in fuel tank < -2 hPa during vapor generation period	
Diagnostic Time	• 0.5 sec.	
Fail Safe	EVAP. System monitoring is inhibited	
MIL On Condition	2 Driving Cycles	

#### MONITOR DTC STATUS E09CDE70

**₩** NOTE

If any DTCs (or pending codes) are present, do ALL REPAIRS associated with those codes before proceeding with this troubleshooting tree.

1. Start engine to normal operating temperature.

**NOTE** 

Evaporative Emissions Systems (EVAP) Leak Tests can be run by the Scan Tool. The tests are automated and provide either a pass-fail result or directions to check for DTCs.

- 2. Install scan tool and clear DTC.
- 3. Perform "EVAP. LEAKAGE TEST" mode referring to enable conditions as below.

**NOTE** 

EVAP. Leakage Test enable conditions.

- Following conditions must be fulfilled to start the test.
  - 1) Engine warm up at Idle Status.
  - 2) No relevant DTC.
  - 3) Fuel level is below 80%.
- 4. Is DTC P0441 set again?

YES

▶ Go to "PCSV Inspection" procedure.

FLA -326 FUEL SYSTEM

#### NO

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

#### **PCSV INSPECTION**

- 1. Ignition "OFF".
- 2. Disconnect the hose leading from the PCSV to the intake manifold at PCSV.
- Using a vacuum pump, apply specified vacuum(Approx. 15 in, Hg) to the manifold side of the valve and verify PCSV holds vacuum.
- 4. Ignition "ON" & Engine "OFF".
- 5. Install scantool and select "EVAP PURGE VALVE" on the Actuation Test mode.
- 6. Activates "EVAP PURGE VALVE" by pressing "STRT(F1)" key.
- 7. Verify PCSV release vacuum while valve is activating(should hear a faint click from PCSV).
- 8. Repeat this procedure 4 or 5 times to ensure PCSV reliability.
- 9. Is PCSV working properly?



▶ Thoroughly check fuel vapor hoses and hose clamp and replace as necessary. Go to "Terminal and connection inspection" procedure.

## NO

▶ Thoroughly check fuel vapor hoses and hose clamps between PCSV and intake manifold. Repair as necessary. If OK, test with a new PCSV and check for proper operation. If problem is corrected, replace PCSV and go to "Verification of Vehicle Repair" procedure

#### TERMINAL AND CONNECTOR INSPECTION ECIDEF68

- 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. Check the following conditions:
  - 1) Check for damaged harness and terminals: contact resistance, oxidation, bent or broken terminals.
  - Check for poor connection between ECM and component: backed out terminal, improper mating, broken locks and poor terminal to wire connection.

## **NOTE**

Using a suitable male pin to ensure that contact in sockets is good. The pin should remain in position when pulled gently.

3) Is a problem found?



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

NO

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

#### VERIFICATION OF VEHICLE REPAIR EDA30ACE

- 1. Return vehicle to original condition.
- 2. Start engine to normal operating temperature.

**NOTE** 

Evaporative Emissions Systems (EVAP) Leak Tests can be run by the Scan Tool. The tests are automated and provide either a pass-fail result or directions to check for DTCs.

- 3. Install scan tool and clear DTC.
- 4. Perform "EVAP. LEAKAGE TEST" mode referring to enable conditions as below.

NOTE

EVAP. Leakage Test enable conditions.

- Following conditions must be fulfilled to start the test.
  - 1) Engine warm up at Idle Status.
  - 2) No relevant DTC.
  - 3) Fuel level is below 80%.
- 5. Monitoring for (pending) DTC.Is the same DTC set?

YES

▶ Go to the applicable troubleshooting procedure.

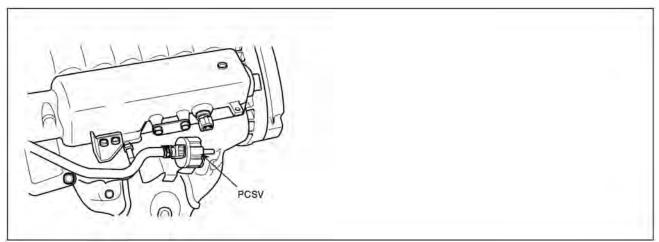
NO

▶ System performing to specification at this time.

FLA -328 FUEL SYSTEM

# DTC P0442 EVAP. EMISSION SYSTEM-LEAK DETECTED (SMALL LEAK) DTC P0456 EVAP. EMISSION SYSTEM-LEAK DETECTED (VERY SMALL LEAK)

#### COMPONENT LOCATION EEFBBEAD



EGOF258A

#### GENERAL DESCRIPTION EBASFBC8

Due to the increasing ambient temperature of the fuel and the return of unused hot fuel from the engine, fuel vapors are generated in the tank. In order to control the release of these vapors to the atmosphere, the evaporative emissions control system is used. The evaporative emission control system reduces hydrocarbon (HC) emissions by trapping fuel tank vapors until they can be burned in the combustion process. Evaporating fuel is stored in a charcoal canister until it can be flushed into the intake manifold. The evaporative emission control system is made up of a fuel tank that can be completely sealed from outside air, a Fuel Tank Pressure Sensor (FTPS), a Canister Close Valve (CCV) that seals the canister from the outside air, a canister filled with activated charcoal granules, a Purge Control Solenoid Valve (PCSV). The evaporative emission system can be checked for leaks by sealing the system off from the outside air, creating a vacuum, and monitoring if the system can hold that vacuum sufficiently for a set amount of time. If it cannot, a leak exists somewhere in the system.

#### DTC DESCRIPTION EF3A4C8B

The ECM closes the Canister Close Valve (CCV) at the charcoal canister to seal off the evaporative emission system and then opens purge control valve (PCSV) to generate a vacuum in the fuel tank. After vacuum generation, the ECM measures pressure differential curve in the fuel tank and sets DTC P0442 or P0456 if the vacuum generated within a monitoring period increases above a defined threshold.

If same error code is set in the next driving cycle, the ECM illuminates the MIL.

#### DTC DETECTING CONDITION EBE1

#### [P0442]

Item	Detecting Condition	Possible Cause
DTC Strategy	Monitoring the tank pressure sensor(DTP) signal with underpressure	Fuel filler cap damage or missing
Enable Conditions	<ul> <li>Idle state (TPS &lt; 1.4° TPS)</li> <li>Minimum modeled ambient temperature &gt; -10°C(14°F)</li> <li>Coolant temperature &gt; 75°C(167°F)</li> <li>Vehicle speed &lt; 5km/h(3mph)</li> <li>Estimated altitude &lt; 2.4km(8000ft)</li> <li>Differential fuel tank pressure : -11 ~ 5.5hPa</li> <li>Limited canister saturation &gt; -22%</li> <li>Minimum purge time : 250sec.</li> </ul>	<ul> <li>Faulty or damaged fuel filler pipe</li> <li>Leaking, disconnected or plugged fuel vapor lines.</li> <li>Fuel in lines due to faulty Rollover Valve</li> <li>On-Board Refueling Vapor Recovery Valve (ORVR valve) or stuck closed CCV.</li> <li>Improperly installed or stuck Purge Control Solenoid Valve (PCSV).</li> </ul>
Threshold Value	Leak. Diameter > 0.8mm	Faulty Fuel Tank Pressure
Diagnostic Time	• 26 sec. In idle	Sensor (FTPS).  • Leaking canister
MIL On Condition	2 Driving Cycles	<b>5</b>

#### [P0456]

Item	Detecting Condition	Possible Cause
DTC Strategy	Monitoring the tank pressure sensor(DTP) signal with underpressure	
Enable Conditions	<ul> <li>Idle state</li> <li>Minimum modeled ambient temperature &gt; -10°C(14°F)</li> <li>Coolant temperature &gt; 75°C(167°F)</li> <li>Vehicle speed &lt; 5km/h(3mph)</li> <li>Estimated altitude &lt; 2.4km(8000ft)</li> <li>Differential fuel tank pressure: -11 ~ 5.5hPa</li> <li>Limited canister saturation &gt; -10%</li> <li>Minimum purge time:100sec.</li> </ul>	Leakage in EVAP system line     Faulty CCV,PCSV or FTPS
Threshold Value	• 0.41mm < leak.diameter < 0.8mm	
Diagnostic Time	• 39 sec. in idle	
MIL On Condition	2 Driving Cycles	

#### MONITOR DTC STATUS E489933F

## **₩** NOTE

If any codes relating to Fuel tank pressure sensor, Canister closing valve or PCSV circuits are present, do ALL RE-PAIRS associated with those codes before proceeding with this troubleshooting tree.

1. Start engine to normal operating temperature.

## **NOTE**

Evaporative Emissions Systems (EVAP) Leak Tests can be run by the Scan Tool. The tests are automated and provide either a pass-fail result or directions to check for DTCs.

2. Install scan tool and clear DTC.

FLA -330 FUEL SYSTEM

3. Perform "EVAP. LEAKAGE TEST" mode referring to enable conditions as below.



EVAP. Leakage Test enable conditions.

- Following conditions must be fulfilled to start the test.
  - 1) Engine warm up at Idle Status.
  - 2) No relevant DTC.
  - 3) Fuel level is below 80%.
- 4. Is DTC P0442set again?



▶ Go to "PCSV Line Inspection" procedure.



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

#### **PCSV LINE INSPECTION**

- 1. Ignition "OFF".
- Disconnect the hose leading from the PCSV to the intake manifold at PCSV.
- Using a vacuum pump, apply specified vacuum(Approx. 15 in, Hg) to the manifold side of the valve and verify PCSV holds vacuum.
- 4. Ignition "ON" & Engine "OFF".
- 5. Install scantool and select "EVAP PURGE VALVE" on the Actuation Test mode.
- 6. Activates "EVAP PURGE VALVE" by pressing "STRT(F1)" key.
- 7. Verify PCSV release vacuum while valve is activating(should hear a faint click from PCSV).
- 8. Repeat this procedure 4 or 5 times to ensure PCSV reliability.
- 9. Is PCSV working properly?

## YES

▶ Go to "Canister Closing Valve(CCV) Line Inspection" procedure.



- ▶ Verify arrow on PCSV is pointing towards intake manifold. If it is not, reverse installation. Reinstall as necessary.
- ▶ If OK, check for cracks or damage in hose connecting PCSV and intake manifold. Repair or replace as necessary.
- ▶ If OK, test with a new PCSV and check for proper operation. If problem is corrected, replace PCSV and go to "Verification of Vehicle Repair" procedure.

#### CANISTER CLOSING VLAVE (CCV) LINE INSPECTION

- 1. Return vehicle to original condition .
- 2. Ignition "OFF".
- 3. Disconnect the hose connecting Canister Closing Valve(CCV) to canister.

- 4. Blow air to the canister side of the valve and verify air escapes to the air filter side.
- Turn ignition on and jumper a wire to GND(back probe) at terminal 2 of the ECM connector(CCV valve should click).
- 6. Blow air into hose and verify air does not escape.
- 7. Repeat this procedure 4 or 5 times to ensure CCV reliability.
- 8. Is CCV working properly?

## YES

▶ Go to "Fuel Tank Pressure Sensor Inspection" procedure.

## NO

- Check for cracks or damage in hose connecting CCV and canister. Repair or replace as necessary.
- If OK, replace CCV. If CCV was stuck closed, inspect all lines and canister for liquid fuel. Replace any contaminated.components and blow out lines and go to "Verification of Vehicle Repair" procedure.

#### **FUEL TANK PRESSURE SENSOR INSPECTION**

- 1. Start engine and install scan tool.
- 2. Monitor "FUEL TANK PRESSURE" parameter on the current data list with depressing increasing engine speed.

Specification: Signal value will vary between -2mmHg to 2 mmHg depending on variation in engine speed.

- Approx. 0~2 mmHg(2.5V) at Ig. On.
- Approx. 0 mmHg at 1400rpm.
- Approx. -2 mmHg at 4000rpm.
- 3. Is signal value within specification?

## YES

▶ Go to "Purge Control Solenoid Valve(PCSV) Inspection" procedure.

## NO

- Check for cracks or damage in hose connecting canister and fuel pump. Repair or replace as necessary.
- Check for open or short in FTPS harness. Repair as necessary.
   If OK, test with a new FTPS and check for proper operation. If problem is corrected, replace FTPS and go to "Verification of Vehicle Repair" procedure.

#### **PCSV TO CANISTER LINE INSPECTION**

- 1. Check for leakage in hose.
  - 1) Disconnect the hose leading from the canister to the PCSV at canister.
  - 2) Using a vacuum pump, apply specified vacuum[Approx. 10cmHg(4 inHg)] to the manifold side of the valve and verify PCSV holds vacuum.
  - 3) Monitor vacuum pressure for 1 minute. After 1 minute, pressure should not drop more than 2cmHg(0.8 inHg).
  - 4) Is pressure within specification?

FLA -332 FUEL SYSTEM

## YES

▶ Go to "2. Check for leakage in canister" procedure.

## ИО

▶ Check for cracks or damage in hose connecting PCSV and canister. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

2. Check for leakage in canister

## **NOTE**

Thoroughly check all fuel vapor hoses and hose clamps between:

- Canister and fuel tank.
- Canister and CCV.
- Canister and PCSV.

If NG, replace hose or clamps as necessary and go to "Verification of Vehicle Repair" procedure. If OK, go to next step as below.

- 1) Disconnect hose clamps and remove canister assembly.
- 2) Block the hose of between:
  - Canister and fuel filler neck.
  - Canister and CCV.
  - Canister and PCSV.
- 3) Apply maximum of 10cmHg(4 inHg) pressure through fuel tank port from canister.
- 4) With system sealed and pressurized, check for leaks.
- 5) Were any leak(s) found?

## YES

▶ Repair or replace leaking system component(s) and go to "Verification of Vehicle Repair" procedure.

## NO

▶ Go to "Fuel Tank Line Inspection" procedure.

#### **FUEL TANK LINE INSPECTION**

1. Relieve the fuel system pressure and remove the fuel tank.



Before removing the fuel tank, make sure the fuel hoses are not leaking.

- 2. Block all of the following outlets:
  - 1) Fuel lines.
  - 2) Fuel filler neck.
- 3. Apply maximum of 10cmHg(4 inHg) pressure to the EVAP. hose at the fuel tank. Then, pinch the EVAP. hose to retain the pressure.
- 4. Check the suspect area for leaks with a soap solution.

5. Were any leak(s) found?



▶ Repair or replace leaking system component(s) and go to "Verification of Vehicle Repair" procedure.



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

#### VERIFICATION OF VEHICLE REPAIR E608D3BA

- 1. Return vehicle to original condition.
- 2. Start engine to normal operating temperature.

## **NOTE**

Evaporative Emissions Systems (EVAP) Leak Tests can be run by the Scan Tool. The tests are automated and provide either a pass-fail result or directions to check for DTCs.

- 3. Install scan tool and clear DTC.
- 4. Perform "EVAP. LEAKAGE TEST" mode referring to enable conditions as below.

## **NOTE**

EVAP. Leakage Test enable conditions.

- Following conditions must be fulfilled to start the test.
  - 1) Engine warm up at Idle Status.
  - 2) No relevant DTC.
  - 3) Fuel level is below 80%.
- 5. Monitoring for (pending) DTC.Is the same DTC set?

## YES

▶ Go to the applicable troubleshooting procedure.

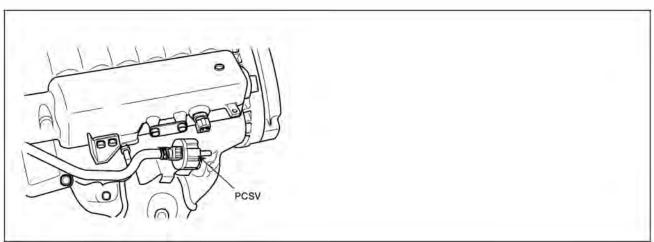
## NO

▶ System performing to specification at this time.

FLA -334 FUEL SYSTEM

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

#### COMPONENT LOCATION EBC17BA8



EGOF258A

#### GENERAL DESCRIPTION EA4E87CB

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

#### DTC DESCRIPTION EBE3CCC1

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

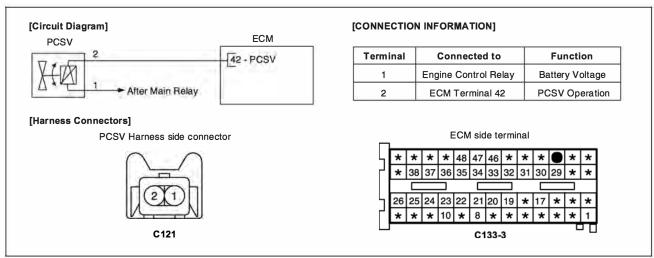
## DTC DETECTING CONDITION E1FE8955

Item	Detecting Condition	Possible Cause
DTC Strategy	Driver stage check	
Enable Conditions	10V < Battery voltage	Open in PCSV harness
Threshold Value	Line break	Contact resistance in connectors     Faulty PCSV
Diagnostic Time	• 1 sec.	
MIL On Condition	2 Driving Cycles	

#### SPECIFICATION EC9FAED1

Temperature		
(°C)	(°F)	PCSV Resistance (Ω )
20	68	24.5 ~ 27.5

#### SCHEMATIC DIAGRAM E5A918FC



K04441

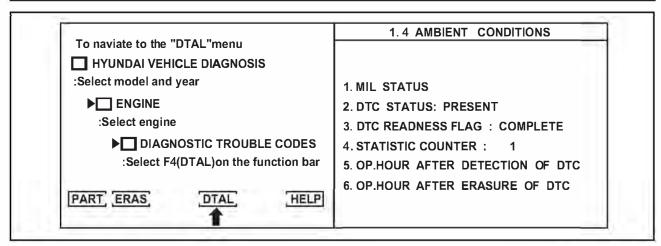
#### MONITOR DTC STATUS EE9C03EC



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.

FLA -336 FUEL SYSTEM



EDTC\_GK

- 5. Is parameter displayed "History(Not Present) fault"?
  - History (Not Present) fault : DTC occurred but has been cleared.
  - Present fault : DTC is occurring at present time.

## YES

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

## NO

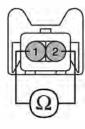
▶ Go to "Component Inspection" procedure.

#### COMPONENT INSPECTION ECAAFC1B

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

Specification : Approx. 24.5 ~ 27.5  $\Omega$  at 20  $^{\circ}$ C (68  $^{\circ}$ F)

<C121>



- 1. Battery Voltage
- 2. PCSV Operation

K04443

4. Is resistance within the specification?

#### YES

▶ Go to next step as below.



▶ 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 ECBB2A63

- 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.
- 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 E527CF5C

- 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 E52E5EB1

- 1. Ignition "OFF".
- 2. Disconnect ECM connector.
- 3. Measure resistance between terminals 2 of the PCSV harness connector and 42 of the ECM harness connector.

Specification : Approx.  $0\Omega$ 

FLA -338 FUEL SYSTEM

4. Is resistance within the specification?



▶ 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.



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

#### VERIFICATION OF VEHICLE REPAIR EEFE6D48

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.
- 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"?



▶ 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 E634BFD8

Refer to DTC P0444.

#### GENERAL DESCRIPTION E6FFCAD1

Refer to DTC P0444.

#### DTC DESCRIPTION E40BD7A4

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

#### DTC DETECTING CONDITION E5DE2E04

Item	Detecting Condition	Possible Cause
DTC Strategy	Driver stage check	
Enable Conditions	• 10V < Battery voltage	Short in PCSV harness     Contact resistance in connectors     Faulty PCSV
Threshold Value	Short to ground or Short to Battery	
Diagnostic Time	• 1 sec.	
MIL On Condition	2 Driving Cycles	

#### SPECIFICATION EBF8D6DF

Refer to DTC P0444.

#### SCHEMATIC DIAGRAM EFEOFBFO

Refer to DTC P0444.

#### MONITOR DTC STATUS E6A29E9D

Refer to DTC P0444.

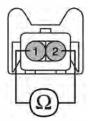
#### COMPONENT INSPECTION EDCEE9E6

- 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 ~ 27.5  $\Omega$  at 20  $^{\circ}$ C(68  $^{\circ}$ F)

FLA -340 FUEL SYSTEM

<C121>



- 1. Battery Voltage
- 2. PCSV Operation

K04443

4. Is resistance within the specification?



▶ Go to next step as below.



▶ 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 E5A1C779

Refer to DTC P0444.

#### POWER SUPPLY CIRCUIT INSPECTION E66999DC

- 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?



▶ Go to "Control Circuit Inspection" procedure.



▶ Check for a open in the power supply circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

#### CONTROL CIRCUIT INSPECTION ED5DFA55

- 1. Check for short to ground in control circuit.
  - 1) Ignition "OFF".
  - 2) Disconnect ECM connector.
  - 3) Measure resistance between terminals 2 of the PCSV harness connector and 42 of the ECM harness connector.

Specification : Approx.  $0\Omega$ 

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 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.

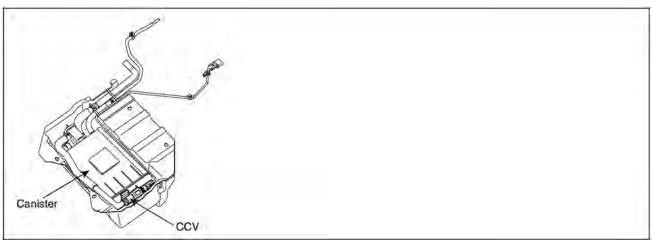
#### VERIFICATION OF VEHICLE REPAIR E8C9D3CE

Refer to DTC P0444.

FLA -342 FUEL SYSTEM

## DTC P0447 EVAP. EMISSION SYSTEM-VENT CONTROL CIRCUIT OPEN

#### COMPONENT LOCATION E36723DE



EGOF259A

#### GENERAL DESCRIPTION E24727EA

The evaporative emissions 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 Canister Closing Valve (CCV) closes off the air inlet into the canister for leak detection of the evaporative emission system. The CCV also prevents fuel vapors from escaping from the canister. When the engine purges the HC vapors from the canister, the clean air comes into the canister through the canister air-filter and the CCV.

#### DTC DESCRIPTION ECC88AF4

ECM sets DTC P0447 if the ECM detects that the CCV control line is open.

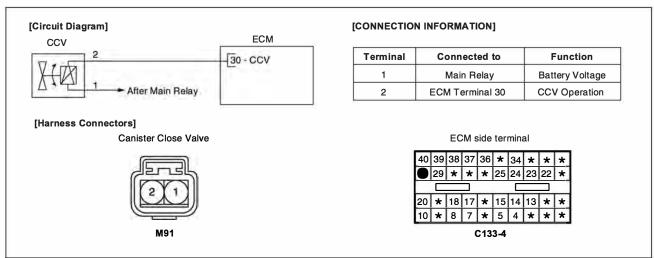
#### DTC DETECTING CONDITION EB8B9E37

Item	Detecting Condition	Possible Cause
DTC Strategy	Driver stage check	
Enable Conditions	• 10V < Battery voltage	Open in CCV harness
Threshold Value	Line break	Contact resistance in connectors
Diagnostic Time	• 3 sec.	Faulty CCV
MIL On Condition	2 Driving Cycles	

#### SPECIFICATION E74612CD

Temperature		2017 11 (2)
(℃)	(°F)	CCV Resistanc (Ω)
20	68	23.9 ~ 26.9

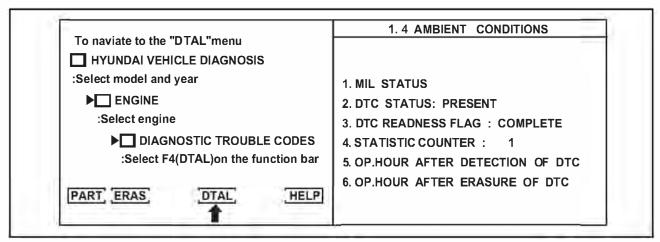
#### SCHEMATIC DIAGRAM



K04471

#### MONITOR DTC STATUS E5C

- 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.



EDTC\_GK

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.

FLA -344 FUEL SYSTEM



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



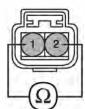
▶ Go to "Component Inspection" procedure.

#### COMPONENT INSPECTION E6D8A991

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

Specification : Approx. 23.9~26.9 $\Omega$  at 20  $^{\circ}$ C(68 $^{\circ}$ F)

<M91>



- 1. Battery Voltage
- 2. CCV Operation

K04473

4. Is resistance within the specification?



▶ Go to next step as below.



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

#### TERMINAL AND CONNECTOR INSPECTION E357D62A

- 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.
- 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 EC897985

- 1. Ignition "ON" & Engine "OFF".
- 2. Measure voltage between terminal 1 of the CCV 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 E69AE790

- 1. Ignition "OFF".
- 2. Disconnect ECM connector.
- 3. Measure resistance between terminals 2 of the CCV harness connector and 30 of the ECM harness connector.

Specification : Approx.  $0\Omega$ 

4. Is resistance within the specification?

YES

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

NO

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

#### VERIFICATION OF VEHICLE REPAIR E7B0B902

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.

FLA -346 FUEL SYSTEM

- 3. Read "DTC Status" parameter.
- 4. Is parameter displayed "History(Not Present) fault"?



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

## NO

▶ Go to the applicable troubleshooting procedure.

## DTC P0448 EVAP. EMISSION SYSTEM-VENT CONTROL CIRCUIT SHORTED

#### COMPONENT LOCATION EOBB9DCE

Refer to DTC P0447.

#### GENERAL DESCRIPTION E1676D1F

Refer to DTC P0447.

#### DTC DESCRIPTION EC2ADB66

ECM sets DTC P0448 if the ECM detects that the CCV control line is short to ground or short to battery line.

#### DTC DETECTING CONDITION E9A024D2

Item	Detecting Condition	Possible Cause
DTC Strategy	Driver stage check	
Enable Conditions	Battery voltage > 10V	Short in CCV harness     Contact resistance in connectors     Faulty CCV
Threshold Value	Short to ground or Short to Battery	
Diagnostic Time	• 3 sec.	
MIL On Condition	2 Driving Cycles	

#### SPECIFICATION E09ECE66

Refer to DTC P0447.

#### SCHEMATIC DIAGRAM EFD311C8

Refer to DTC P0447.

#### MONITOR DTC STATUS EB8E6756

Refer to DTC P0447.

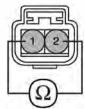
#### **COMPONENT INSPECTION** EB49334A

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

Specification : Approx. 23.9 ~ 26.9 $\Omega$  at 20  $^{\circ}$ C (68 $^{\circ}$ F)

FLA -348 FUEL SYSTEM

<M91>



- 1. Battery Voltage
- 2. CCV Operation

K04473

4. Is resistance within the specification?



▶ Go to next step as below.



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

#### TERMINAL AND CONNECTOR INSPECTION E9523F80

Refer to DTC P0447.

#### POWER SUPPLY CIRCUIT INSPECTION EC2B9B9C

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

Specification: Approx. B+

3. Is voltage within the specification?



▶ Go to "Control Circuit Inspection" procedure.



▶ Check for a open in the power supply circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

#### CONTROL CIRCUIT INSPECTION E70E8185

- 1. Check for short to ground in control circuit.
  - 1) Ignition "OFF".
  - 2) Disconnect ECM connector.
  - 3) Measure resistance between terminals 2 of the CCV harness connector and 30 of the ECM harness connector.

Specification : Approx.  $0\Omega$ 

4) Is resistance within the specification?

YES

▶ Go to "Control Circuit Inspection" procedure.

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 CCV harness connector and chassis ground.

Specification: Approx. 0V

3) Is voltage within the specification?

YES

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

NO

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

#### VERIFICATION OF VEHICLE REPAIR EAGADCED

Refer to DTC P0447.

FLA -350 FUEL SYSTEM

## DTC P0449 EVAP. EMISSION SYSTEM-VENT VALVE / SOLENOID CIRCUIT

#### COMPONENT LOCATION E9EF0043

Refer to DTC P0447.

#### GENERAL DESCRIPTION EACSACDE

Refer to DTC P0447.

#### DTC DESCRIPTION E2ABBFDA

The ECM measures pressure in the fuel tank by means of tank pressure sensor during all engine operating states except engine stop and start. The DTC P0449 is set if pressure is lower than predetermined threshold. If same error code is set in the next driving cycle, the ECM illuminates the MIL.

#### DTC DETECTING CONDITION E79AC503

Item	Detecting Condition	Possible Cause
DTC Strategy	Monitoring the tank pressure sensor(DTP) signal with underpressure	
Enable Conditions	<ul> <li>Idle state (TPS &lt; 1.4° TPS)</li> <li>Minimum modeled ambient temperature &gt; -10 °C (14°F)</li> <li>Coolant temperature &gt; 75 °C (167°F)</li> <li>Vehicle speed &lt; 5km/h(3mph)</li> <li>Estimated altitude &lt; 2.4km(8000ft)</li> <li>Differential fuel tank pressure : -11 ~ 5.5hPa</li> <li>Limited canister saturation &gt; -22%</li> <li>Minimum purge time : 250sec.</li> </ul>	Canister Air-Filter contamination     Faulty CCV
Threshold Value	Voltage of differential fuel tank pressure < 1.5V	
Diagnostic Time	• 0.5 sec.	
Fail Safe	<ul> <li>EVAP. emission control function is disabled</li> <li>EVAP. System monitoring is inhibited</li> <li>Fuel Tank Pressure Sensor monitoring is inhibited</li> </ul>	
MIL On Condition	2 Driving Cycles	

#### SPECIFICATION E22223D0

Refer to DTC P0447.

#### SCHEMATIC DIAGRAM E290CBE6

Refer to DTC P0447.

#### MONITOR DTC STATUS E1EC1CCD

Refer to DTC P0447.

#### **CANISTER AIR-FILTER INSPECTION**

- 1. Disassemble the Canister Air-Filter and hose from their respective positions.
- 2. Check the Canister air-filter for contamination. Disconnect CCV connector.
- 3. Is Canister Air-Filter contaminated with dust?

YES

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

NO

▶ Go to "Canister Closing Valve(CCV) inspection" procedure.

#### CANISTER CLOSING VLAVE (CCV) LINE INSPECTION

- 1. Return vehicle to original condition.
- 2. Ignition "OFF".
- 3. Disconnect the hose connecting Canister Closing Valve(CCV) to canister.
- 4. Blow air to the canister side of the valve and verify air escapes to the air filter side.
- 5. Turn ignition on and jumper a wire to GND(back probe) at terminal 2 of the ECM connector(CCV valve should click).
- 6. Blow air into hose and verify air does not escape.
- 7. Repeat this procedure 4 or 5 times to ensure CCV reliability.
- 8. Is CCV working properly?

**NOTE** 

If hose was pinched or restricted:

- 1. Fueling would be difficult if not impossible.
- 2. Restriction or blockage could cause pressure to accumulate in tank triggering a P0451.

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

▶ Replace CCV. If CCV was stuck closed, inspect all lines and canister for liquid fuel. Replace any contaminated components and blow out lines.

Go to "Verification of Vehicle Repair" procedure.

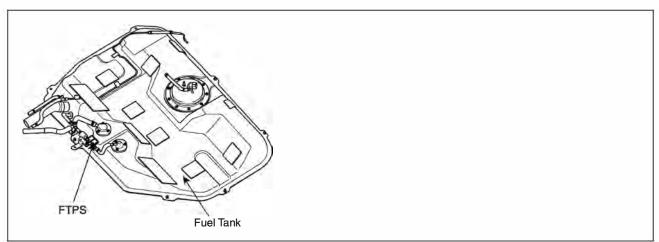
#### VERIFICATION OF VEHICLE REPAIR E5FCF1C7

Refer to DTC P0447.

FLA -352 FUEL SYSTEM

## DTC P0451 EVAP. EMISSION SYSTEM-PRESSURE SENSOR RANGE / PERFORMANCE

#### COMPONENT LOCATION E986AB5A



EGOF260A

#### GENERAL DESCRIPTION E83E7CE

The evaporative emission control system prevents hydrocarbon vapors from escaping from the fuel tank into the atmosphere where they could form photochemical smog. Gasoline vapors are collected in the charcoal canister. The Fuel Tank Pressure Sensor (FTPS) is an integral part of the evaporative monitoring system. The ECM monitors the FTPS signal to detect vacuum decay and excess vacuum. The FTPS measures the difference between the air pressure inside the fuel tank and outside air pressure to check the purge control solenoid valve operation and for leak detection in the evaporative emission control system by monitoring pressure and vacuum levels in the fuel tank during the purge control solenoid valve operating cycles.

#### DTC DESCRIPTION EBCCA9EE

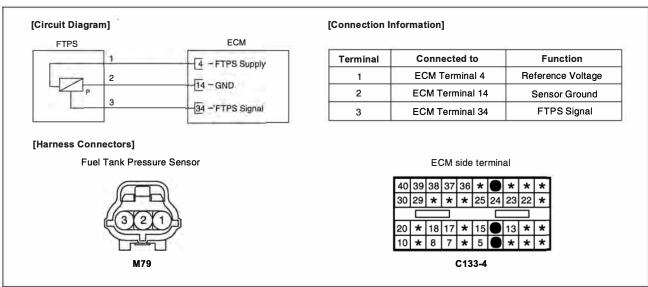
The ECM monitors pressure in the fuel tank by means of Fuel Tank Pressure Sensor (FTPS) during purge control valve opening or closing phase. This monitoring will determine if pressure sensor signal is stuck. The ECM sets DTC P0451 if pressure variation is smaller than the predetermined threshold.

If same error code is set in the next driving cycle, the ECM illuminates the MIL.

#### DTC DETECTING CONDITION EAA21E2A

Item	Detecting Condition	Possible Cause
DTC Strategy	Check signal oscillations	
Enable Conditions	<ul> <li>Minimum time in part load : 290 sec.</li> <li>Vehicle speed once above threshold : 45km/h(28mph)</li> </ul>	
Threshold Value	Difference between max./min.voltage < 0.015V	Contact resistance in connectors
Diagnostic Time	Immediate	• Faulty FTPS
Fail Safe	EVAP. System monitoring is inhibited     Fuel Tank Pressure Sensor monitoring is inhibited     Canister close valve monitoring is inhibited	
MIL On Condition	• 2 Driving Cycles	

#### SCHEMATIC DIAGRAM E3A4C74E



K04511

#### MONITOR DTC STATUS EDE1B69

**NOTE** 

If any DTCs (or pending codes) are present, do ALL REPAIRS associated with those codes before proceeding with this troubleshooting tree.

1. Start engine to normal operating temperature.

**NOTE** 

Evaporative Emissions Systems (EVAP) Leak Tests can be run by the Scan Tool. The tests are automated and provide either a pass-fail result or directions to check for DTCs.

- 2. Install scan tool and clear DTC.
- 3. Perform "EVAP. LEAKAGE TEST" mode referring to enable conditions as below.

FLA -354 FUEL SYSTEM



EVAP. Leakage Test enable conditions.

- Following conditions must be fulfilled to start the test.
  - 1) Engine warm up at Idle Status.
  - 2) No relevant DTC.
  - 3) Fuel level is below 80%.
- 4. Is DTC P0451 set again?



▶ Go to next step as below.



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

#### TERMINAL AND CONNECTOR INSPECTION E1C4FEDB

- 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?



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



▶ Go to "Fuel Tank Pressure Sensor(FTPS) inspection" procedure.

#### **FUEL TANK PRESSURE SENSOR INSPECTION**

- 1. Start engine and install scan tool.
- 2. Monitor "FUEL TANK PRESSURE" parameter on the current data list with depressing increasing engine speed.

Specification: Signal value will vary between -2mmHg to 2 mmHg depending on variation in engine speed.

- Approx. 0~2 mmHg(2.5V) at Ig. On
- Approx. 0 mmHg at 1400rpm
- Approx. -2 mmHg at 4000rpm
- 3. Is signal value within specification?



▶ 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 for cracks or damage in hose connecting canister and fuel pump. Repair or replace as necessary.
- ▶ Check for open or short in FTPS harness. Repair as necessary.

If OK, test with a new FTPS and check for proper operation. If problem is corrected, replace FTPS and go to "Verification of Vehicle Repair" procedure.

#### VERIFICATION OF VEHICLE REPAIR E399DB36

- 1. Return vehicle to original condition.
- 2. Start engine to normal operating temperature.



Evaporative Emissions Systems (EVAP) Leak Tests can be run by the Scan Tool. The tests are automated and provide either a pass-fail result or directions to check for DTCs.

- 3. Install scan tool and clear DTC.
- 4. Perform "EVAP. LEAKAGE TEST" mode referring to enable conditions as below.

**NOTE** 

EVAP. Leakage Test enable conditions.

- Following conditions must be fulfilled to start the test.
  - 1) Engine warm up at Idle Status.
  - 2) No relevant DTC.
  - 3) Fuel level is below 80%.
- 5. Monitoring for (pending) DTC.Is the same DTC set?

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System performing to specification at this time.

FLA -356 FUEL SYSTEM

## DTC P0452 EVAP. EMISSION SYSTEM-PRESSURE SENSOR LOW INPUT

#### COMPONENT LOCATION E9F7D20F

Refer to DTC P0451.

#### GENERAL DESCRIPTION E9379581

Refer to DTC P0451.

#### DTC DESCRIPTION E7E1DEA4

ECM sets DTC P0452 if the ECM detects signal voltage lower than the possible range of a properly operating FTPS.

#### DTC DETECTING CONDITION EA46C9C9

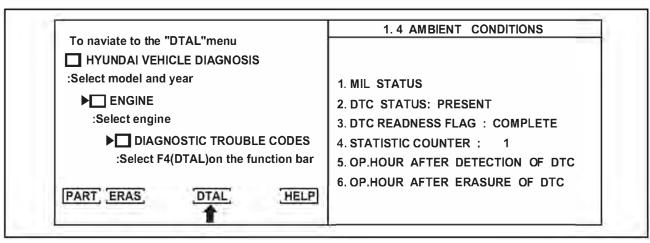
Item	Detecting Condition	Possible Cause
DTC Strategy	Voltage range check	
Enable Conditions	Battery voltage > 11V	Short to ground in FTPS harness
Threshold Value	Signal voltage < 0.35V	<ul><li> Open in FTPS harness</li><li> Contact resistance in connectors</li></ul>
Diagnostic Time	• 5 sec.	Defective FTPS
MIL On Condition	2 Driving Cycles	

#### SCHEMATIC DIAGRAM ECBA906E

Refer to DTC P0451.

#### MONITOR DTC STATUS EA1AE5C6

- 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.



EDTC\_GK

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 next step as below.

#### TERMINAL AND CONNECTOR INSPECTION EB6F4E2D

Refer to DTC P0451.

#### POWER SUPPLY CIRCUIT INSPECTION EOB73BE1

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

Specification: Approx. 5V

5. Is voltage within the specification?



▶ Go to "Signal Circuit Inspection" procedure.

FLA -358 FUEL SYSTEM

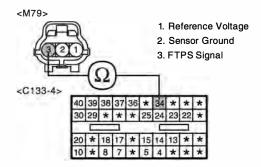
NO

▶ Check for a open in the power supply circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

#### SIGNAL CIRCUIT INSPECTION EDBBC04C

- 1. Check for open in signal circuit.
  - 1) Ignition "OFF".
  - 2) Disconnect ECM connector.
  - 3) Measure resistance between terminals 3 of the FTPS harness connector and 34 of the ECM harness connector

Specification : Approx.  $0\Omega$ 



K04524

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 circuit.
  - 1) Measure resistance between terminal 3 of the FTPS 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.

#### **FUEL TANK PRESSURE SENSOR INSPECTION**

- 1. Start engine and install scan tool.
- 2. Monitor "FUEL TANK PRESSURE" parameter on the current data list with depressing increasing engine speed. Specification: Signal value will vary between -2mmHg to 2 mmHg depending on variation in engine speed.
  - Approx. 0~2 mmHg(2.5V) at lg. On
  - Approx. 0 mmHg at 1400rpm
  - Approx. -2 mmHg at 4000rpm
- 3. Is signal value within specification?



▶ 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 for cracks or damage in hose connecting canister and fuel pump. Repair or replace as necessary.
- ▶ Check for open or short in FTPS harness. Repair as necessary.

If OK, test with a new FTPS and check for proper operation. If problem is corrected, replace FTPS and go to "Verification of Vehicle Repair" procedure.

#### VERIFICATION OF VEHICLE REPAIR EEBA8E2E

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

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

FLA -360 FUEL SYSTEM

## DTC P0453 EVAP. EMISSION SYSTEM-PRESSURE SENSOR HIGH INPUT

#### COMPONENT LOCATION E920BA1C

Refer to DTC P0451.

#### GENERAL DESCRIPTION EE0C1002

Refer to DTC P0451.

#### DTC DESCRIPTION ED9FC59D

ECM sets DTC P0453 if the ECM detects signal voltage higher than the possible range of a properly operating FTPS.

#### DTC DETECTING CONDITION ECC4E1BB

Item	Detecting Condition	Possible Cause
DTC Strategy	Voltage range check	Short to battery in FTPS harness     Contact resistance in connectors     Faulty FTPS
Enable Conditions	Battery voltage > 11V	
Threshold Value	Signal voltage > 4.78V	
Diagnostic Time	• 5 sec.	
MIL On Condition	2 Driving Cycles	

#### SCHEMATIC DIAGRAM EF4EB2BE

Refer to DTC P0451.

#### MONITOR DTC STATUS ED3F36FA

Refer to DTC P0452.

#### TERMINAL AND CONNECTOR INSPECTION EBD5064D

Refer to DTC P0451.

## POWER SUPPLY CIRCUIT INSPECTION EE979440

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

Specification: Approx. 5V

5. Is voltage within the specification?



▶ Go to "Ground Circuit Inspection" procedure.



▶ Check for a open in the power supply circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

#### GROUND CIRCUIT INSPECTION E15772B5

- 1. Ignition "OFF".
- 2. Disconnect ECM connector.
- 3. Measure resistance between terminals 2 of the FTPS harness connector and 14 of the ECM harness connector.

Specification : Approx.  $0\Omega$ 

4. Is resistance within the specification?



▶ Go to "Signal Circuit Inspection" procedure.



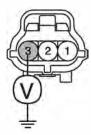
▶ Check for a open/short circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

#### SIGNAL CIRCUIT INSPECTION E82E0ACD

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

Specification: Approx. 0V

<M79>



- 1. Reference Voltage
- 2. Sensor Ground
- 3. FTPS Signal

K04533

FLA -362 FUEL SYSTEM

3. Is voltage within the specification?



▶ Go to next step as below.



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

#### **FUEL TANK PRESSURE SENSOR INSPECTION**

- 1. Start engine and install scan tool.
- 2. Monitor "FUEL TANK PRESSURE" parameter on the current data list with depressing increasing engine speed.

Specification: Signal value will vary between -2mmHg to 2 mmHg depending on variation in engine speed.

- Approx. 0~2 mmHg(2.5V) at Ig. On
- Approx. 0 mmHg at 1400rpm.
- Approx. -2 mmHg at 4000rpm.
- 3. Is signal value within specification?



▶ 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.



- ▶ Check for cracks or damage in hose connecting canister and fuel pump. Repair or replace as necessary.
- ▶ Check for open or short in FTPS harness. Repair as necessary.

If OK, test with a new FTPS and check for proper operation. If problem is corrected, replace FTPS and go to "Verification of Vehicle Repair" procedure

### VERIFICATION OF VEHICLE REPAIR EBDEE AAF

Refer to DTC P0452.

# DTC P0454 EVAP. EMISSION SYSTEM-PRESSURE SENSOR INTERMITTENT

#### COMPONENT LOCATION E8B9CB82

Refer to DTC P0451.

#### GENERAL DESCRIPTION E6A13A9A

Refer to DTC P0451.

### DTC DESCRIPTION E4F8733D

The ECM monitors pressure stability in the fuel tank by means of Fuel Tank Pressure Sensor (FTPS) for predetermined duration just before start the leakage monitoring to detect noise signal of pressure sensor. The ECM sets DTC P0454 if the pressure fluctuation is bigger than predetermined threshold.

If same error code is set in the next driving cycle, the ECM illuminates the MIL.

#### DTC DETECTING CONDITION E10E608C

Item	Detecting Condition	Possible Cause
DTC Strategy	Sensor signal noise check	
Enable Conditions	<ul> <li>Idle state (TPS &lt; 1.4° TPS)</li> <li>Minimum modeled ambient temperature &gt; -10 ℃ (14°F)</li> <li>Coolant temperature &gt; 75 ℃ (167°F)</li> <li>Vehicle speed &lt; 5km/h(3mph)</li> <li>Estimated altitude &lt; 2.4km(8000ft)</li> <li>Differential fuel tank pressure : -11 ~ 5.5hPa</li> <li>Limited canister saturation &gt; -22%</li> <li>Minimum purge time : 250sec.</li> </ul>	Contact resistance in connectors     Faulty FTPS
Threshold Value	Signal fluctuation > 0.5hPa	
Diagnostic Time	Immediate	
Fail Safe	<ul> <li>EVAP. System monitoring is inhibited</li> <li>Fuel Tank Pressure Sensor monitoring is inhibited</li> <li>Canister close valve monitoring is inhibited</li> </ul>	
MIL On Condition	2 Driving Cycles	

#### SCHEMATIC DIAGRAM EE856E1D

Refer to DTC P0451.

### MONITOR DTC STATUS E78BD4A6



If any DTCs (or pending codes) are present, do ALL REPAIRS associated with those codes before proceeding with this troubleshooting tree.

1. Start engine to normal operating temperature.

FLA -364 FUEL SYSTEM



Evaporative Emissions Systems (EVAP) Leak Tests can be run by the Scan Tool. The tests are automated and provide either a pass-fail result or directions to check for DTCs.

- 2. Install scan tool and clear DTC.
- 3. Perform "EVAP. LEAKAGE TEST" mode referring to enable conditions as below.



EVAP. Leakage Test enable conditions.

- Following conditions must be fulfilled to start the test.
  - 1) Engine warm up at Idle Status.
  - 2) No relevant DTC.
  - 3) Fuel level is below 80%.
- 4. Is DTC P0454 set again?



▶ Go to next step as below.



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

### TERMINAL AND CONNECTOR INSPECTION EDB403DA

Refer to DTC P0451.

#### **FUEL TANK PRESSURE SENSOR INSPECTION**

- 1. Start engine and install scan tool.
- 2. Monitor "FUEL TANK PRESSURE" parameter on the current data list with depressing increasing engine speed.

Specification: Signal value will vary between -2mmHg to 2 mmHg depending on variation in engine speed.

- Approx. 0~2 mmHg(2.5V) at lg. On
- Approx. 0 mmHg at 1400rpm.
- Approx. -2 mmHg at 4000rpm.
- 3. Is signal value within specification?



▶ 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 for cracks or damage in hose connecting canister and fuel pump. Repair or replace as necessary.
- ▶ Check for open or short in FTPS harness. Repair as necessary.

If OK, test with a new FTPS and check for proper operation. If problem is corrected, replace FTPS and go to "Verification of Vehicle Repair" procedure.

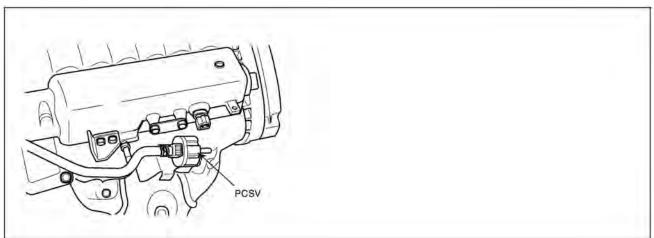
# VERIFICATION OF VEHICLE REPAIR EDDBOBES

Refer to DTC P0451.

FLA -366 FUEL SYSTEM

# DTC P0455 EVAP. EMISSION SYSTEM-LEAK DETECTED(LARGE LEAK)

#### COMPONENT LOCATION EE 125E9B



EGOF258A

#### GENERAL DESCRIPTION E10B3ECD

Due to the increasing ambient temperature of the fuel and the return of unused hot fuel from the engine, fuel vapors are generated in the tank. In order to control the release of these vapors to the atmosphere, the evaporative emissions control system is used. The evaporative emission control system reduces hydrocarbon (HC) emissions by trapping fuel tank vapors until they can be burned in the combustion process. Evaporating fuel is stored in a charcoal canister until it can be flushed into the intake manifold. The evaporative emission control system is made up of a fuel tank that can be completely sealed from outside air, a Fuel Tank Pressure Sensor (FTPS), a Canister Close Valve (CCV) that seals the canister from the outside air, a canister filled with activated charcoal granules, a Purge Control Solenoid Valve (PCSV). The evaporative emission system can be checked for leaks by sealing the system off from the outside air, creating a vacuum, and monitoring if the system can hold that vacuum sufficiently for a set amount of time. If it cannot, a leak exists somewhere in the system.

#### DTC DESCRIPTION ESAESED9

The ECM closes the Canister Close Valve (CCV) at the charcoal canister to seal off the evaporative emission system and then opens purge control valve (PCSV) to generate a vacuum in the fuel tank. This vacumm generation phase will determine if there is a large leak like tank cap open or canister shut off valve (CCV) stuck open. The ECM sets DTC P0455 if the pressure in the fuel tank does not drop as low as predetermined threshold during predetermined maximum vacuum generation period.

If the same error code is set in the next driving cycle, the ECM illuminates the MIL.

#### DTC DETECTING CONDITION E73FA4BE

Item	Detecting Condition	Possible Cause
DTC Strategy	Monitoring the tank pressure sensor(DTP) signal with underpressure	,
Enable Conditions	<ul> <li>Idle state (TPS &lt; 1.4° TPS)</li> <li>Minimum modeled ambient temperature &gt; -10°C(14°F)</li> <li>Coolant temperature &gt; 75°C(167°F)</li> <li>Vehicle speed &lt; 5km/h(3mph)</li> <li>Estimated altitude &lt; 2.4km(8000ft)</li> <li>Differential fuel tank pressure : -11 ~ 5.5hPa</li> <li>Limited canister saturation &gt; -22%</li> <li>Minimum purge time : 250sec.</li> </ul>	Leakage in EVAP. System
Threshold Value	<ul> <li>-12hPa &lt; Pressure fluctuation in fuel tank &lt; 40hPa for 12~17 seconds during under pressure period</li> </ul>	
Diagnostic Time	• 24 sec. in idle	
MIL On Condition	2 Driving Cycles	

#### MONITOR DTC STATUS EFC3F3B3



If any codes relating to Fuel tank pressure sensor, Canister closing valve or PCSV circuits are present, do ALL RE-PAIRS associated with those codes before proceeding with this troubleshooting tree.

1. Start engine to normal operating temperature.

# **₩** NOTE

Evaporative Emissions Systems (EVAP) Leak Tests can be run by the Scan Tool. The tests are automated and provide either a pass-fail result or directions to check for DTCs.

- 2. Install scan tool and clear DTC.
- 3. Perform "EVAP. LEAKAGE TEST" mode referring to enable conditions as below.

# **NOTE**

EVAP. Leakage Test enable conditions.

- Following conditions must be fulfilled to start the test.
  - 1) Engine warm up at Idle Status.
  - 2) No relevant DTC.
  - 3) Fuel level is below 80%.
- 4. Is DTC P0455 set again?



▶ Go to "Fuel Filler Cap & Pipe Inspection" procedure.

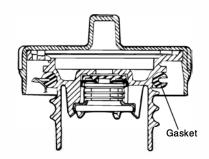
FLA -368 FUEL SYSTEM



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

#### **FUEL FILLER CAP & PIPE INSPECTION**

- 1. Check fuel filler cap for being tightly installed, has o-ring seal installed and is in good condition.
- Verify cap releases pressure / vacuum at specified values.
   Specification : Approx. 2 psi pressure and approximately 1.5 inches of mercury vacuum)
- 3. Are cap, o-ring and release pressures okay?



K04553

### YES

▶ Thoroughly check fuel filler pipe for cracks, damage and o-ring seat for deformation and replace as necessary. Go to "PCSV to Intake manifold Line Inspection" procedure.

# NO

Replace fuel filler cap and go to "Verification of Vehicle Repair" procedure.

### PCSV TO INTAKE MANIFOLD LINE INSPECTION

- 1. Ignition "OFF".
- 2. Disconnect the hose leading from the PCSV to the intake manifold at PCSV.
- Using a vacuum pump, apply specified vacuum(Approx. 15 in, Hg) to the manifold side of the valve and verify PCSV holds vacuum.
- 4. Ignition "ON" & Engine "OFF".
- 5. Install scantool and select "EVAP PURGE VALVE" on the Actuation Test mode.
- 6. Activates "EVAP PURGE VALVE" by pressing "STRT(F1)" key.
- 7. Verify PCSV release vacuum while valve is activating(should hear a faint click from PCSV).
- 8. Repeat this procedure 4 or 5 times to ensure PCSV reliability.
- 9. Is PCSV working properly?

### YES

▶ Go to "Canister Closing Valve(CCV) Line Inspection" procedure

### NO

- ▶ Verify arrow on PCSV is pointing towards intake manifold. If it is not, reverse installation. Reinstall as necessary.
- ▶ If OK, check for cracks or damage in hose connecting PCSV and intake manifold. Repair or replace as necessary.
- ▶ If OK, test with a new PCSV and check for proper operation. If problem is corrected, replace PCSV and go to "Verification of Vehicle Repair" procedure.

#### CANISTER CLOSING VLAVE (CCV) LINE INSPECTION

- 1. Return vehicle to original condition.
- 2. Ignition "OFF".
- 3. Disconnect the hose connecting Canister Closing Valve(CCV) to canister.
- 4. Blow air to the canister side of the valve and verify air escapes to the air filter side.
- 5. Turn ignition on and jumper a wire to GND(back probe) at terminal 2 of the ECM connector(CCV valve should click).
- 6. Blow air into hose and verify air does not escape.
- 7. Repeat this procedure 4 or 5 times to ensure CCV reliability.
- 8. Is CCV working properly?

### YES

▶ Go to "Fuel Tank Pressure Sensor Inspection" procedure

### NO

▶ Check for cracks or damage in hose connecting CCV and canister. Repair or replace as necessary. If OK, replace CCV. If CCV was stuck closed, inspect all lines and canister for liquid fuel. Replace any contaminated components and blow out lines and go to "Verification of Vehicle Repair" procedure.

#### **FUEL TANK PRESSURE SENSOR INSPECTION**

- 1. Start engine and install scan tool.
- 2. Monitor "FUEL TANK PRESSURE" parameter on the current data list with depressing increasing engine speed. Specification: Signal value will vary between -2mmHg to 2 mmHg depending on variation in engine speed.
  - Approx. 0~2 mmHg(2.5V) at lg. On
  - Approx. 0 mmHg at 1400rpm.
  - Approx. -2 mmHg at 4000rpm.
- 3. Is signal value within specification?

### YES

▶ Go to "PCSV to Canister Line Inspection" procedure.

### NO

- Check for cracks or damage in hose connecting canister and fuel pump. Repair or replace as necessary.
- ▶ Check for open or short in FTPS harness. Repair as necessary.

FLA -370 FUEL SYSTEM

If OK, test with a new FTPS and check for proper operation. If problem is corrected, replace FTPS and go to "Verification of Vehicle Repair" procedure.

#### **PCSV TO CANISTER LINE INSPECTION**

- 1. Check for leakage in hose
  - 1) Disconnect the hose leading from the canister to the PCSV at canister.
  - 2) Using a vacuum pump, apply specified vacuum[Approx. 10cmHg(4 inHg)] to the manifold side of the valve and verify PCSV holds vacuum.
  - 3) Monitor vacuum pressure for 1 minute. After 1 minute, pressure should not drop more than 2cmHg(0.8 inHg).
  - 4) Is pressure within specification?

YES

▶ Go to "2. Check for leakage in canister" procedure.

NO

- ▶ Check for cracks or damage in hose connecting PCSV and canister. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.
- 2. Check for leakage in canister.

**NOTE** 

Thoroughly check all fuel vapor hoses and hose clamps between:

- Canister and fuel tank.
- Canister and CCV.
- Canister and PCSV.

If NG, replace hose or clamps as necessary and go to "Verification of Vehicle Repair" procedure. If OK, go to next step as below.

- 1) Disconnect hose clamps and remove canister assembly.
- 2) Block the hose of between:
  - Canister and fuel filler neck.
  - Canister and CCV.
  - Canister and PCSV.
- 3) Apply maximum of 10cmHg(4 inHg) pressure through fuel tank port from canister.
- 4) With system sealed and pressurized, check for leaks.
- 5) Were any leak(s) found?

YES

▶ Repair or replace leaking system component(s) and go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Fuel Tank Line Inspection" procedure.

#### **FUEL TANK LINE INSPECTION**

1. Relieve the fuel system pressure and remove the fuel tank.



Before removing the fuel tank, make sure the fuel hoses are not leaking.

- 2. Block all of the following outlets:
  - 1) Fuel lines.
  - 2) Fuel filler neck.
- Apply maximum of 10cmHg(4 inHg) pressure to the EVAP. hose at the fuel tank. Then, pinch the EVAP. hose to retain the pressure.
- 4. Check the suspect area for leaks with a soap solution.
- 5. Were any leak(s) found?

### YES

▶ Repair or replace leaking system component(s) and go to "Verification of Vehicle Repair" procedure.

### NO

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

#### VERIFICATION OF VEHICLE REPAIR EB75F450

- 1. Return vehicle to original condition.
- 2. Start engine to normal operating temperature.

# **NOTE**

Evaporative Emissions Systems (EVAP) Leak Tests can be run by the Scan Tool. The tests are automated and provide either a pass-fail result or directions to check for DTCs.

- Install scan tool and clear DTC.
- 4. Perform "EVAP. LEAKAGE TEST" mode referring to enable conditions as below.

# **₩** NOTE

EVAP. Leakage Test enable conditions.

- Following conditions must be fulfilled to start the test.
  - 1) Engine warm up at Idle Status.
  - 2) No relevant DTC.
  - 3) Fuel level is below 80%.
- 5. Monitoring for (pending) DTC.Is the same DTC set?

# YES

▶ Go to the applicable troubleshooting procedure.

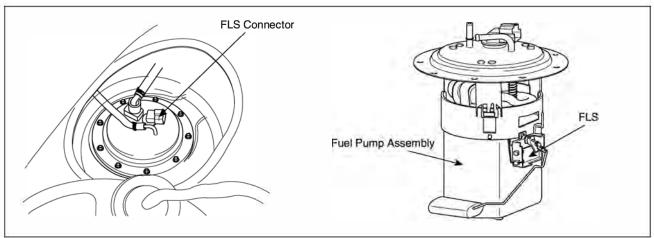
# NO

▶ System performing to specification at this time.

FLA -372 FUEL SYSTEM

# DTC P0461 FUEL LEVEL SENSOR "A" CIRCUIT RANGE/PERFORMANCE

#### COMPONENT LOCATION EBBE40E9



FGOF261A

#### GENERAL DESCRIPTION E2A1C38

The fuel level sensor measures the fuel level in fuel tank and its signal is used to determine if the fuel level is too high or too low to be able to accurately detect EVAP system failures.

### DTC DESCRIPTION EAAACC32

The ECM sets DTC P0461 if ECM detects that fuel level change from maximum to minimum is less than the threshold value.

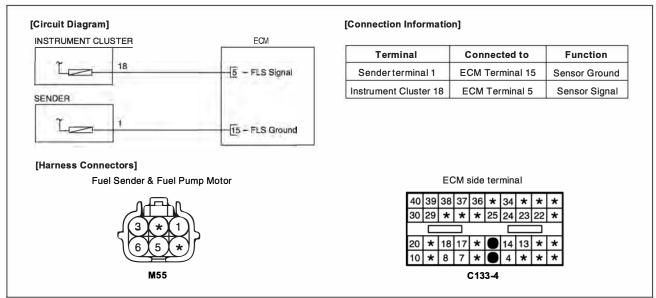
### DTC DETECTING CONDITION EBAC75BC

Item	Detecting Condition	Possible Cause
DTC Strategy	Check signal stuck	
Enable Conditions	Minimum mileage:322km(200 mile)	
Threshold Value	Difference between filtered max./min.value and initial value < 5%	Contact resistance in connectors     Faulty FLS
Diagnostic Time	Immediate	
MIL On Condition	• -	

#### SPECIFICATION E9EDFB45

Fuel Level	Resistance(Ω )
E(Empty)	198.0 ~ 202.0
1/2	65.0 ~ 67.0
F(Full)	7.0 ~ 9.0

#### SCHEMATIC DIAGRAM EFBBE33B



K04611

#### MONITOR DTC STATUS E

NOTE

If any codes relating to Fuel tank pressure sensor, Canister closing valve or PCSV circuits are present, do ALL RE-PAIRS associated with those codes before proceeding with this troubleshooting tree.

1. Start engine to normal operating temperature.

**NOTE** 

Evaporative Emissions Systems (EVAP) Leak Tests can be run by the Scan Tool. The tests are automated and provide either a pass-fail result or directions to check for DTCs.

- Install scan tool and clear DTC.
- 3. Perform "EVAP. LEAKAGE TEST" mode referring to enable conditions as below.
  - **NOTE**

EVAP. Leakage Test enable conditions.

- Following conditions must be fulfilled to start the test.
  - 1) Engine warm up at Idle Status.
  - 2) No relevant DTC.
  - 3) Fuel level is below 80%.
- 4. Is DTC P0461 set again?



▶ Go to next step as below.

FLA -374 FUEL SYSTEM

### NO

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

#### TERMINAL AND CONNECTOR INSPECTION E32A9ADO

- 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.
- Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?



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



▶ Go to next step as below

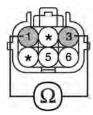
#### COMPONENT INSPECTION EA76CE4B

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

### Specification:

Fuel Level	Resistance(Ω)	
E(Empty)	198.0 ~ 202.0	
1/2	65.0 ~ 67.0	
F(Full)	7.0 ~ 9.0	

<M55>



- 1. Ground
- 3. Signal

K04613

4. Is resistance within specification?

### YES

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

### NO

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

#### VERIFICATION OF VEHICLE REPAIR EAF5E9CD

- 1. Return vehicle to original condition.
- 2. Start engine to normal operating temperature.

# **NOTE**

Evaporative Emissions Systems (EVAP) Leak Tests can be run by the Scan Tool. The tests are automated and provide either a pass-fail result or directions to check for DTCs.

- 3. Install scan tool and clear DTC.
- 4. Perform "EVAP. LEAKAGE TEST" mode referring to enable conditions as below.

### **NOTE**

EVAP. Leakage Test enable conditions.

- Following conditions must be fulfilled to start the test.
  - 1) Engine warm up at Idle Status.
  - 2) No relevant DTC.
  - 3) Fuel level is below 80%.
- 5. Monitoring for (pending) DTC.Is the same DTC set?

### YES

▶ Go to the applicable troubleshooting procedure.

#### NO

▶ System performing to specification at this time.

FLA -376 FUEL SYSTEM

# DTC P0462 FUEL LEVEL SENSOR "A" CIRCUIT LOW INPUT

#### COMPONENT LOCATION E212FA9B

Refer to DTC P0461.

#### GENERAL DESCRIPTION E7CB2805

Refer to DTC P0461.

#### DTC DESCRIPTION EB9A5E0D

The ECM sets DTC P0462 if ECM detects that fuel level change from maximum to minimum is less than the threshold value

#### DTC DETECTING CONDITION E7FE7E7A

Item	Detecting Condition	Possible Cause
DTC Strategy	Voltage range check	
Enable Conditions	Battery voltage > 11V     Minimum time > 200 sec.	Short to ground in signal harness     Open in power supply harness
Threshold Value	Short to ground or Line Break(Voltage < 0.02)	Contact resistance in connectors
Diagnostic Time	• 20 sec.	• Faulty FLS
MIL On Condition	• -	

#### SPECIFICATION EDCA791B

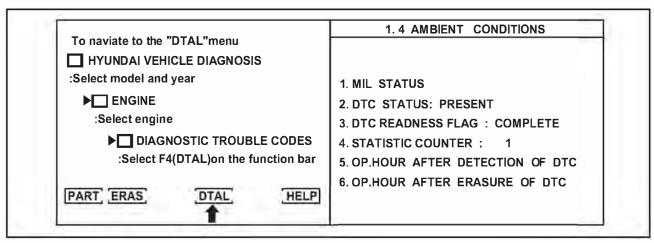
Refer to DTC P0461.

### SCHEMATIC DIAGRAM E8AEDED4

Refer to DTC P0461.

#### MONITOR DTC STATUS E3D3317A

- 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.



EDTC\_GK

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 next step as below.

### TERMINAL AND CONNECTOR INSPECTION EABF1F44

Refer to DTC P0461.

#### SIGNAL CIRCUIT INSPECTION E4C1D04A

- 1. Check for open in signal circuit.
  - 1) Ignition "OFF".
  - 2) Disconnect FLS and ECM connector.
  - 3) Measure resistance between terminals 3 of the FLS harness connector and 5 of the ECM harness connector

Specification : Approx.  $0\Omega$ 

4) Is resistance within the specification?



Go to next step as below.

FLA -378 FUEL SYSTEM

NO

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

- 2. Check for short to ground in signal circuit
  - 1) Measure resistance between terminal 3 of the FLS harness connector and chassis ground

Specification: Infinite

2) Is resistance within the specification?



▶ Go to next step as below.



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

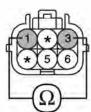
#### COMPONENT INSPECTION EE29BCEA

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

#### Specification :

Fuel Level	Resistance(Ω)
E(Empty)	198.0 ~ 202.0
1/2	65.0 ~ 67.0
F(Full)	7.0 ~ 9.0

<M55>



- 1. Ground
- 3. Signal

K04613

4. Is resistance within specification?



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

### VERIFICATION OF VEHICLE REPAIR EDDB9879

Refer to DTC P0461.

FLA -380 FUEL SYSTEM

# DTC P0463 FUEL LEVEL SENSOR "A" CIRCUIT HIGH INPUT

#### COMPONENT LOCATION E0F5F23A

Refer to DTC P0461.

#### GENERAL DESCRIPTION EEA294A7

Refer to DTC P0461.

#### DTC DESCRIPTION EAE8C2AA

The ECM sets DTC P0463 if ECM detects that fuel level change from maximum to minimum is less than the threshold value.

#### DTC DETECTING CONDITION E2DC55B1

Item	Detecting Condition	Possible Cause
DTC Strategy	Voltage range check	
Enable Conditions	Battery voltage > 11V     Minimum time > 200 sec.	Short to battery in signal harness     Open in power supply/ground
Threshold Value	Signal voltage > 4.965V	harness  Contact resistance in connectors
Diagnostic Time	• 20 sec.	Faulty FLS
MIL On Condition	• -	

# SPECIFICATION E37F85AF

Refer to DTC P0461.

### SCHEMATIC DIAGRAM E8B64BFC

Refer to DTC P0461.

#### MONITOR DTC STATUS EA2E6FD3

Refer to DTC P0462.

#### TERMINAL AND CONNECTOR INSPECTION E3FD5DED

Refer to DTC P0462.

#### GROUND CIRCUIT INSPECTION E659CDF2

- 1. Ignition "OFF".
- Disconnect FLS and ECM connector.
- 3. Measure resistance between terminal 1 of the FLS harness connector and 15 of the ECM harness connector

Specification : Approx.  $0\Omega$ 

4. Is resistance within the specification?



▶ Go to "Signal Circuit Inspection" procedure.



▶ Check for a open/short circuit. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

#### SIGNAL CIRCUIT INSPECTION EDE6E19F

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

Specification: Approx. 0V

3. Is resistance within the specification?



▶ Go to next step as below.



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

#### COMPONENT INSPECTION EBCBA609

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

#### Specification:

Fuel Level	Resistance(Ω)	
E(Empty)	198.0 ~ 202.0	
1/2	65.0 ~ 67.0	
F(Full)	7.0 ~ 9.0	

FLA -382 FUEL SYSTEM

<M55>



- 1. Ground
- 3. Signal

K04613

4. Is resistance within specification?



▶ 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.



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

### VERIFICATION OF VEHICLE REPAIR E7D0926B

Refer to DTC P0461.

# DTC P0464 FUEL LEVEL SENSOR "A" CIRCUIT INTERMITTENT

#### COMPONENT LOCATION EEF1269C

Refer to DTC P 0461.

#### GENERAL DESCRIPTION E62FA607

Refer to DTC P0461.

#### DTC DESCRIPTION EFAAD022

The ECM sets DTC P0463 if ECM detects that fuel level signal is higher than the threshold value.

### DTC DETECTING CONDITION EB44056D

Item	Detecting Condition	Possible Cause
DTC Strategy	Sensor signal intermittent	
Enable Conditions	<ul> <li>Engine state: part load (TPS ≥ 1.4° TPS)</li> <li>Minimum vehicle speed &gt; 34km/h(21mph)</li> <li>Wheel speed gradient &lt; 0.18%</li> </ul>	Contact resistance in connectors
Threshold Value	Signal fluctuation > 50%	• Faulty FLS
Diagnostic Time	• 10 sec.	
MIL On Condition	• -	1

### SPECIFICATION EBEF4ADO

Refer to DTC P0461.

#### SCHEMATIC DIAGRAM EEFABAOA

Refer to DTC P0461.

### MONITOR DTC STATUS EA41CC7F

Refer to DTC P0462.

#### TERMINAL AND CONNECTOR INSPECTION E10BF2DC

Refer to DTC P0461.

#### COMPONENT INSPECTION ECEBIAEC

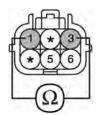
- 1. Ignition "OFF".
- 2. Disconnect FLS harness connector.
- 3. Measure resistance between terminals 1 and 3 of the FLS connector(Component side).

Specification:

FLA -384 FUEL SYSTEM

Fuel Level	Resistance(Ω )	
E(Empty)	198.0 ~ 202.0	
1/2	65.0 ~ 67.0	
F(Full)	7.0 ~ 9.0	

<M55>



- 1. Ground
- 3. Signal

K04613

4. Is resistance within specification?



▶ 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.



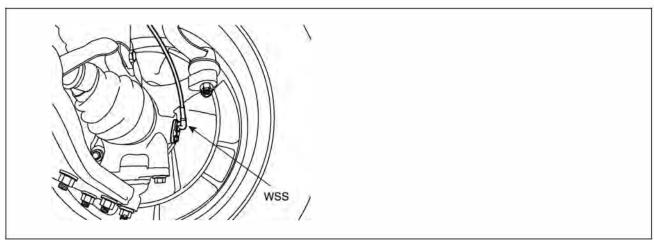
▶ Check FLS for contamination, deterioration, or damage. Substitute with a known-good FLS and check for proper operation. If the problem is corrected, replace FLS and then go to "Verification of Vehicle Repair" procedure.

### VERIFICATION OF VEHICLE REPAIR E1BA97EC

Refer to DTC P0461.

### DTC P0501 VEHICLE SPEED SENSOR A RANGE/PERFORMANCE

#### COMPONENT LOCATION EFC2BABC



EGOF440S

#### GENERAL DESCRIPTION EAFE9BBB

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

#### DTC DESCRIPTION EFD352F8

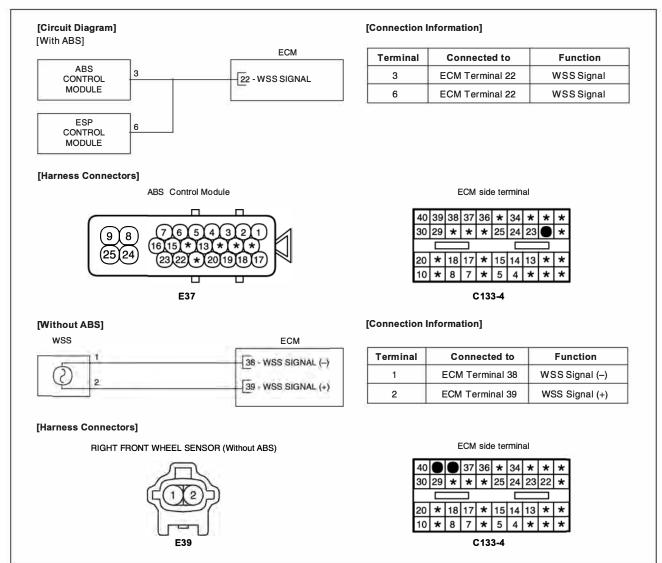
The ECM evaluates engine speed and mass air flow if there is no vehicle speed signal. This evaluation of both values will detect open circuit or short circuit errors on the wheel speed sensor. The ECM sets DTC P0501 if there is no vehicle speed signal from wheel speed sensor while both engine speed and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

#### DTC DETECTING CONDITION E1271C99

Item	Detecting Condition	Possible Cause
DTC Strategy	Check vehicle speed signal	
Enable Conditions	<ul> <li>Engine speed &gt; 2016 rpm</li> <li>Mass air flow &gt; 654mg/rev</li> <li>Coolant temperature &gt; 60 ℃(140°F)</li> <li>No fuel shut-off</li> </ul>	Open or short in harness     Contact resistance in connectors
Threshold Value	Vehicle speed=0 with high engine speed and high load	Faulty wheel speed sensor
Diagnostic Time	• 60 sec.(AT)/40 sec.(MT)	
MIL On Condition	2 Driving Cycles	

FLA -386 FUEL SYSTEM

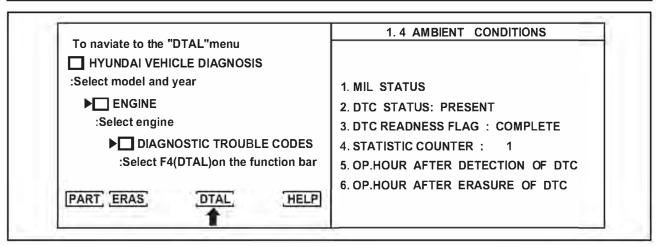
#### SCHEMATIC DIAGRAM EEF13A44



K05011

### MONITOR DTC STATUS E589E2F1

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



EDTC\_GK

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

# **NOTE**

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

### YES

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

### NO

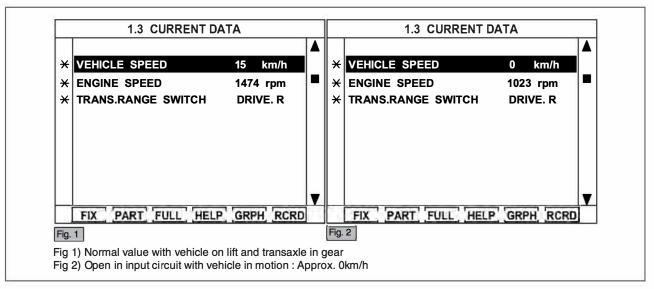
- ▶ [With ABS] Go to "Monitor Scan tool Data" procedure.
- ▶ [Without ABS system] Go to "Signal Circuit Inspection[Without ABS]" procedure.

#### MONITOR SCANTOOL DATA EF72A271

- 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. Connect 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)

FLA -388 FUEL SYSTEM



K05012

4. Is value within the specification?

### YES

Wheel speed sensor is OK. Go to "Signal Circuit Inspection" procedure.

### NO

▶ Check the following conditions:

1)

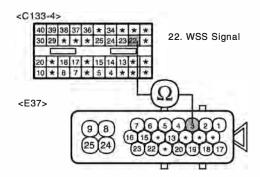
Open or short circuit between wheel speed sensor(FR) and ABS control module
If problems are found, repair as necessary and go to "Verification of Vehicle Repair" procedure
If OK, check wheel speed sensor(FR). Repair as necessary and go to "Verification of Vehicle Repair" procedure

#### SIGNAL CIRCUIT INSPECTION EE0D8256

#### [With ABS]

- 1. Check for open in circuit
  - 1) Ignition "OFF".
  - 2) Disconnect ECM and ABS or ESP Control Module connectors.
  - Measure resistance between terminals 22 of the ECM harness connector and 3 of the ABS Control Module harness connector(W/ABS)

Specification : Approx.  $0\Omega$ 



K05013

4) Is resistance within the specification?



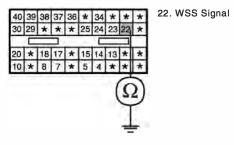
▶ Go to next step as below.



- ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.
- 2. Check for short to ground in circuit.
  - 1) Measure resistance between terminal 22 of the ECM harness connector and chassis ground.

Specification: Infinite

<C133-4>



K05014

2) Is resistance within the specification?



▶ 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.



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

### [Without ABS system]

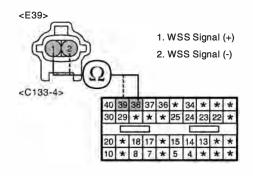
3. Check for open in circuit.

FLA -390 FUEL SYSTEM

- 1) Ignition "OFF".
- 2) Disconnect ECM and wheel speed sensor(front right) harness connector.
- 3) Measure resistance between wheel speed sensor harness connector and ECM harness connector.

Specification : Approx.  $0\Omega$ 

- Terminal 1(sensor) & Terminal 38(ECM)
- Terminal 2(sensor) & Terminal 39(ECM)



K05015

4) Is resistance within the specification?



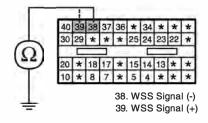
▶ Go to next step as below.

NO

- ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.
- 4. Check for short to ground in circuit.
  - 1) Measure resistance between terminal 38 of the ECM harness connector and chassis ground.
  - 2) Measure resistance between terminal 39 of the ECM harness connector and chassis ground.

Specification: Infinite

<C133-4>



K05016

3) Is resistance within the specification?

### YES

- ► Check wheel speed sensor(FR) as follow:
- Gap between ABS sensor and trigger wheel (Air gap: 0.3~0.9 mm(0.011 ~ 0.035 in))
- Trigger wheel condition.
- Sensor resistance : Approx. 1,275~1,495 Ω at 20 ℃ (68°F)
- ▶ Replace wheel speed sensor as necessary and go to "Verification of Vehicle Repair" procedure.

### NO

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

#### VERIFICATION OF VEHICLE REPAIR EFA8382E

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.
- Read "DTC Status" parameter.
- 4. Is parameter displayed "History(Not Present) fault"?

### YES

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

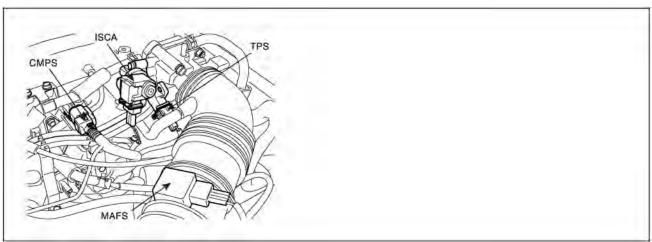
### NO

▶ Go to the applicable troubleshooting procedure.

FLA -392 FUEL SYSTEM

# DTC P0506 IDLE AIR CONTROL SYSTEM-RPM LOWER THAN EXPECTED

#### COMPONENT LOCATION E286D5ED



EGOF254A

#### GENERAL DESCRIPTION E86A6B4

When the TP sensor's signal indicates closed throttle position and the engine is idling, the ECM adjusts the Idle Speed Control Actuator(ISCA) 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.

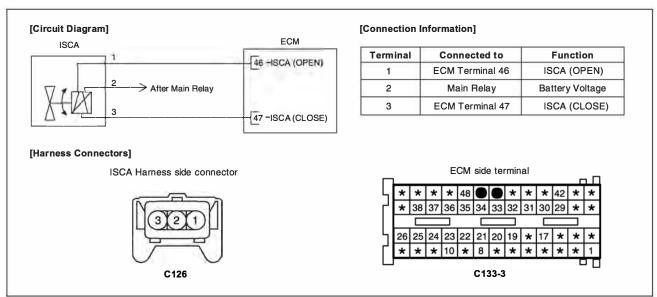
#### DTC DESCRIPTION ED6A9F55

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

### DTC DETECTING CONDITION EACCBEES

Item	Detecting Condition	Possible Cause
DTC Strategy	Compare engine speed and nominal idle speed in idle state	Restriction in intake or exhaust system     Carbonustment of the accelerator cable     Contact resistance in connectors     Faulty ISCA valve
Enable Conditions	<ul> <li>Vehicle speed = 0 mph</li> <li>Coolant temperature &gt; 75°C(167°F)</li> <li>Engine load &lt; 840 mg/rev.</li> <li>Throttle angle: closed</li> <li>Minimum time after start: 15sec.</li> <li>Canister purge control &lt; 50%</li> </ul>	
Threshold Value	Target idle speed - Engine speed > 100rpm (Engine speed too low)	
Diagnostic Time	• 35 sec.	
Fail Safe	Evaporative System monitoring is inhibited	
MIL On Condition	• -	

#### SCHEMATIC DIAGRAM



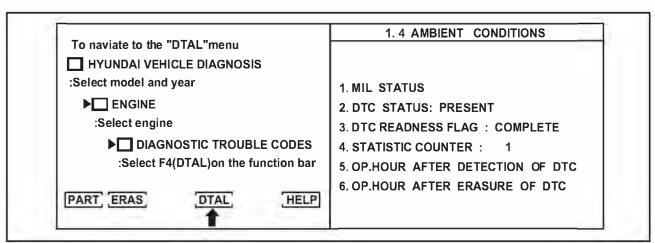
K05061

#### MONITOR DTC STATUS EC636AA8



If any TPS, MAFS or ISCA Valve circuit codes are present, do ALL REPAIRS associated with them before proceeding with this troubleshooting tree.

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



EDTC\_GK

- 5. Is parameter displayed "History(Not Present) fault"?
  - History (Not Present) fault : DTC occurred but has been cleared.

FLA -394 FUEL SYSTEM

Present fault : DTC is occurring at present time.



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



▶ Go to next step as below.

### CHECK FOR RESTRICTED INTAKE OR EXHAUST SYSTEM

- 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?



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



▶ Go to next step as below.

#### TERMINAL AND CONNECTOR INSPECTION E6EDFBF5

- 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.
- Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?



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



▶ Go to "Componment Inspection" procedure.

#### COMPONENT INSPECTION EDB4FACE

- Ignition "OFF".
- Remove ISCA from Throttle body and Check for throttle bore, throttle plate and the ISCA passages for chocking and for any foreign objects. Repair or clean as necessary.
- 3. Ignition "ON" & Engine "OFF".
- 4. Connect scan tool and select "IDLE SPEED ACTUATOR" parameter on the "ACTUATION TEST" mode.

- 5. Activates ISCA by pressing "STAT" key.
- 6. Check the ISCA for clicking sound and visually verifying valve closes and opens.



Repeat numerous times to ensure valve reliability.

7. Is ISCA OK?



▶ 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



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

#### VERIFICATION OF VEHICLE REPAIR EFO1C1CE

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.

FLA -396 FUEL SYSTEM

# DTC P0507 IDLE AIR CONTROL SYSTEM-RPM HIGHER THAN EXPECTED

#### COMPONENT LOCATION EABEB994

Refer to DTC P0506.

#### GENERAL DESCRIPTION ESCEFD2C

Refer to DTC P0506.

#### DTC DESCRIPTION E8FD242D

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

#### DTC DETECTING CONDITION E3D86000

Item	Detecting Condition	Possible Cause
DTC Strategy	Compare engine speed and nominal idle speed in idle state	A stuck or binding throttle plate     Misadjustment of the accelerator cable     Contact resistance in connectors     Faulty ISCA valve
Enable Conditions	<ul> <li>Vehicle speed = 0 mph</li> <li>Coolant temperature &gt; 75°C(167°F)</li> <li>Engine load &lt; 840 mg/rev.</li> <li>Throttle angle : closed</li> <li>Minimum time after start : 15sec.</li> <li>Canister purge control &lt; 50%</li> </ul>	
Threshold Value	Engine speed - Target idle speed > 200rpm (Engine speed too high)	
Diagnostic Time	• 35 sec.	
MIL On Condition	• -	

### SCHEMATIC DIAGRAM ED5D34AC

Refer to DTC P0506.

### MONITOR DTC STATUS E85E6B10

Refer to DTC P0506.

#### 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?



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

NO

▶ Go to next step as below.

#### AIR LEAKAGE INSPECTION EEBB4AB9

 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?



▶ Go to next step as below.



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

# TERMINAL AND CONNECTOR INSPECTION E2E7C473

Refer to DTC P0506.

# COMPONENT INSPECTION ED4FE3B2

- 1. Ignition "OFF".
- 2. Remove ISCA from Throttle body and Check for throttle bore, throttle plate and the ISCA passages for chocking and for any foreign objects. Repair or clean as necessary.
- 3. Ignition "ON" & Engine "OFF".
- 4. Connect scan tool and select "IDLE SPEED ACTUATOR" parameter on the "ACTUATION TEST" mode.
- 5. Activates ISCA by pressing "STAT" key.
- 6. Check the ISCA for clicking sound and visually verifying valve closes and opens.



Repeat numerous times to ensure valve reliability.

FLA -398 FUEL SYSTEM

7. Is ISCA OK?



▶ 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.



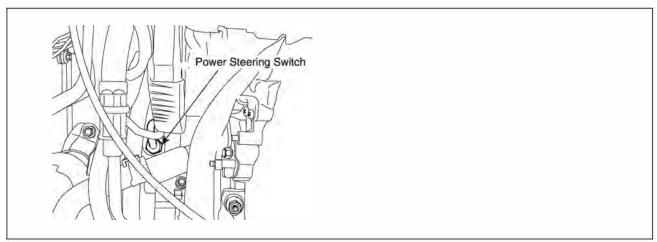
▶ Check ISCA valve for contamination, deterioration, or damage. Substitute with a known-good ISCA valve and check for proper operation. If the problem is corrected, replace ISCA valve and then go to "Verification of Vehicle Repair" procedure.

# VERIFICATION OF VEHICLE REPAIR E33DEFFB

Refer to DTC P0506.

# DTC P0551 POWER STEERING PRESSURE SENSOR/SWITCH CIRCUIT RANGE/PERFORMANCE

# COMPONENT LOCATION E03FD6DE



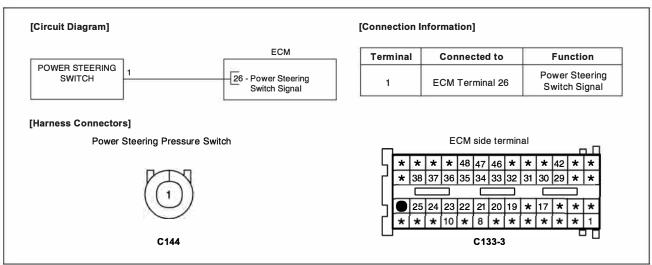
EGOF440T

# DTC DETECTING CONDITION EDC886BC

Item	Detecting Condition	Possible Cause
DTC Strategy	Power steering switch check	
Enable Conditions	No vehicle speed error     Coolant temperature > 75℃(167°F)     Power steering switch is ON	Open or short circuit
Threshold Value	Power steering is ON with vehicle speed > 97km/h(60mph) & time > 25.5 sec.	Contact resistance in connectors     Faulty power steering switch
Diagnostic Time	• 0.1 sec.	
MIL On Condition	• -	

FLA -400 FUEL SYSTEM

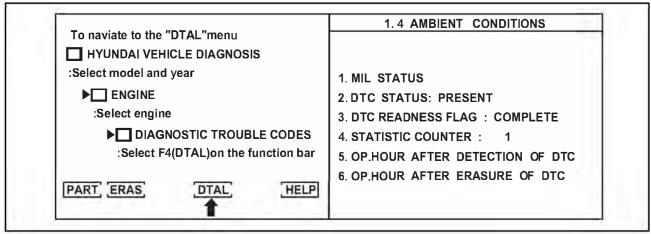
#### SCHEMATIC DIAGRAM EB4AECAF



K05511

#### MONITOR DTC STATUS EDCFEF72

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



EDTC GK

- 5. Is parameter displayed "History(Not Present) fault"?
  - History (Not Present) fault : DTC occurred but has been cleared.
  - Present fault : DTC is occurring at present time.



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

NO

▶ Go to next step as below.

#### TERMINAL AND CONNECTOR INSPECTION E7AA0A99

- 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.
- 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.



▶ Go to "Signal Circuit Inspection" procedure.

#### SIGNAL CIRCUIT INSPECTION EDDE0798

- 1. Ignition "OFF".
- 2. Disconnect P/S switch connector.
- 3. Start the engine, and measure voltage between P/S switch harness connector and chassis ground referring to specification.

#### Specification

Steering Wheel	Voltage
Straight ahead	Approx. B+
Turned	Approx. 0V

4. Is voltage within the specification?

YES

▶ Go to "Component Inspection" procedure.

NO

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

# COMPONENT INSPECTION EF55C69D

- 1. Ignition "OFF".
- 2. Disconnect P/S switch connector.
- 3. Check continuity of the switch referring to specification.

FLA -402 FUEL SYSTEM

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Steering Wheel	Voltage
Straight ahead	No
Turned	Yes

4. Is resistance within the specification?



▶ 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.



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

#### VERIFICATION OF VEHICLE REPAIR EADD4AD9

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

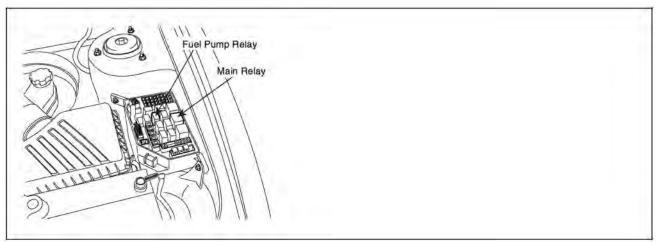
▶ System performing to specification at this time. Clear the DTC.



▶ Go to the applicable troubleshooting procedure.

# DTC P0560 SYSTEM VOLTAGE

#### COMPONENT LOCATION E89A11C2



EGOF256A

# GENERAL DESCRIPTION E30E35A5

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

#### DTC DESCRIPTION E1608746

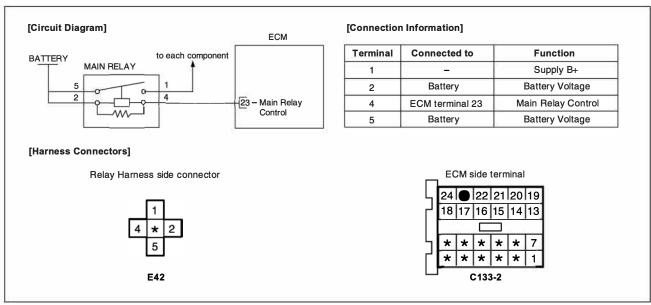
The ECM measures the voltage from ignition key and from main relay respectively and compares two voltages. This comparison will watch if the Main Relay has switched and remains on after ignition Key-On and if it has switched off after the ignition Key-Off. The ECM sets DTC P0560 if the voltage after Main Relay is lower than a predetermined threshold after ignition key-on or higher than a predetermined threshold after ignition key-off.

# DTC DETECTING CONDITION ED32A6C2

Item	Detecting Condition	Possible Cause
DTC Strategy	Comparison of battery voltage and voltage after Main relay	
Enable Conditions	Battery voltage > 10V     Ignition Key ON     Ignition Key OFF	Open or short circuit
Threshold Value	Voltage after main relay when ON < 6V or voltage after main relay when OFF > 6V	Contact resistance in connectors
Diagnostic Time	• 0.1 sec.	
MIL On Condition	• -	

FLA -404 FUEL SYSTEM

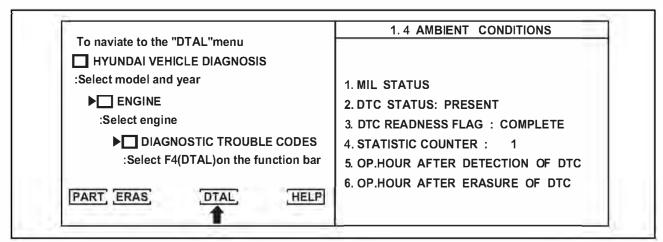
#### SCHEMATIC DIAGRAM E130DD6A



K05601

#### MONITOR DTC STATUS EA388117

- 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.



EDTC\_GK

- 5. Is parameter displayed "History(Not Present) fault"?
  - History (Not Present) fault: DTC occurred but has been cleared.
  - Present fault : DTC is occurring at present time.

YES

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



▶ Go to next step as below.

#### COMPONENT INSPECTION ECCC44C0

- 1. Ignition "OFF".
- 2. Remove the main relay.
- 3. Apply 12V and a ground to 2 and 4 terminals of the main relay
- 4. Check if the main relay works well when it is energized. (If the main relay works normally, a clicking sound can be heard.)
- 5. Does the main relay operate normally?



▶ Go to next step as below.



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

#### TERMINAL AND CONNECTOR INSPECTION EBEO8F7E

- 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.
- 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.



▶ Go to "Power Supply Circuit Inspection" procedure.

#### POWER SUPPLY CIRCUIT INSPECTION EEEAF2DE

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

FLA -406 FUEL SYSTEM

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

Specification: Approx. B+

5. Is voltage within the specification?



▶ Go to "Control Circuit Inspection".



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

# CONTROL CIRCUIT INSPECTION EE10FD7C

- 1. Check for short to ground in control circuit.
  - 1) Ignition "OFF".
  - 2) Disconnect Relay harness connector.
  - 3) Measure resistance between terminal 4 of the relay harness connector and chassis ground

Specification: Infinite

4) Is resistance within the specification?



▶ 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) Ignition "OFF".
  - 2) Disconnect relay and ECM connectors.
  - 3) Ignition "ON" and Engine "OFF".
  - 4) Measure voltage between terminal 4 of the relay harness connector and chassis ground

Specification: Approx 0V

5) Is voltage within the specification?



▶ Go to next step as below.

NO

- ▶ Repair as necessary and go to "Verification of Vehicle Repair" procedure.
- 3. Check for open in control harness.
  - 1) Ignition "OFF".
  - 2) Disconnect relay and ECM connectors.
  - 3) Measure resistance between terminals 4 of the relay harness connector and 23 of the ECM harness connector

Specification: Approx 0Ω

4) Is resistance within the specification?



▶ 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 E1F78EFA

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.
- 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.

FLA -408 FUEL SYSTEM

# DTC P0562 SYSTEM VOLTAGE LOW DTC P0563 SYSTEM VOLTAGE HIGH

# COMPONENT LOCATION E01B8A0E

Refer to DTC P0560.

#### GENERAL DESCRIPTION E24AC6EC

Refer to DTC P0560.

#### DTC DESCRIPTION E114A5D3

[P0562]ECM sets DTC P0562 if the ECM detects system voltage lower than the possible range of battery voltage. [P0563]ECM sets DTC P0563 if the ECM detects system voltage lower than the possible range of battery voltage.

# DTC DETECTING CONDITION EDE48EFE

Item	Detecting Condition	Possible Cause
DTC Strategy	Check system voltage	
Enable Conditions	Vehicle speed > 19km/h(12mph)	
Threshold Value	Voltage after main relay when ON < 9.96V	Contact resistance in connectors     Faulty charging system
Diagnostic Time	• 240 sec.	
MIL On Condition	• -	

#### SCHEMATIC DIAGRAM E8FAEC4E

Refer to DTC P0560.

# MONITOR DTC STATUS E4517D06

Refer to DTC P0560.

#### TERMINAL AND CONNECTOR INSPECTION EE6895C5

Refer to DTC P0560.

#### CHARGING SYSTEM INSPECTION E3668C32

- 1. Check battery condition and Generator output
- 2. Are battery conditions and Generator output both okay?

# 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.

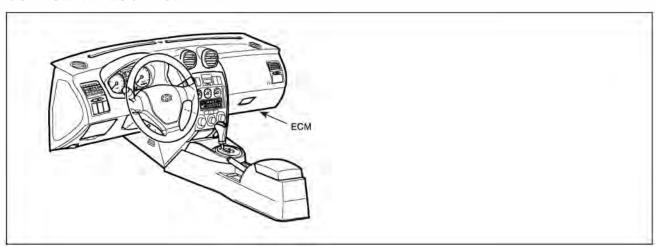
# VERIFICATION OF VEHICLE REPAIR E03EF861

Refer to DTC P0560.

FLA -410 FUEL SYSTEM

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

# COMPONENT LOCATION EF4293CF



EGOF440V

# GENERAL DESCRIPTION E569BD8E

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 EB6A18ED

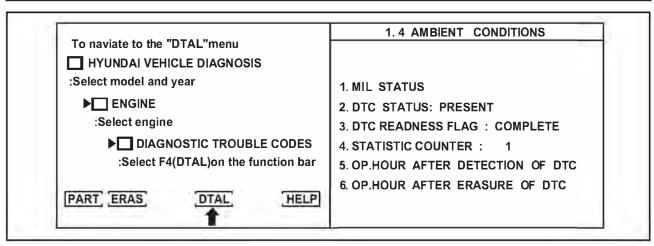
The ECM monitors RAM areas and communication connections between microcontroller and output drivers and sets DTC P0605 if failure is detected.

# DTC DETECTING CONDITION E218AAED

Item	Detecting Condition	Possible Cause
DTC Strategy	<ul> <li>Internal Control Module Read / Read Only Memory(ROM) Error</li> </ul>	
Enable Conditions	Ignition Key ON	Contact resistance in connectors
Threshold Value	Internal check	Faulty ECM
Diagnostic Time	• 0.1 second	
MIL On Condition	2nd Driving Cycles	

#### MONITOR DTC STATUS E04B6828

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



EDTC\_GK

- 5. Is parameter displayed "History(Not Present) fault"?
  - History (Not Present) fault : DTC occurred but has been cleared.
  - Present fault : DTC is occurring at present time.

# YES

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

# NO

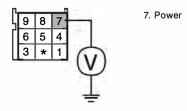
▶ Go to next step as below.

#### **BACK VOLTAGE INSPECTION**

- 1. Ignition "OFF".
- 2. Disconnect ECM connector.
- 3. Turn ignition "ON" and measure voltage between terminal 7 of the ECM harness connector and chassis ground.

Specification: Remain stable at battery voltage

<C133-1>



K06053

FLA -412 FUEL SYSTEM

4. Are circuits remaining stable at battery voltage?



▶ Test with a new ECM and check for proper operation. If problem is corrected, replace ECM and go to "Verification of Vehicle Repair" procedure.



▶ If voltage fluctuates, check circuit Thoroughly for loose, bent or corroded terminals, Repair as necessary and go to "Verification of Vehicle Repair" procedure.

# VERIFICATION OF VEHICLE REPAIR EBB4B891

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"?



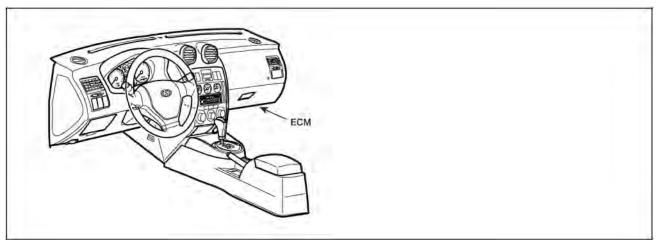
▶ System performing to specification at this time. Clear the DTC.



▶ Go to the applicable troubleshooting procedure.

# DTC P0630 VIN NOT PROGRAMMED OR INCOMPACTIBLE-ECM/PCM

#### COMPONENT LOCATION EDA31A1B



EGOF440V

# GENERAL DESCRIPTION E5C7B52B

Regulations require that all 2005 and subsequent model year vehicles shall have the Vehicle Identification Number(VIN) available in a standardized format through the standardized data link connector in accordance with SAE J1979 specifications. Using a scan tool, PERFORM "VIN WRITING" procedure after replacing or flashing an ECM

#### DTC DESCRIPTION E24CF159

The ECM monitors ROM areas and sets DTC P0630 if there is no Vehicle Identification Number(VIN) information.

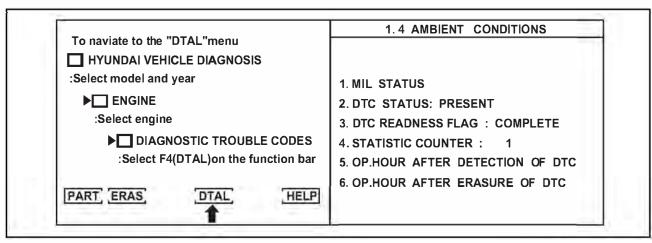
# DTC DETECTING CONDITION E79660EB

Item	Detecting Condition	Possible Cause
DTC Strategy	Ignition Key ON	
Enable Conditions	Ignition ON	
Threshold Value	Internal check	ECM is Virgin(not programmed)     status
Diagnostic Time	Immediate	Cialab
MIL On Condition	Immediate	

# MONITOR DTC STATUS E4B9FC9E

- 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.

FLA -414 FUEL SYSTEM



EDTC\_GK

- 5. Is parameter displayed "History(Not Present) fault"?
  - History (Not Present) fault : DTC occurred but has been cleared.
  - Present fault : DTC is occurring at present time.

# YES

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

# NO

▶ Go to next step as below.

#### SYSTEM INSPECTION EEF97321

1. Was the ECM just replaced or reflashed?

# YES

▶ Using a scan tool, perform "VIN WRITING" procedure. Refer to the latest reference manual for scan tool and go to "Verification of Vehicle Repair" procedure.

# NO

▶ Using a scan tool, read VIN information.

If there is no proper VIN information, perform "VIN WRITING" procedure.

If VIN information exists, substitute with a known-good ECM and check for proper operation. If the problem.

And go to "Verification of Vehicle Repair" procedure.

#### VERIFICATION OF VEHICLE REPAIR E9884316

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.
- 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"?



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

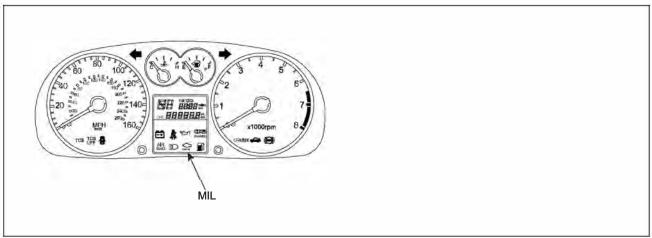


▶ Go to the applicable troubleshooting procedure.

FLA -416 FUEL SYSTEM

# DTC P0650 MALFUNCTION INDICATOR LAMP(MIL) CONTROL CIRCUIT

# COMPONENT LOCATION E31E23F1



EGOF440U

# GENERAL DESCRIPTION ED53AB6B

The Malfunction Indicator Lamp (MIL), which is located in the instrument cluster, comes on to notify the driver that there may be a problem with the vehicle and that service is needed. Immediately after the ignition switch turns on, the malfunction indicate that the MIL operates normally and goes off after starting.

# DTC DESCRIPTION E4AD2DC5

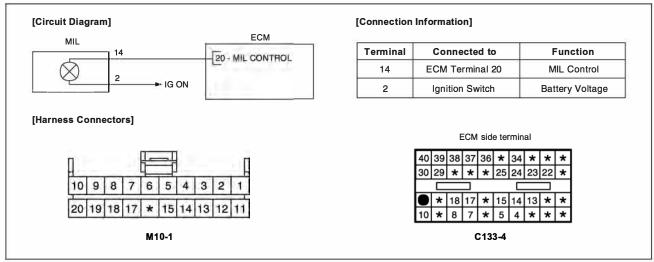
ECM sets DTC P0650 if the ECM detects that the MIL control line is open or short circuit to ground or battery line.

# DTC DETECTING CONDITION E5558C34

Item	Detecting Condition	Possible Cause
DTC Strategy	Driver stage check	
Enable Conditions	Battery voltage > 10V	Open or short between MIL
Threshold Value	Short to ground or Line break or short to battery	and ECM     Contact resistance in connectors
Diagnostic Time	• 20 sec.	Burned out MIL bulb
MIL On Condition	• -	

#### SCHEMATIC DIAGRAM

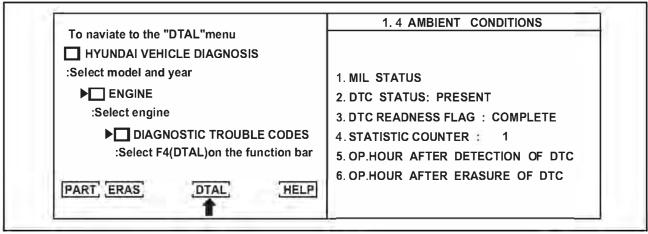
FAD0FF91



K06501

#### MONITOR DTC STATUS EB2A

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



EDTC\_GK

- 5. Is parameter displayed "History(Not Present) fault"?
  - History (Not Present) fault : DTC occurred but has been cleared.
  - Present fault : DTC is occurring at present time.



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

FLA -418 FUEL SYSTEM



▶ Go to next step as below.

#### CONTROL CIRCUIT INSPECTION E3F8CF3B

- 1. Ignition "OFF" and disconnect ECM connector.
- 2. Ignition "ON" & Engine "OFF".
- 3. Using a suitable wire, jumper the terminal 20 of ECM harness connector to chassis ground.
- 4. Is MIL bulb illuminated?



▶ Go to next step.

# NO

- ▶ Remove instrument cluster and inspect MIL bulb. If it is burned out, replace bulb. If bulb is okay, locate source of open between bulb and (20/C133-4) or between bulb and Meter Fuse. Repair as necessary and go to "Verification of Vehicle Repair" procedure
- 5. Remove wire from ECM harness connector.
- 6. Does MIL bulb go out?

# YES

▶ Thoroughly check for loose, bent, or corroded terminals in MIL circuit (including circuit board). Repair as necessary and go to "Verification of Vehicle Repair" procedure.

# NO

▶ Check for source of short to GND between bulb and ECM(20/C133-4). Repair as necessary. and go to "Verification of Vehicle Repair" procedure

#### VERIFICATION OF VEHICLE REPAIR E9BAE93F

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

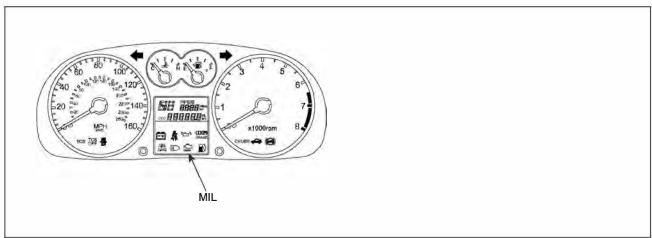
▶ System performing to specification at this time. Clear the DTC.

#### NO

▶ Go to the applicable troubleshooting procedure.

# DTC P0700 TCU REQUEST FOR MIL ON

#### COMPONENT LOCATION EB79B9D3



EGOF 440U

# GENERAL DESCRIPTION ECFC2BE7

The TCM can request activation of the MIL lamp Via a communication line to the ECM. This is only a request from TCM to ECM to turn the MIL on. The fault code is stored in the TCM. Select Transaxle system on the Scantool and monitor DTC related automatic transaxle system.

DO ALL REPAIRS associated malfunction with A/T.

# DTC DETECTING CONDITION EABB3EAC

Item	Detecting Condition	Possible Cause
DTC Strategy	Freeze frame request via CAN	
Enable Conditions	<ul><li>Battery voltage &gt; 10V</li><li>Engine speed &gt; 256 rpm</li></ul>	<del>-</del>
Threshold Value	MIL is requested by TCM	Transaxle system
Diagnostic Time	Immediate	
MIL On Condition	Immediate	

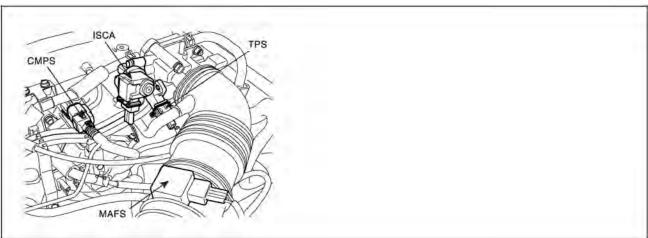
#### MONITOR DTC STATUS E361AC70

- This is only a request from TCM to ECM to turn the MIL on. The fault code is stored in the TCM. The Freeze Frame
  Data is stored in the ECM under the P0700 request code. Be sure to retrieve freeze frame data before clearing code
  P0700 from ECM.
- 2. Check the transaxle system.

FLA -420 FUEL SYSTEM

# DTC P1505 IDLE CHARGE ACTUATOR SIGNAL LOW OF COIL #1

#### COMPONENT LOCATION E69CC198



FGOF254A

#### GENERAL DESCRIPTION ECFDF6EC

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

#### DTC DESCRIPTION E509B1C6

ECM sets DTC P1505 if the ECM detects that the ISCA(OPEN) control circuit is open or short to ground.

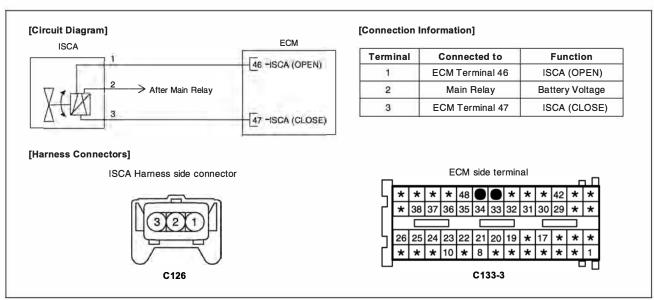
# DTC DETECTING CONDITION E410E67A

Item	Detecting Condition	Possible Cause
DTC Strategy	Driver stage check	Open or short to ground in power
Enable Conditions	Battery voltage > 10V	supply circuit of the ISCA valve
Threshold Value	Short to ground or Line break	Open or short to ground in power supply circuit of the main relay
Diagnostic Time	• 0.5 sec.	Contact resistance in connectors     ISCA valve
MIL On Condition	2 Driving Cycles	

#### SPECIFICATION E5C531C2

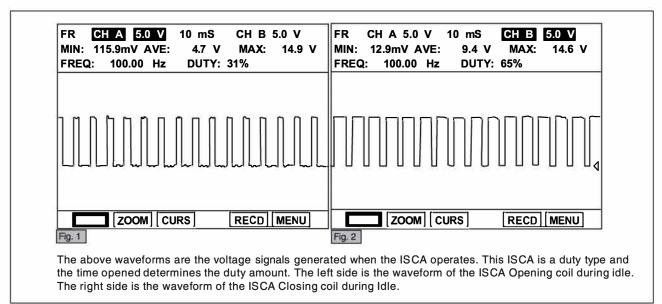
Specification	
Opening Coil Closing Coil	
14.9 ~ 16.1Ω at 20℃(68°F)	17.0 ~ 18.2Ω at 20 ℃(68°F)

#### SCHEMATIC DIAGRAM EE90094E



K05061

#### SIGNAL WAVEFORM EFCA3

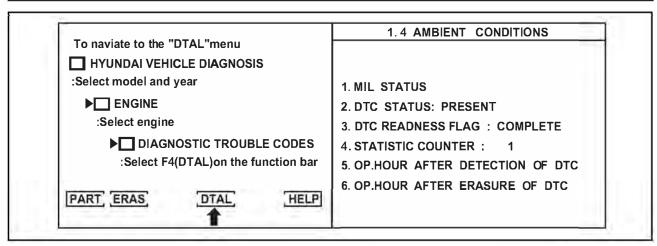


K15052

# MONITOR DTC STATUS ECDBOAC6

- 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.

FLA -422 FUEL SYSTEM



EDTC\_GK

- 5. Is parameter displayed "History(Not Present) fault"?
  - History (Not Present) fault : DTC occurred but has been cleared.
  - Present fault : DTC is occurring at present time.

# YES

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

# NO

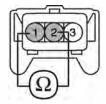
▶ Go to "Component Inspection" procedure.

#### COMPONENT INSPECTION EDF77B8E

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

Specification :  $14.9 \sim 16.1\Omega$  at  $20^{\circ}C(68^{\circ}F)$ 

<C126>



- 1. ISCA(Opening)
- 2. Battery Voltage
- 3. ISCA (Closing)

K15053

4. Is resistance within the specification?

# YES

▶ Go to next step as below.



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

#### TERMINAL AND CONNECTOR INSPECTION EA9A8BE2

- 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.
- Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?



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

# NO

▶ Go to "Power Supply Circuit Inspection" procedure.

#### POWER SUPPLY CIRCUIT INSPECTION E3D658DA

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

Specification: Approx. B+

- 5. Ignition "OFF"
- 6. Disconnect ECM connectors
- 7. Ignition "ON" & Engine "OFF"
- 8. Measure voltage between terminal 9 of the ECM harness connector(C133-1) and chassis ground

Specification: Approx. B+

9. Is voltage display near the specified value?

# YES

▶ With ignition "OFF", reconnect the ECM connectors. Then go to next step as below.

FLA -424 FUEL SYSTEM

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

#### SIGNAL CIRCUIT INSPECTION E6D368CA

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

Specification: Approx. 3~4V

3. Is voltage within the specification?



▶ Thoroughly check connectors for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Go to next step as below.
- 4. Check for open in signal harness
  - 1) Ignition "OFF".
  - Measure resistance between terminals 1 of the ISCA harness connector and 46 of the ECM harness connector

Specification : Approx.  $0\Omega$ 

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.
- Check for short to ground in signal harness.
  - 1) Ignition "OFF".
  - 2) Measure resistance between terminal 1 of the ISCA harness connector and chassis ground

Specification: Infinite

3) Is resistance within the specification?

YES

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

NO

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

# VERIFICATION OF VEHICLE REPAIR EE6E0C97

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"?



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



▶ Go to the applicable troubleshooting procedure.

FLA -426 FUEL SYSTEM

# DTC P1506 IDLE CHARGE ACTUATOR SIGNAL HIGH OF COIL #1

# COMPONENT LOCATION EC95E06D

Refer to DTC P1505.

# GENERAL DESCRIPTION E64EA8D9

Refer to DTC P1505.

# DTC DESCRIPTION EAFD3150

ECM sets DTC P1506 if the ECM detects that the ISCA(OPEN) control circuit is short to battery.

# DTC DETECTING CONDITION E11E3361

Item	Detecting Condition	Possible Cause	
DTC Strategy	Driver stage check		
Enable Conditions	Battery voltage > 10V	Short to battery in harness	
Threshold Value	Short to battery	Contact resistance in connectors	
Diagnostic Time	• 0.5 sec.	Faulty ISCA valve	
MIL On Condition	2 Driving Cycles		

#### SPECIFICATION E3CC36BA

Refer to DTC P1505.

#### SCHEMATIC DIÁGRAM E64642E6

Refer to DTC P1505.

#### SIGNAL WAVEFORM E8EE01EA

Refer to DTC P1505.

# MONITOR DTC STATUS E9A35BF0

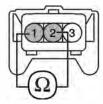
Refer to DTC P1505.

# COMPONENT INSPECTION E6AE6BBD

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

Specification : 14.9~16.1 $\Omega$  at 20  $^{\circ}$ C(68 $^{\circ}$ F)

<C126>



- 1. ISCA(Opening)
- 2. Battery Voltage
- 3. ISCA (Closing)

K15053

4. Is resistance within the specification?



▶ Go to next step as below.



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

#### TERMINAL AND CONNECTOR INSPECTION E4C11508

Refer to DTC P1505.

# POWER SUPPLY CIRCUIT INSPECTION E627E5AD

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

Specification: Approx. B+

5. Is voltage within the specification?



▶ Go to "Signal Circuit Inspection" procedure.

NO

▶ Check for an open or short to ground in the power supply circuit between the ISCA valve and fuel pump relay. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

# SIGNAL CIRCUIT INSPECTION E88F518C

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

FLA -428 FUEL SYSTEM

Specification: Approx. 3~4V

3. Is voltage within the specification?



▶ 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.



- ▶ Go to next step as below.
- 4. Check for short to power in signal harness.
  - 1) Ignition "OFF".
  - 2) Disconnect ECM connector.
  - 3) Ignition "ON".
  - 4) Measure voltage between terminal 1 of the ISCA harness connector and chassis ground

Specification: Approx. 0V

5) Is voltage within the specification?



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

NO

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

# VERIFICATION OF VEHICLE REPAIR EE1FCCOF

Refer to DTC P1505.

# DTC P1507 IDLE CHARGE ACTUATOR SIGNAL LOW OF COIL #2

COMPONENT LOCATION E71D50B3

Refer to DTC P1505.

GENERAL DESCRIPTION EB19768A

Refer to DTC P1505.

DTC DESCRIPTION E60B6BDF

ECM sets DTC P1507 if the ECM detects that the ISCA(OPEN) control circuit is open or short to ground.

# DTC DETECTING CONDITION ED99FDAC

Item	Detecting Condition	Possible Cause	
DTC Strategy	Driver stage check	Open or short to ground in power supply circuit of the ISCA valve	
Enable Conditions	Battery voltage > 10V		
Threshold Value	Short to ground or Line break	Open or short to ground in power supply circuit of the main relay     Contact resistance in connectors	
Diagnostic Time	• 0.5 sec.		
MIL On Condition	2 Driving Cycles	ISCA valve	

#### SPECIFICATION E8021FE9

Refer to DTC P1505.

SCHEMATIC DIAGRAM EEE1DF1C

Refer to DTC P1505.

SIGNAL WAVEFORM ETBAFCCE

Refer to DTC P1505.

MONITOR DTC STATUS E4D0F2EE

Refer to DTC P1505.

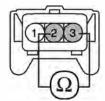
#### COMPONENT INSPECTION EF6DE1E5

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

Specification: 17.0~18.2Ω at 20 ℃ (68°F)

FLA -430 FUEL SYSTEM

<C126>



- 1. ISCA(Opening)
- 2. Battery Voltage
- 3. ISCA (Closing)

K15073

4. Is resistance within the specification?



▶ Go to next step as below.



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

#### TERMINAL AND CONNECTOR INSPECTION EF88482E

Refer to DTC P1505.

# POWER SUPPLY CIRCUIT INSPECTION EAD4DF6D

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

Specification: Approx. B+

- 5. Ignition "OFF"
- 6. Disconnect ECM connectors
- 7. Ignition "ON" & Engine "OFF"
- 8. Measure voltage between terminal 9 of the ECM harness connector(C133-1) and chassis ground

Specification: Approx. B+

9. Is voltage display near the specified value?



▶ With ignition "OFF", reconnect the ECM connectors. Then go to next step as below.

# 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

#### SIGNAL CIRCUIT INSPECTION E3F381EF

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

Specification: Approx. 0.5~0.6V

3. Is voltage within the specification?



▶ Thoroughly check connectors for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure.

# NO

- ▶ Go to next step as below.
- Check for open in signal harness.
  - 1) Ignition "OFF".
  - 2) Measure resistance between terminals 3 of the ISCA harness connector and 47 of the ECM harness connector

Specification : Approx.  $0\Omega$ 

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.
- Check for short to ground in signal harness.
  - 1) Ignition "OFF".
  - 2) Measure resistance between terminal 3 of the ISCA harness connector and chassis ground.

Specification: Infinite

3) Is resistance within the specification?

# YES

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

FLA -432 FUEL SYSTEM



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

# VERIFICATION OF VEHICLE REPAIR EEFCC194

Refer to DTC P1505.

# DTC P1508 IDLE CHARGE ACTUATOR SIGNAL HIGH OF COIL #2

COMPONENT LOCATION E35DCE0B

Refer to DTC P1505.

GENERAL DESCRIPTION E33A2D0A

Refer to DTC P1505.

DTC DESCRIPTION E2BD2BA1

ECM sets DTC P1508 if the ECM detects that the ISCA(CLOSE) control circuit is short to battery.

#### DTC DETECTING CONDITION E389743F

Item	Detecting Condition	Possible Cause	
DTC Strategy	Driver stage check	Short to battery in harness	
Enable Conditions	Battery voltage > 10V		
Threshold Value	Short to battery		
Diagnostic Time	• 0.5 sec.	Contact resistance in connectors     Equity ISCA valve	
Fail Safe	ECM controls idle speed with predetermined value	Faulty ISCA valve	
MIL On Condition	2 Driving Cycles		

SPECIFICATION E2524FBF

Refer to DTC P1505.

SCHEMATIC DIAGRAM E6B2DACA

Refer to DTC P1505.

SIGNAL WAVEFORM E4BCD3DD

Refer to DTC P1505.

MONITOR DTC STATUS EC93B937

Refer to DTC P1505.

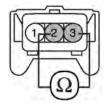
# COMPONENT INSPECTION EAA58F18

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

FLA -434 FUEL SYSTEM

Specification:  $17.0\sim18.2\Omega$  at  $20^{\circ}C(68^{\circ}F)$ 

<C126>



- 1. ISCA(Opening)
- 2. Battery Voltage
- 3. ISCA (Closing)

K15073

4. Is resistance within the specification?



▶ Go to next step as below.



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

# TERMINAL AND CONNECTOR INSPECTION E420222F

Refer to DTC P1505.

#### POWER SUPPLY CIRCUIT INSPECTION ECF74A41

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

Specification: Approx. B+

5. Is voltage within the specification?



▶ Go to "Signal Circuit Inspection" procedure.



▶ Check for an open or short to ground in the power supply circuit between the ISCA valve and fuel pump relay. Repair as necessary and go to "Verification of Vehicle Repair" procedure.

#### SIGNAL CIRCUIT INSPECTION ER

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

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

Specification: Approx. 0.5~0.6V

3. Is voltage within the specification?

# YES

▶ Thoroughly check connectors for loose or poor connections, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and go to "Verification of Vehicle Repair" procedure

# NO

- ▶ Go to next step as below.
- 4. Check for short to power in signal harness
  - 1) Ignition "OFF".
  - 2) Disconnect ECM connector
  - 3) Ignition "ON"
  - 4) Measure voltage between terminal 3 of the ISCA harness connector and chassis ground

Specification: Approx. 0V

5) Is voltage within the specification?

# YES

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



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

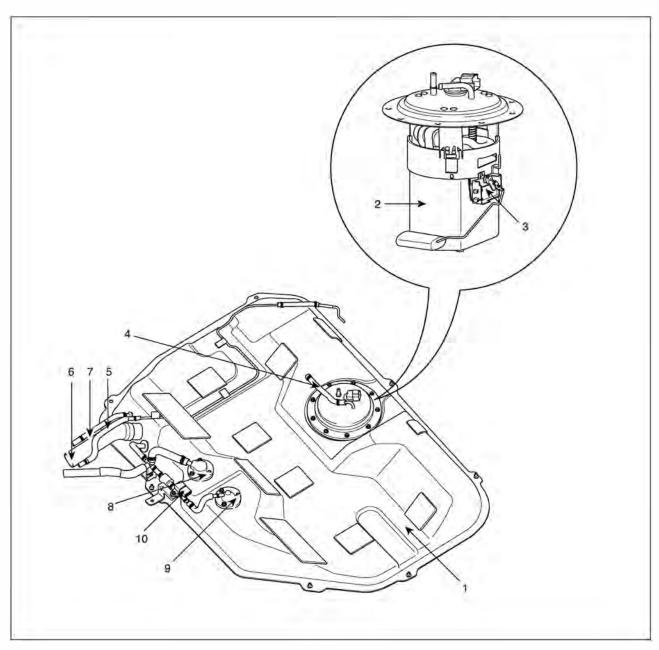
# VERIFICATION OF VEHICLE REPAIR EB1F55A2

Refer to DTC P1505.

FLA -436 **FUEL SYSTEM** 

# **FUEL DELIVERY SYSTEM**

# COMPONENTS LOCATION EDA17E44



- 1. Fuel Tank
- 2. Fuel Pump (Including Fuel Filter and Fuel Pressure Regulator)
- 3. Fuel Sender
- 4. Hose Suction 5. Hose Canister

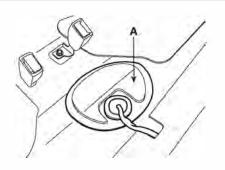
- 6. Fuel Filler Hose
- 7. Leveling Hose
- 8. Fuel Vent Valve
- 9. 2-way Valve
- 10. Fuel Tank Pressure Sensor (FTPS)

EGOF203A

#### FUEL PRESSURE TEST EA35328

#### 1. PREPARING

- Remove the rear seat cushion (Refer to ""BD"" group in this SHOP MANUAL).
- 2. Open the service cover (A) under the rear seat cushion.

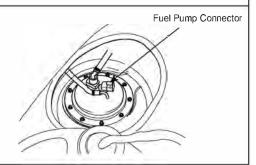


#### 2. RELEASE THE INTERNAL PRESSURE

- 1. Disconnect the fuel pump connector.
- 2. Start the engine and wait until fuel in fuel line is exhausted.
- 3. After the engine stalls, turn the ignition switch to OFF position and diconnect the negative (-) terminal from the battery.



Be sure to reduce the fuel pressure before disconnecting the fuel feed hose, otherwise fuel will spill out.



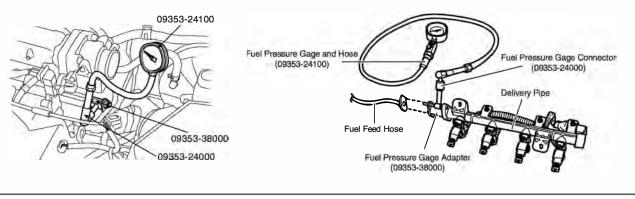
#### 3. INSTALL THE SPECIAL SERVICE TOOL (SST) FOR MEASURING THE FUEL PRESSURE

1. Disconnect the fuel feed hose from the delivery pipe.



 $Cover the \ hose \ connection \ with \ a \ shop \ towel \ to \ prevent \ splashing \ of \ fuel \ caused \ by \ residual \ pressure \ in \ the \ fuel \ line.$ 

- 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).



EGOF204A

FLA -438 FUEL SYSTEM

#### 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/cm², 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
	Clogged fuel filter	Fuel filter
Fuel Pressure too low	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

_	Cton the engine	and shook for	a abanga in the	fuel procesure	gauge reading.
Э.	Stop the endine	and check for	a change in the	Tuel bressure	daude reading.

After engine stops, the gage reading should hold for about 5 minutes

 Observing the declination of the fuel pressure when the gage reading drops and perform the necessary repairs using the table below.

Condition	Probable Cause	Supected Area
Fuel pressure drops slowly after engine is stopped	Injector leak	Injector
Fuel pressure drops immediately after engine is stopped	The check valve within the fuel pump is open	Fuel Pump

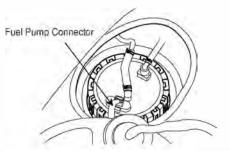
EWOF008Z

#### 6. RELEASE THE INTERNAL PRESSURE

- 1. Disconnect the fuel pump connector.
- 2. Start the engine and wait until fuel in fuel line is exhausted.
- 3. After the engine stalls, turn the ignition switch to OFF position and diconnect the negative (-) terminal from the battery.



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).
- 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.



Cover the hose connection with a shop towel to prevent splashing of fuel caused by residual pressure in the fuel line.

5. Conenct the fuel feed hose to the delivery pipe.

#### 8. INSPECT FUEL LEAKAGE ON CONNECTION

- 1. Connect the battery negative (-) terminal.
- 2. Apply battery voltage to the fuel pump terminal and activate the fuel pump. With fuel pressure applied, check that there is no fuel leakage from the fuel pressure gauge or connection part.
- 3. If the vehicle is normal, connect the fuel pump connector.

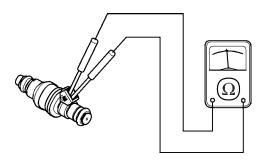
EWOF008K

FLA -440 FUEL SYSTEM

# **FUEL INJECTOR**

# INSPECTION EF79131D

1. Measure resistance between the terminal 1 and 2 of the injector.



EGOF205A

# **SPECIFICATION (RESISTANCE):**

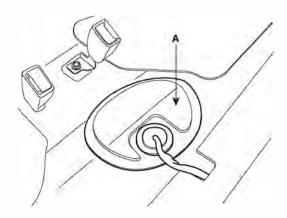
Tempera	Resistance		
(%)	<b>(</b> °F)	(᠒)	
-20	-4	12.2 ~ 12.3	
0	32	13.3 ~ 13.5	
20	68	14.4 ~ 14.6	
40	104	15.5 ~ 15.7	
60	140	16.6 ~ 16.8	
80	176	17.7 ~ 17.9	
100	212	18.8 ~ 19.0	
120	248	19.9 ~ 20.1	

2. If the resistance is not within specification, replace the injector

# **FUEL PUMP (FP)**

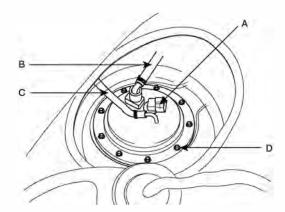
# REMOVAL (INCLUDING FUEL FILTER AND FUEL PRESSURE REGULATOR) E4900E41

- Remove the rear seat cushion (Refer to "BD" group in this SHOP MANUAL).
- Open the service cover (A) under the rear seat cushion.



EFOF008C

- Release the internal pressure of the fuel lines and hoses as following:
  - a. Disconnect the fuel pump assembly harness connector (A).
  - b. Start the engine and wait until fuel in fuel line is exhausted. After the engine stalls, turn the ignition switch to OFF position.
  - Disconnect the negative (-) terminal from the battery.



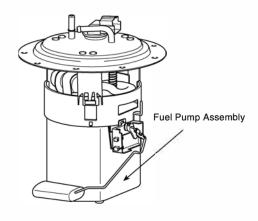
EGOF206A

4. Disconnect the fuel feed line (B) and suction hose(C).

# ( CAUTION

Cover the hose connection with a shop towel to prevent splashing of fuel caused by residual pressure in the fuel line

- 5. Unfasten the fuel pump assembly mounting bolts (D).
- 6. Remove the fuel pump assembly.



EGOF207A

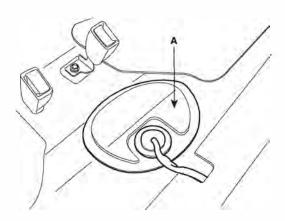
FLA -442 FUEL SYSTEM

# **FUEL TANK**

#### REMOVAL EB8C0BFD

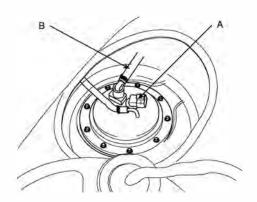
 Remove the rear seat cushion (Refer to "BD" group in this SHOP MANUAL).

Open the service cover (A) under the rear seat cushion.



EFOF008C

- Release the internal pressure of the fuel lines and hoses as following:
  - Disconnect the fuel pump assembly harness connector (A).
  - b. Start the engine and wait until fuel in fuel line is exhausted. After the engine stalls, turn the ignition switch to OFF position.
  - c. Disconnect the negative (-) terminal from the battery.



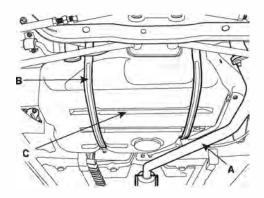
EGOF208A

4. Disconnect the fuel feed line (B).

# ( CAUTION

Cover the hose connection with a shop towel to prevent splashing of fuel caused by residual pressure in the fuel line

- 5. Lift the vehicle.
- 6. Disconnect the hoses connected to the fuel tank.
- Remove the muffler (A) (Refer to "EM" group in this SHOP MANUAL).



EFOF008H

8. Remove the fuel tank band (B) and remove the fuel tank (C).