FL-3

General Information

SPECIFICATIONS

FUEL DELIVERY SYSTEM

Items	Specification	
Fuel Tank	Capacity	62 lit. (12.75 Imp.gal., 15.32 U.S.gal.)
Fuel Return System	Туре	Return Type
Fuel Filter	Туре	High pressure type (Built in engine room)
Lligh Dynasyma Fyral Dynas	Туре	Mechanical, Plunger Pumping Type
High Pressure Fuel Pump	Driven by	Camshaft
Fuel Pressure (Maximum)	Pressure	1,600 bar (160 MPa, 23,206 psi)

INPUT SENSORS

MASS AIR FLOW SENSOR (MAFS)

▷ Specification

* At intake air temperature = 20 °C (68° F)

Air Flow (kg/h)	Frequency (kHz)
8	1.94 ~ 1.96
10	1.98 ~ 1.99
(303205	2.06 ~ 2.07
75	2.72 ~ 2.75
160	3.36 ~ 3.41
310	4.44 ~ 4.53
640	7.66 ~ 8.01
800	10.13 ~ 11.17

^{*} At intake air temperature = -15 $^{\circ}\text{C}(5^{\circ}\text{F})$ or 80 $^{\circ}\text{C}(176^{\circ}\text{F})$

Air Flow (kg/h)	Frequency (kHz)
10	1.97 ~ 1.99
75	2.71 ~ 2.76
160	3.34 ~ 3.43
310	4.39 ~ 4.58

INTAKE AIR TEMPERATURE SENSOR (IATS) #1 [BUILT IN MAFS]

▷ Specification

Temperature [°C(°F)]	Resistance(^{kΩ})
-40(-40)	35.14 ~ 43.76
-20(-4)	12.66 ~ 15.1 <mark>2</mark>
0(32)	5.12 ~ 5.89
20(68)	2.29 ~ <mark>2.5</mark> 5
40(104)	1.10 ~ 1.24
60 (140)	0.57 ~ 0.65
80(176)	0.31 ~ 0.37

BOOST PRESSURE SENSOR (BPS)

▷ Specification

Pressure (kPa)	Output Voltage (V)
32.5	0.5
70	1.02 ~ 1.17
140	2.13 ~ 2.28
210	3.25 ~ 3.40
270	4.20 ~ 4.35
284	4.5

Fuel System

INTAKE AIR TEMPERATURE SENSOR (IATS) #2 [BUILT IN BPS]

▷ Specification

Temperature [˚ℂ(˚F)]	Resistance(^{kΩ})
-40(-40)	40.93 ~ 48.35
-20(-4)	13.89 ~ 16.03
0(32)	5.38 ~ 6.09
20(68)	2.31 ~ 2.57
40(104)	1.08 ~ 1.21
60(140)	0.54 ~ 0.62
80(176)	0.29 ~ 0.34

ENGINE COOLANT TEMPERATURE SENSOR (ECTS)

▷ Specification

Temperature [°C(°F)]	Resistance(^{kΩ})
-40(-40)	48.14
-20(-4)	14.13 ~ 16.83
0(32)	5.79
20(68)	2.31 ~ 2.59
40(104)	1.15
60(140)	0.59 ميرڪرير
80(176)	0.32

CAMSHAFT POSITION SENSOR (CMPS)

▷ Specification

Level	Output Pulse (V)
High	12V
Low	0V

Items	Specification
Air Gap	1.5 \pm 0.1 mm

CRANKSHAFT POSITION SENSOR (CKPS)

○ Output Voltage (V): 0 ~ 5V

Items	Specification
Coil Resistance (Ω))	774 ~ 946Ω [20°C(68°F)]

ACCELERATOR POSITION SENSOR (APS)

▷ Specification

Test Condition	Output \	/oltage(V)
rest Condition	APS 1	APS 2
Idle	0.7 ~ 0.8	0.275 ~ 0.475
Fully depressed	3.8 ~ 4.4	1.75 ~ 2.35

Items	Specification	
items	APS 1	APS 2
Potentiometer Resistance (k\O)	0.7 ~ 1.3	1.4 ~ 2.6

FUEL TEMPERATURE SENSOR (FTS)

▷ Specification

Temperature [°C(°F)]	Resistance(^{kΩ})
-30(-22)	27.00
-20(-4)	15.67
-10(14)	9.45
0(32)	5.89
20(68)	2.27 ~ <mark>2.73</mark>
40(104)	1.17
50(122)	0.83
60(140)	0.60
70(158)	0.43
80(176)	0.30 ~ 0.32

RAIL PRESSURE SENSOR (RPS)

▷ Specification

Test Condition	Rail pressure (bar)	Output Voltage(V)
ldle	220 ~ 320	Below 1.7
Fully depressed	1800	Approx. 4.5

FL-5

LAMBDA SENSOR

▷ Specification

λ Value (A/F Ratio)	Pumping Current(A)
0.65	-2.22
0.70	-1.82
0.80	-1.11
0.90	-0.50
1.01	0.00
1.18	0.33
1.43	0.67
1.70	0.94
2.42	1.38
Air (Atmosphere)	2.54

Temperature [°C(°F)]	Heater Resistance(Ω)
20(68)	9.2
100(212)	10.7
200(392)	13.1
300(572)	ال خودر 14.6 امانه (م
400(752)	17.7
500(932)	د پدیتال 19.2 میرکارار
600(1,112)	20.7
700(1,292)	22.5

EXHAUST GAS TEMPERATURE SENSOR (EGTS) #1 FOR VGT

▷ Specification

Temperature [˚ℂ(˚F)]	Resistance(^{kΩ})
100(212)	289.0 ~ 481.0
300(572)	5.30 ~ 6.61
600(1,112)	0.35 ~ 0.38
900(1,652)	0.08 ~ 0.09

DIFFERENTIAL PRESSURE SENSOR (DPS)

 \triangleright Specification: Vout = (4.5 - 1.0) / 100 * \triangle P + 1.0 (V)

Differential Pressure [△ P] (kPa)	Output Voltage (V)
0	1.00
10	1.35
20	1.70
30	2.05
40	2.40
50	2.75
60	3.10
70	3.45
80	3.80
90	4.15
100	4.50

EXHAUST GAS TEMPERATURE SENSOR (EGTS) #2
FOR CPF

▷ Specification

Temperature [˚ℂ(˚F)]	Resistance(^{kΩ})
100(212)	289.0 ~ 481 <mark>.0</mark>
300(572)	5.30 ~ 6.61
600(1,112)	0.35 ~ 0.38
900(1,652)	0.08 ~ 0.09

VEHICLE SPEED SENSOR (VSS)

Fuel System

OUTPUT ACTUATORS

INJECTOR

Number: 4

▷ Specification

Items	Specification
Coil Resistance (Ω)	0.33Ω [20°C(68°F)]

FUEL PRESSURE REGULATOR VALVE

▷ Specification

Items	Specification
Coil Resistance (Ω)	2.9 ~ 3.15Ω [20°C (68°F)]

RAIL PRESSURE REGULATOR VALVE

▷ Specification

Items	Specification
Coil Resistance (Ω)	3.42 ~ 3.78Ω [20°C(68°F)]

THROTTLE CONTROL ACTUATOR

□ Type : Duty control motor type

Duty (%)	Throttle Valve Position
5	Open
5 ~ 94	Normal operation (Partially open in proportion to duty value)
94 يا 94	ان خودرو Closed
94 ~ 95	Maintaining the last valid position
95 ~ 97	Fully closed

ELECTRIC EGR CONTROL VALVE

▷ Specification

Items	Specification
Coil Resistance (Ω)	7.3 ~ 8.3Ω [20 °C (68 °F)]

VGT CONTROL SOLENOID VALVE

▷ Specification

Items	Specification	
Coil Resistance (Ω)	14.7 ~ 16.1Ω [20°C(68°F)]	

VARIABLE SWIRL CONTROL ACTUATOR

▷ Specification

Motor

Items	Specification
Coil Resistance (Ω)	3.4 ~ 4.4Ω [20 °C (68° F)]

Position Sensor

Items	Specification
Coil Resistance (kΩ)	3.44 ~ 5.16 ^{kΩ} [20°C(68°F)]

FL-7

SERVICE STANDARD

Basic Idle rpm(After warm u-p) A/C OFF A/C ON	A/C OFF	Neutral,N,P-range	850 \pm 100 rpm
		D-range	850 \pm 100 rpm
	A/C ON	Neutral,N,P-range	850 \pm 100 rpm
	D-range	850 \pm 100 rpm	

TIGHTENING TORQUES ENGINE CONTROL SYSTEM

Item	N·m	Kgf⋅m	lbf·ft
ECM installation bolts	7.8 ~ 11.8	0.8 ~ 1.2	5.8 ~ 8.7
ECM bracket installation bolts/nuts	3.9 ~ 5.9	0.4 ~ 0.6	2.9 ~ 4.3
Mass air flow sensor clamp installation bolts	2.9 ~ 4.9	0.3 ~ 0.5	2.2 ~ 3.6
Boost pressure sensor installation bolts	7.8 ~ 11.8	0.8 ~ 1.2	5.8 ~ 8.7
Engine coolant temperature sensor installation	19.6 ~ 39.2	2.0 ~ 4.0	14.5 ~ 28.9
Crankshaft position sensor installation bolt	3.9 ~ 5.9	0.4 ~ 0.6	2.9 ~ 4.3
Camshaft position sensor installation bolt	3.9 ~ 5.9	0.4 ~ 0.6	2.9 ~ 4.3
Lambda sensor installation	40.2 ~ 59.8	4.1 ~ 6.1	29.7 ~ 44.1
Electric EGR control valve installation bolts	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
Variable swirl control actuator installation bolts	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Exhaust gas temperature sensor (For CPF) installation	39.2 ~ 49.1	4.0 ~ 5.0	28.9 ~ 36.2
Exhaust gas temperature sensor (For VGT) installation	39.2 ~ 49.1	4.0 ~ 5.0	28.9 ~ 36.2
DPS & VGT control solenoid valve bracket installation bolts	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Throttle body installation bolts	9.8 ~ 11.8	1.0 ~ 1.2	7.2 ~ 8.7
Oil pressure switch installation	14.7 ~ 21.6	1.5 ~ 2.2	10.9 ~ 15.9
Glow plug installation	9.8 ~ 13.7	1.0 ~ 1.4	7.2 ~ 10.1
Pipe (DPS ↔ CPF) installation (CPF side)	39.2 ~ 49.1	4.0 ~ 5.0	28.9 ~ 36.2

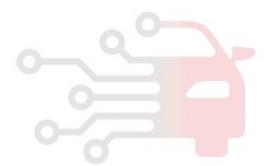
Fuel System

FUEL DELIVERY SYSTEM

Item	N·m	Kgf⋅m	lbf∙ft
Injector clamp installation bolt	24.5 ~ 28.4	2.5 ~ 2.9	18.1 ~ 21.0
Common rail installation bolts	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
High pressure fuel pump installation bolts	19.6 ~ 26.5	2.0 ~ 2.7	14.5 ~ 19.5
High pressure pipe (Injector ↔ Common Rail) installation nuts	24.5 ~ 28.4	2.5 ~ 2.9	18.1 ~ 21.0
High pressure pipe (Common Rail ↔ High Pressure Fuel Pump) installation nuts	24.5 ~ 28.4	2.5 ~ 2.9	18.1 ~ 21.0
Fuel tank band installation bolts	39.2 ~ 54.0	4.0 ~ 5.5	28.9 ~ 39.8
Fuel pump (Low Pressure) plate cover	58.9 ~ 68.7	6.0 ~ 7.0	43.4 ~ 50.6
Fuel filter installation nuts	16.7 ~ 25.5	1.7 ~ 2.6	12.3 ~ 18.8
Accelerator pedal module installation bolts	12.8 ~ 15.7	1.3 ~ 1.6	9.4 ~ 11.6







FL-9

SPECIAL SERVICE TOOLS

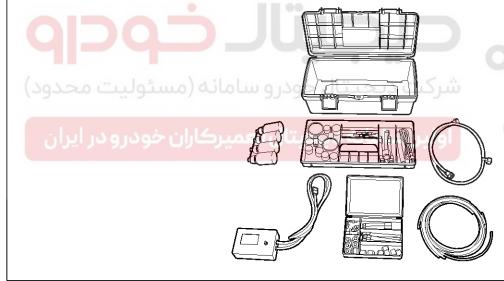
Tool (Number and name)	Illustration	Application
09351-27210 Injector Remover Adapter		Removing the injector
09351-4A200 Injector Remover		Removing the injector
09314-27110(14mm) 09314-27120(17mm) Torque Wrench Socket		Installing the high pressure pipe
03910-2B100 Fuel Pump Plate Cover Wrench		Removing and installing the fuel sender plate cover

Tool Number	Tool Name
CTR-1000	Common Rail Tester (Standard kit)
CRT-1010	Tool Case
CRT-1020	Regulator Valve
CRT-1021	Plug (for Delphi) M14mm
CRT-1022	Plug (for Bosch) M12mm
CRT-1023	Adapter (for Bosch)
CRT-1030	Flask & Holder
CRT-1031	Visible Tube
CRT-1032	Injector Return Hose Adapter
CRT-1033	Injector Return Hose Plug

Fuel System

CRT-1034	Flushing Tube
CRT-1035	Dust Cap
CRT-1040	High Pressure Meter
CRT-1041	Adapter Connector (for Delphi Old)
CRT-1042	Adapter Connector (for Delphi New)
CRT-1043	Adapter Connector (for Bosch)
CRT-1044	IMV Control Valve
CRT-1050	Vacuum Gauge
CRT-1051	Pressure Gauge
CRT-1052	Gauge Connection Tube
CRT-1053	Connection Adapter
CRT-1054	Connection Adapter with Hose
CRT-1055	Hose Clamp
CRT-1060	User's Guide





FL-11

BASIC TROUBLESHOOTING 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.



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 of 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

Fuel System

CUSTOMER PROBLEM ANALYSIS SHEET

1. VEHICLEINFORMAITON

VIN No.			Transmission	☐ M/T ☐ A/T ☐CVT ☐ etc.	
Production d	late		Driving type	☐ 2WD (FF) ☐ 2WD (FR) ☐ 4WD	
Odometer Reading		km/mile			
2. SYMPTO	OMS				
☐ Unable to	o start	☐ Engine does not t☐ Initial combustion		plete combustion	
☐ Difficult to	o start	☐ Engine turns over	slowly ☐ Other_		
☐ Poor idlin	ng	☐ Rough idling ☐ II☐ Unstable idling (H☐ Other	ncorrect idling igh:rpm, Low:rpm)		
		g ☐ After accelerator pedal depressed pedal released ☐ During A/C ON p-range			
☐ Others	•	☐ Poor driving (Surg		Poor fuel economy	
3. ENVIRC	NMENT				
Problem frequency ☐ Constant ☐ Someti ☐ Other		times (Once only		
Weather	رمستوبيد	☐ Fine ☐ Cloudy ☐	Rainy 🗌 Snowy 🗆	Other	
Outdoor tem	perature	Approx °C/°F	a dilala a		
Place ☐ Highway ☐ Suburbs ☐ Rough road ☐ Othe					
Engine temp	perature	☐ Cold ☐ Warming ι	ıp □ After warmin	g up 🗌 Any temperature	
Engine operation ☐ Driving ☐ Cons			nt speed 🗌 Accele	min)	
4. MIL/DTO	4. MIL/DTC				
MIL (Malfunction Indicator Lamp)		☐ Remains ON ☐ Sometimes lights up ☐ Does not light			
Normal check)			
DTC	Check mode	□ Normal □ DTC () □ Freeze Frame Data)	
5. ECM/PC	M INFORMATI	ON			
ECM/PCM F	Part No.				
ROM ID					

SCMFL6150L

FL-13

BASIC INSPECTION PROCEDURE

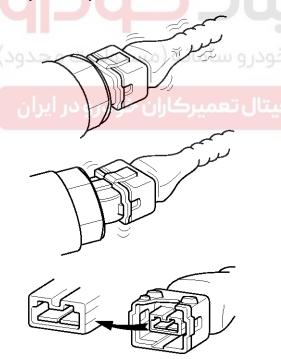
The measured resistance at high temperature after vehicle running may be high or low. So all resistance must be measured at ambient temperature ($20^{\circ}C$, $68^{\circ}F$), unless stated otherwise.

MNOTICE

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

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, the 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

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

SIMULATING VIBRATION

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

WARNING

Strong vibration may break sensors, actuators or relays

- b. Connectors and Harness
 - : Lightly shake the connector and wiring harness vertically and then horizontally.
- SIMULATING HEAT
- Heat components suspected of causing the malfunction with a hair dryer or other heat source.

WARNING

- DO NOT heat components to the point where they may be damaged.
- · DO NOT heat the ECM directly.
- SIMULATING WATER SPRINKLING
- a. Sprinkle water onto vehicle to simulate a rainy day or a high humidity condition.

WARNING

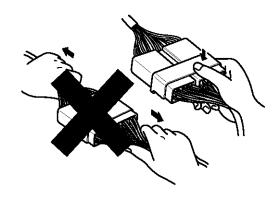
DO NOT sprinkle water directly into the engine compartment or electronic components.

- SIMULATING ELECTRICAL LOAD
- a. Turn on all electrical systems to simulate excessive electrical loads (Radios, fans, lights, rear window defogger, etc.).

Fuel System

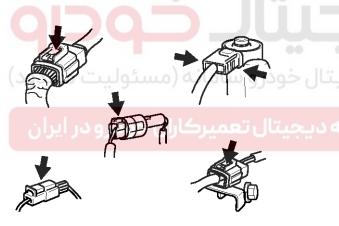
CONNECTOR INSPECTION PROCEDURE

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



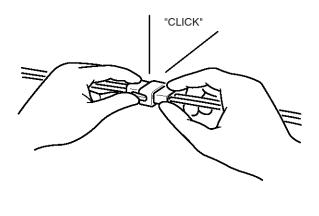
BFGE015F

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



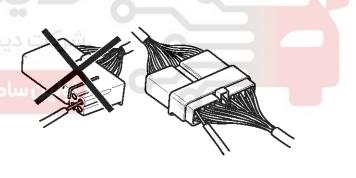
BFGE015G

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



BFGE015H

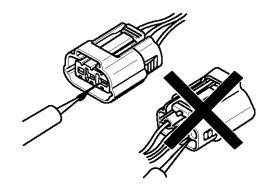
d. When a tester is used to check for continuity, or to measure voltage, always insert tester probe from wire harness side.



BFGE015I

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

FL-15



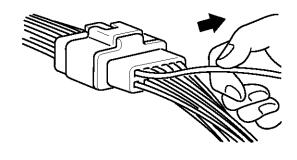
BFGE015J

MOTICE

- Use a fine wire to prevent damage to the terminal.
- Do not damage the terminal when inserting the tester lead.
- 2. Checking Point for Connector
 - a. While the connector is connected:
 Hold the connector, check connecting condition and locking efficiency.
 - b. When the connector is disconnected:
 Check missed terminal, crimped terminal or broken core wire by slightly pulling the wire harness.

 Visually check for rust, contamination, deformation and bend.
 - c. Check terminal tightening condition:

 Insert a spare male terminal into
 - 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
 - a. Clean the contact points using air gun and/or shop rag.

MNOTICE

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

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

Fuel System

WIRE HARNESS INSPECTION PROCEDURE

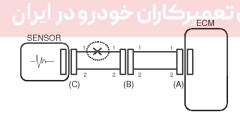
- Before removing the wire harness, check the wire harness position and crimping in order to restore it correctly.
- 2. Check whether the wire harness is twisted, pulled or loosened.
- 3. Check whether the temperature of the wire harness is abnormally high.
- 4. Check whether the wire harness is rotating,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

ELECTRICAL CIRCUIT INSPECTION PROCEDURE

- 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.





BFGE501A

2. Continuity Check Method

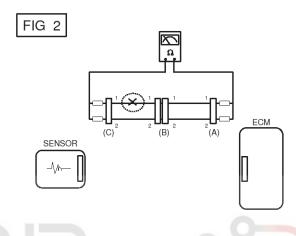
MOTICE

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

Specification (Resistance) 1Ω or less \rightarrow Normal Circuit $1^{M\Omega}$ or Higher \rightarrow Open Circuit

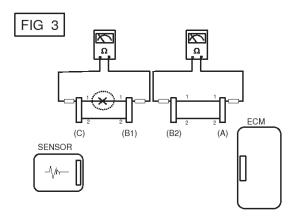
 a. Disconnect connectors (A), (C) and measure resistance between connector (A) and (C) as shown in [FIG. 2].

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



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

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



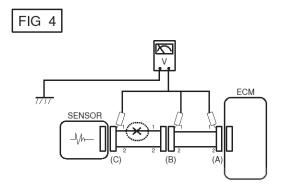
BFGE501C

BFGE501B

FL-17

- 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).

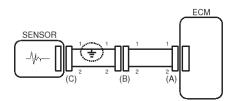


• CHECK SHORT CIRCUIT

- 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 Step 2 (Continuity Check Method with Chassis Ground) as shown below.

FIG 5



BFGE501E

BFGE501D

2. Continuity Check Method (with Chassis Ground)

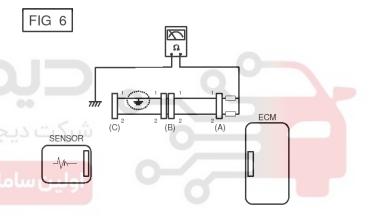
MNOTICE

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

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

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

The measured resistance of line 1 and 2 in this example is below 1 Ω and higher than 1M Ω 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.

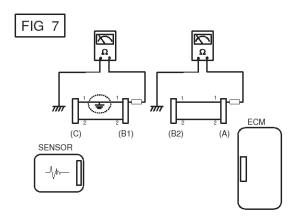


BFGE501F

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

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

Fuel System



BFGE501G





FL-19

SYMPTOM TROUBLESHOOTING GUIDE TABLE (SYMPTOM 1) ENGINE DOES NOT START

Possible Cause

- Run out of fuel
- Starter faulty
- Fuel pump hose supply cut
- High pressure leakage
- · Fuse out of order
- Drift of the rail pressure sensor not detected
- · Cam and Crank signals missing simultaneously
- Battery voltage too low
- Faulty immobilizer
- Electric EGR control valve blocked open
- Fuel pressure regulator valve contaminated, stuck, jammed
- Rail pressure regulator valve contaminated, stuck, jammed
- · Fuel quality / presence of water

- · Inversion of low pressure fuel connections
- Fuel filter not adapted
- Low pressure fuel circuit sealed
- Sealed fuel filter
- · Intermittent fault connection
- · Air ingress in the low pressure fuel circuit
- Fuel return circuit of the pump sealed
- · Engine compression too low
- · Leakage at the injector
- Low pressure fuel pump faulty
- · High pressure fuel pump faulty
- Injector jammed open
- · Bug software or hardware fault not detected
- Glow system faulty

(SYMPTOM 2) ENGIEN STARTS WITH DIFFICULTY OR STARTS AND STALLS

- Run out of fuel
- Fuel return hose of injector cut
- · High pressure leakage
- Fuse faulty
- Air filter sealed
- Alternator or voltage regulator faulty
- The compensation of individual injector not adapted
- The compensation of individual injector not adapted
- Drift of the engine coolant temperature sensor not detected
- Drift of the rail pressure sensor not detected
- · Battery voltage too low
- Electric EGR control valve blocked open
- Fuel pressure regulator valve contaminated, stuck, jammed
- Rail pressure regulator valve contaminated, stuck, jammed
- Fuel quality / presence of water

- Inversion of low pressure fuel connections
- Low pressure fuel circuit sealed
- Sealed fuel filter
- Oil level too high/too low
- Catalytic converter sealed or damaged
- Intermittent fault connection
- Air ingress in the low pressure fuel circuit
- · Fuel return circuit of the pump sealed
- Glow system faulty
- · Engine compression too low
- Fuel return hose of injector sealed
- Carbon deposit on the injector (sealed holes)
- Needle stuck (injection possible over a certain pressure
- · Gasoline in fuel
- Bug software or hardware fault not detected

Fuel System

(SYMPTOM 3) POOR STARTING WHEN HOT

Possible Cause

- The compensation of individual injector not adapted
- · Drift of the rail pressure sensor not detected
- Electric EGR control valve blocked open
- Fuel pressure regulator valve contaminated, stuck, jammed
- Rail pressure regulator valve contaminated, stuck, jammed
- · Air filter sealed
- Air ingress in the low pressure fuel circuit
- · Fuel quality / presence of water

- · Fuel return circuit of the pump sealed
- · Sealed fuel filter
- · Engine compression too low
- Intermittent fault connection
- Carbon deposit on the injector (sealed holes)
- Needle stuck (injection possible over a certain pressure
- Gasoline in fuel
- · Bug software or hardware fault not detected

(SYMPTOM 4) UNSTABLE IDLING

Possible Cause

- Fuel return hose of injector cut
- · The compensation of individual injector not adapted
- · Drift of the rail pressure sensor not detected
- Harness resistance increased
- Air ingress in the low pressure fuel circuit
- Fuel quality / presence of water
- Sealed fuel filter
- Air filter sealed
- · Fuel return hose of injector sealed
- High pressure leakage

- Glow system faulty
- · Engine compression too low
- · Bad flanging of the injector
- High pressure pump out of order
- Injector not adapted
- Carbon deposit on the injector (sealed holes)
- Needle stuck (injection possible over a certain pressure
- Injector jammed open
- · Electric EGR control valve blocked open

(SYMPTOM 5) IDLE SPEED TOO HIGH OR TOO LOW

- Drift of the engine coolant temperature sensor not detected
- · Incorrect state of the electrical pack devices
- · Alternator or voltage regulator faulty

- · Clutch not well set
- Bug software or hardware fault not detected
- · Electric EGR control valve blocked open
- Throttle control actuator faulty

FL-21

(SYMPTOM 6) BLUE, WHITE, OR BLACK SMOKES

Possible Cause

- The compensation of individual injector not adapted
- Drift of the engine coolant temperature sensor not detected
- Drift of the rail pressure sensor not detected
- Electric EGR control valve blocked open
- Fuel pressure regulator valve contaminated, stuck, jam-
- Rail pressure regulator valve contaminated, stuck, jammed
- Oil level too high/too low
- Fuel quality / presence of water

- Catalytic converter sealed or damaged
- Air filter sealed
- Oil suction (engine racing)
- Glow system faulty
- Engine compression too low
- Bad flanging of the injector
- Injector washer not adapted, forgotten, doubled
- Injector not adapted
- Carbon deposit on the injector (sealed holes)
- Injector jammed open
- Gasoline in fuel

(SYMPTOM 7) ENGINE RATTLING, NOISY ENGINE

Possible Cause

- The compensation of individual injector not adapted
- Electric EGR control valve blocked closed (noisy engine)
- Electric EGR control valve blocked open
- Drift of the engine coolant temperature sensor not detected
- Glow system faulty
- Engine compression too low
- Fuel return hose of injector sealed

- Drift of the rail pressure sensor not detected
- Injector washer not adapted, forgotten, doubled
- Injector not adapted
- Carbon deposit on the injector (sealed holes)
- Needle stuck (injection possible over a certain pressure
- Injector jammed open
- Drift of engine coolant temperature sensor not detected

(SYMPTOM 8) BURST NOISE

Possible Cause

- The compensation of individual injector not adapted
- Intermittent fault connection
- Exhaust system sealed
- Drift of the rail pressure sensor not detected
- Fuel pressure regulator valve contaminated, stuck, jam-
- Rail pressure regulator valve contaminated, stuck, jam-
- Bug software or hardware fault not detected

(SYMPTOM 9) UNTIMELY ACCELERATION/DECELERATION AND ENGINE RACING

- Accelerator position sensor blocked
- Electric EGR valve blocked open
- Intermittent fault connection

- Oil suction (engine racing)
- Drift of the rail pressure sensor not detected
- Bug software or hardware fault not detected

Fuel System

(SYMPTOM 10) GAP WHEN ACCELERATING AND AT RE-COUPLING (RESPONSE TIME)

Possible Cause

- Air inlet circuit open
- · Incorrect state of the electrical pack devices
- Accelerator position sensor blocked
- Electric EGR valve blocked open
- Turbo charger damaged, vacuum hose line leakage
- Sealed fuel filter

- Engine compression too low
- · High pressure leakage
- Fuel pressure regulator valve contaminated, stuck, jammed
- Rail pressure regulator valve contaminated, stuck, jammed
- Needle stuck (injection possible over a certain pressure
- Bug software or hardware fault not detected

(SYMPTOM 11) ENGINE STOP OR STALLING

Possible Cause

- Run out of fuel
- Fuel pump hose supply cut
- · High pressure leakage
- · Fuse faulty
- Fuel quality / presence of water
- Low pressure fuel circuit sealed
- Sealed fuel filter
- Crank signals missing simultaneously
- · Electric EGR valve blocked open
- Fuel pressure regulator valve contaminated, stuck, jammed

- Rail pressure regulator valve contaminated, stuck, jammed
- Alternator or voltage regulator faulty
- Intermittent fault connection
- Catalytic converter sealed or damaged
- Oil suction (engine racing)
- · Low pressure fuel pump faulty
- High pressure pump faulty
- Faulty ignition key
- Gasoline in fuel
- · Bug software or hardware fault not detected

(SYMPTOM 12) ENGINE JUDDER

- Run out of fuel
- · Fuel return hose of injector cut
- · Incorrect state of the electrical pack devices
- · The compensation of individual injector not adapted
- Electric EGR valve blocked open
- Fuel filter not adapted
- · Air ingress in the low pressure fuel circuit
- · Fuel quality / presence of water
- Sealed fuel filter
- · Intermittent fault connection
- Harness resistance increased

- Glow system faulty
- Engine compression too low
- Fuel return hose of injector sealed
- Valve clearance
- · Low pressure fuel pump faulty
- Injector washer not adapted, forgotten, doubled
- Carbon deposit on the injector (sealed holes)
- Needle stuck (injection possible over a certain pressure
- Injector jammed open
- Gasoline in fuel
- Bug software or hardware fault not detected

FL-23

(SYMPTOM 13) LACK OF POWER

Possible Cause

- The compensation of individual injector not adapted
- · Accelerator position sensor blocked
- Incorrect state of the electrical pack devices
- · Electric EGR valve blocked open
- Air inlet circuit open
- Air filter sealed
- Oil level too high/too low
- · Catalytic converter sealed or damaged
- Turbo charger damaged, vacuum hose line leakage

- Sealed fuel filter
- · Leakage at the injector
- · Fuel return circuit of the pump sealed
- Fuel return hose of injector sealed
- · Engine compression too low
- · Injector not adapted
- Carbon deposit on the injector (sealed holes)
- Valve clearance

(SYMPTOM 14) TOO MUCH POWER

Possible Cause

- The compensation of individual injector not adapted
- Oil suction (engine racing)

· Bug software or hardware fault not detected

(SYMPTOM 15) EXCESSIVE FUEL CONSUMPTION

Possible Cause

- Fuel return hose of injector cut
- Leakage at the Fuel pressure regulator valve
- Leakage at fuel temperature sensor
- Leakage at the spacers
- High pressure leakage
- Air inlet circuit open
- Air filter sealed
- · The compensation of individual injector not adapted
- Electric EGR valve blocked open

- Incorrect state of the electrical pack devices
- Oil level too high/too low
- Fuel quality / presence of water
- Catalytic converter sealed or damaged
- Turbo charger damaged
- Engine compression too low
- Injector not adapted
- Bug software or hardware fault not detected

(SYMPTOM 16) OVER SPEED ENGINE WHEN CHANGING THE GEAR BOX RATIO

- Accelerator position sensor blocked
- The compensation of individual injector not adapted
- · Intermittent fault connection
- Clutch not well set

- Oil suction (engine racing)
- Turbo charger damaged
- Injector not adapted
- · Bug software or hardware fault not detected

Fuel System

(SYMPTOM 17) EXHAUST SMELLS

Possible Cause

- Electric EGR control valve leakage
- Oil suction (engine racing)
- Turbo charger damaged
- · Oil level too high/too low
- · The compensation of individual injector not adapted
- Catalytic converter sealed or damaged
- · Bad flanging of the injector

- Injector washer not adapted, forgotten, doubled
- Injector not adapted
- Carbon deposit on the injector (sealed holes)
- Needle stuck (injection possible over a certain pressure
- Injector jammed open
- Bug software or hardware fault not detected

(SYMPTOM 18) SMOKES (BLACK, WHITE, BLUE) WHEN ACCELERATING

Possible Cause

- · The compensation of individual injector not adapted
- Electric EGR valve blocked open
- · Air filter sealed
- Fuel quality / presence of water
- Oil level too high/too low
- · Turbo charger damaged
- Catalytic converter sealed or damaged
- Oil suction (engine racing)
- Air heaters out of order
- Engine compression too low
- High pressure leakage

- · Intermittent fault connection
- · Bad flanging of the injector
- · Injector washer not adapted, forgotten, doubled
- Injector not adapted
- Carbon deposit on the injector (sealed holes)
- Needle stuck (injection possible over a certain pressure
- Injector jammed open
- Gasoline in fuel
- · Bug software or hardware fault not detected
- · Catalyzed Particulate Filter (CPF) fail

(SYMPTOM 19) FUEL SMELLS

Possible Cause

- Fuel pump hose supply cut
- · Fuel return hose of injector cut
- · Leakage at the Fuel pressure regulator valve
- · Leakage at fuel temperature sensor
- Leakage at the spacers
- · High pressure leakage

(SYMPTOM 20) THE ENGINE COLLAPSES AT TAKE OFF

- Accelerator position sensor blocked
- Incorrect state of the electrical pack devices
- · Air filter sealed
- · Inversion of low pressure fuel connections
- Fuel filter not adapted
- · Fuel quality/presence of water
- · Air ingress in the low pressure fuel circuit
- Sealed fuel filter

- · Catalytic converter sealed or damaged
- · Clutch not well set
- Intermittent fault connection
- Drift of the rail pressure sensor not detected
- Fuel pressure regulator valve contaminated, stuck, jammed
- Rail pressure regulator valve contaminated, stuck, jammed
- · Gasoline in fuel
- · Bug software or hardware fault not detected

FL-25

(SYMPTOM 21) THE ENGINE DOES NOT STOP

Possible Cause

- Faulty ignition key
- · Oil suction (engine racing)
- · Bug software or hardware fault not detected

(SYMPTOM 22) DIFFERENT MECHANICAL NOISES

- Buzzer noise (discharge by the injectors)
- Clip broken (vibrations, resonance, noises)
- · Incorrect state of the electrical pack devices
- · Catalytic converter sealed or damaged
- · Air inlet circuit open

- · Bad flanging of the injector
- · Clutch not well set
- Turbo charger damagedValve clearance
- Valve clearance





Fuel System

Engine Control System

DESCRIPTION

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

MOTICE

- Before removing or installing any part, read the diagnostic trouble codesand then disconnect the battery negative (-) terminal.
- Before disconnecting the cable from battery terminal, turn the ignition switch to OFF. Removal or connection of the battery cable during engine operationor while the ignition switch is ON could cause damage to the ECM.
- Wchecking the generator for the charging state, do not disconnect the battery '+' terminal to prevent the ECM from damage due to the voltage.
- Wcharging the battery with the external charger, disconnect the vehicleside battery terminals to prevent damage to the ECM.

SELF-DIAGNOSIS

MNOTICE

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

CHECKING PROCEDURE (SELF-DIAGNOSIS)

MNOTICE

- When attery voltage is excessively low, diagnostic trouble codes can not be read. Be sure to check the battery for voltage and the charging system before starting the test
- Diagnosis memory is erased if the battery or the ECM connector is disconnected. Do not disconnect the battery before the diagnostic trouble codes are completely read and recorded.

INSPECTION PROCEDURE (USING GENERIC SCAN TOOL)

- 1. Turn OFF the ignition switch.
- 2. Connect the scan tool to the data link connector on the lower crash pad.
- 3. Turn ON the ignition switch.
- 4. Use the scan tool to check the diagnostic trouble code.
- 5. Repair the faulty part from the diagnosis chart.
- 6. Erase the diagnostic trouble code.
- 7. Disconnect the GST.

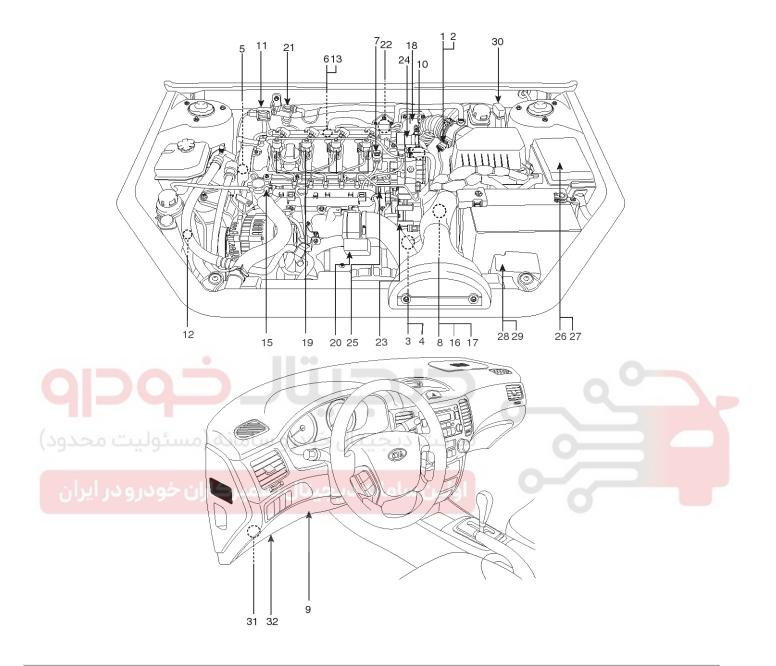
MNOTICE

When deleting diagnostic trouble code, use scan tool as possible. When deleting diagnostic trouble code by disconnecting battery terminal(-), data for ECM control may delete simultaneously.

Engine Control System

FL-27

COMPONENT LOCATION



- 1. Mass Air Sensor (MAFS)
- 2. Intake Air Temperature Sensor (IATS) #1 built in MAFS
- 3. Boost Pressure Sensor (BPS)
- 4. Intake Air Temperature Sensor (IATS) #2 built in BPS
- 5. Engine Coolant Temperature Sensor (ECTS)
- 6. Lambda Sensor
- 7. Camshaft Position Sensor (CMPS)
- 8. Crankshaft Position Sensor (CKPS)
- 9. Accelerator Position Sensor (APS)
- 10. Fuel Temperature Sensor (FTS)

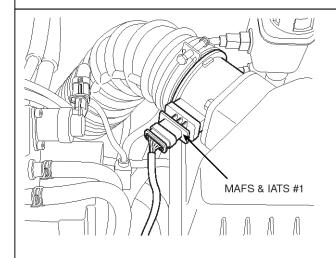
- 11. Differential Pressure Sensor (DPS)
- 12. A/C Pressure Transducer (APT)
- 13. Exhaust Gas Temperature Sensor (EGTS) #1 for VGT
- 14. Exhaust Gas Temperature Sensor (EGTS) #2 for CPF
- 15. Rail Pressure Sensor (RPS)
- 16. Vehicle Speed Sensor (VSS)
- 17. Oil Pressure Switch (OPS)
- 18. Water Sensor (included in Fuel Filter)
- 19. Injector
- 20. Throttle Control Actuator

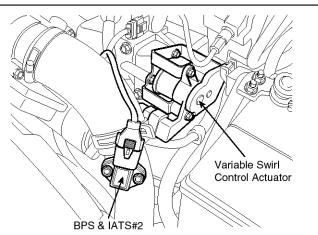
- 21. VGT Control Solenoid Valve
- 22. Electric EGR Control Valve
- 23. Variable Swirl Control Actuator
- 24. Fuel Pressure Regulator Valve
- 25. Rail Pressure Regulator Valve
- 26. Main Relay
- 27. Fuel Pump Relay
- 28. Glow Relay
- 29. Auxiliary Heater Relay
- 30. Multi-Purpose Check Connector
- 31. Data Link Connector (DLC)
- 32. ECM (Engine Control Module)

SMGFL6149L

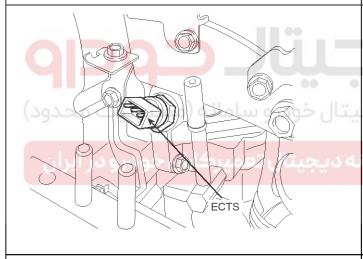
Fuel System

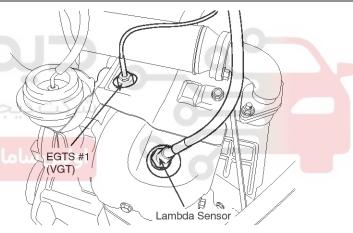
- 1. Mass Air Flow Sensor (MAFS)
- 2. Intake Air Temperature Sensor (IATS) #1 built in MAFS
- 3. Boost Pressure Sensor (BPS)
- 4. Intake Air Temperature Sensor (IATS) #2 built in BPS
- 23. Variable Swirl Control Actuator





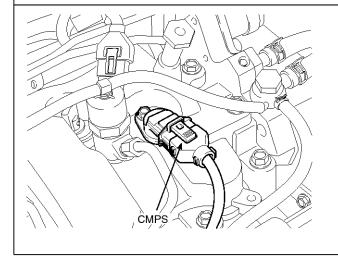
- 5. Engine Coolant Temperature Sensor (ECTS)
- 6. Lambda Sensor
- 13. Exhaust Gas Temperature Sensor (EGTS) #1 for VGT





7. Camshaft Position Sensor (CMPS)

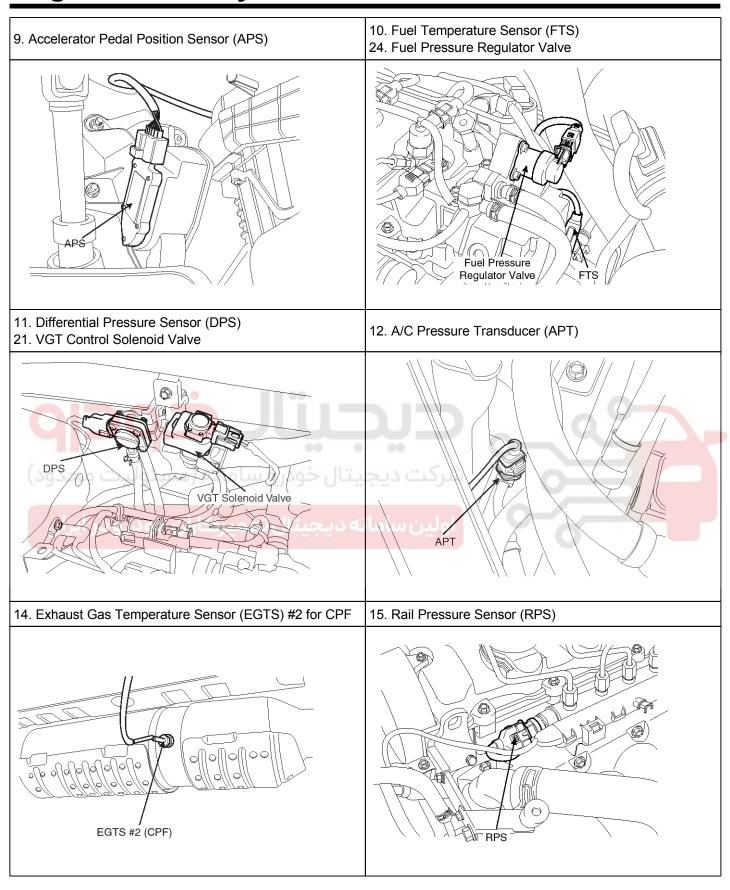
- 8. Crankshaft Position Sensor (CKPS)
- 17. Oil Pressure Switch (OPS)



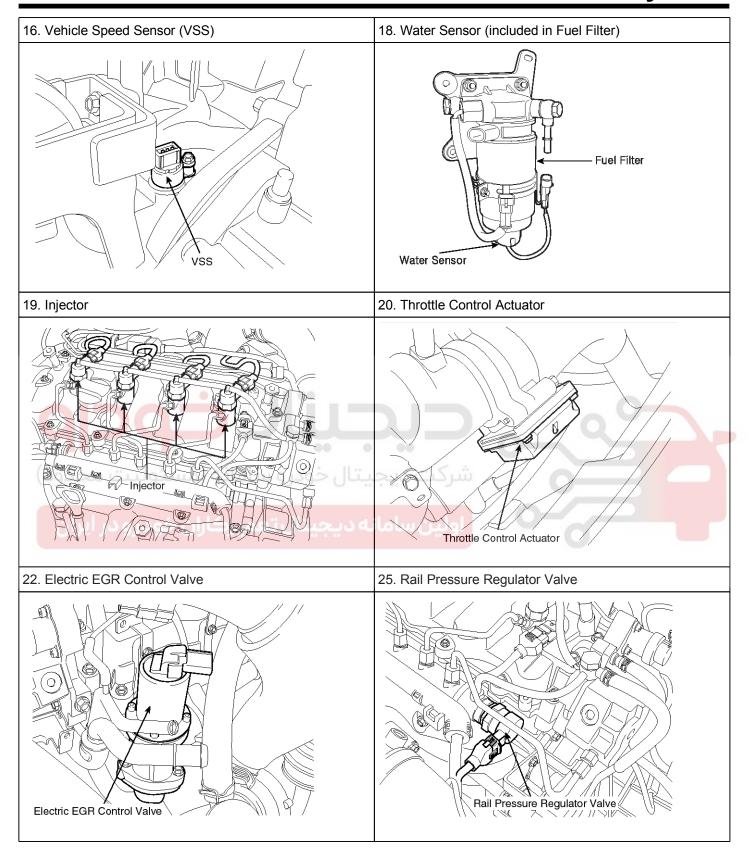
CKPS

Engine Control System

FL-29

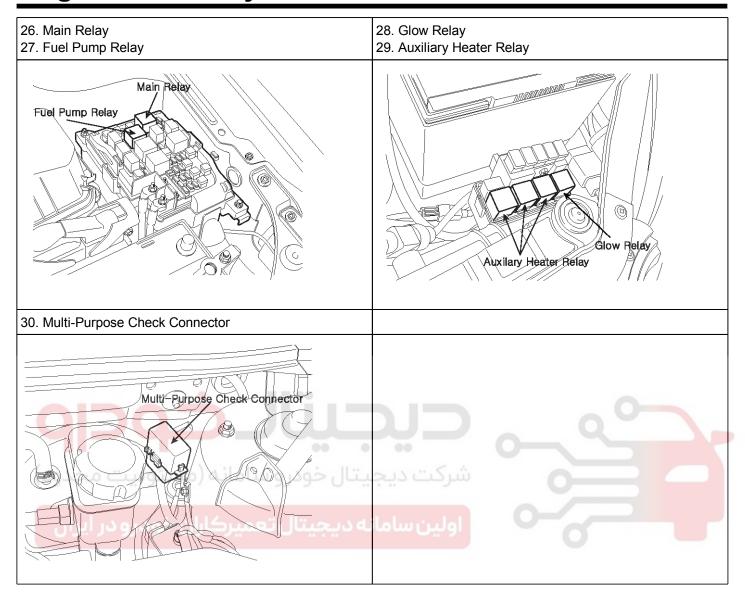


Fuel System



Engine Control System

FL-31

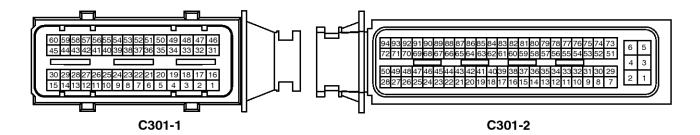


Fuel System

Engine Control Module (ECM)

ECM (ENGINE CONTROL MODULE)

1. ECM HARNESS CONNECTOR



SMGFL6100L

2. ECM TERMINAL FUNCTION

CONNECTOR [C301-1]

Pin	Description	Connected to
1	Injector (Cylinder #3) [HIGH] control output	Injector (Cylinder #3)
2	Injector (Cylinder #2) [HIGH] control output	Injector (Cylinder #2)
3		
4	Battery power	Rail Pressure Regulator Valve
حدود)	یتال خودر و سام ا نه (مسئولیت م	شرکت دیچ
6	Sensor ground	Position Sensor in Variable Swirl Control Actuator
7	Sensor shield	Crankshaft Position Sensor (CKPS)
8	Sensor ground	Rail Pressure Sensor (RPS)
9	-	
10	-	
11	-	
12	Crankshaft Position Sensor (CKPS) [-] signal input	Crankshaft Position Sensor (CKPS)
13	Reference voltage (+5V)	Boost Pressure Sensor (BPS)
14	-	
15	-	
16	Injector (Cylinder #1) [HIGH] control output	Injector (Cylinder #1)
17	Injector (Cylinder #4) [HIGH] control output	Injector (Cylinder #4)
18	-	
19	Battery power	Fuel Pressure Regulator Valve
20	Sensor ground	Camshaft Position Sensor (CMPS)
21	-	
22	-	

Engine Control System

FL-33

Pin	Description	Connected to
23	Sensor ground	Boost Pressure Sensor (BPS)
24	-	
25	-	
26	Reference voltage (+5V)	Position Sensor in Variable Swirl Control Actuator
27	Crankshaft Position Sensor (CKPS) [+] signal i nput	Crankshaft Position Sensor (CKPS)
28	Reference voltage (+5V)	Rail Pressure Sensor (RPS)
29	-	
30	Motor [-] control output	Variable Swirl Control Actuator
31	Injector (Cylinder #2) [LOW] control output	Injector (Cylinder #2)
32	-	
33	Injector (Cylinder #4) [LOW] control output	Injector (Cylinder #4)
34	Rail Pressure Regulator Valve control output	Rail Pressure Regulator Valve
35	-	
36	11**	
37	Reference frequency	Mass Air Flow Sensor (MAFS)
38	- 00 0	0
39	ىتال خودر و سام ا نه (مسئولىت م	شرکت دید
40	Boost Pressure Sensor (BPS) signal input	Boost Pressure Sensor (BPS)
41	Sensor ground	Engine Coolant Temperature Sensor (ECTS)
42	Mass Air Flow Sensor (MAFS) signal input	Mass Air Flow Sensor (MAFS)
43	Rail Pressure Sensor (RPS) signal input	Rail Pressure Sensor (RPS)
44	Sensor ground	MAFS & IATS #1
45	Fuel Pump Relay output	Fuel Pump Relay
46	Injector (Cylinder #3) [LOW] control output	Injector (Cylinder #3)
47	Injector (Cylinder #1) [LOW] control output	Injector (Cylinder #1)
48	-	
49	Fuel Pressure Regulator Valve control output	Fuel Pressure Regulator Valve
50	Camshaft Position Sensor (CMPS) signal input	Camshaft Position Sensor (CMPS)
51	-	
52	-	
53	Intake Air Temperature Sensor (IATS) #2 signal input	Intake Air Temperature Sensor (IATS) #2 built in BPS
54	-	
55	-	
56	Position Sensor signal input	Position Sensor in Variable Swirl Control Actuator

Fuel System

Pin	Description	Connected to	
57	-		
58	Engine Coolant Temperature Sensor (ECTS) signal input	Engine Coolant Temperature Sensor (ECTS)	
59	Electric EGR Control Valve control output	Electric EGR Control Valve	
60	Motor [+] control output	Variable Swirl Control Actuator	

CONNECTOR [C301-2]

Pin	Description	Connected to		
1	Batter voltage supply after main relay	Main Relay		
2	Power ground	Chassis Ground		
3	Batter voltage supply after main relay	Main Relay		
4	Power ground	Chassis Ground		
5	Batter voltage supply after main relay	Main Relay		
6	Power ground	Chassis Ground		
7	Cooling Fan Relay [HIGH] control output	Cooling Fan Relay [HIGH]		
8	Sensor ground	Accelerator Position Sensor (APS) #2		
9	Accelerator Position Sensor (APS) #1 signal input	Accelerator Position Sensor (APS) #1		
10	Sensor ground	Fuel Temperature Sensor (FTS)		
11	Fuel Temperature Sensor (FTS) signal input	Fuel Temperature Sensor (FTS)		
12	Ground	A/C Pressure Transducer		
13	A/C Pressure Transducer signal input	A/C Pressure Transducer		
14	Ground	Cruise Control Switch		
15	Cruise Control "ACTIVATOR" signal input	Cruise Control Switch		
16	Ground	Immobilizer Control Module		
17	-			
18	-			
19	-			
20	-			
21	-			
22	Reference voltage (+5V)	A/C Pressure Transducer		
23	-			
24	Reference voltage (+5V)	Cruise Control Switch		
25	Diagnosis Data Line (K-Line)	Data Link Connector (DLC)		
26	-			
27	Fuel consumption signal output	Trip computer		

Engine Control System

FL-35

Pin	Description	Connected to		
28	Ignition switch signal input	Ignition Switch		
29	VGT Control Solenoid Valve control output	VGT Control Solenoid Valve		
30	Sensor ground	Accelerator Position Sensor (APS) #1		
31	Accelerator Position Sensor (APS) #2 signal input	Accelerator Position Sensor (APS) #2		
32	Exhaust Gas Temperature Sensor (EGTS) #2 signal input	Exhaust Gas Temperature Sensor (EGTS) #2 for CPF		
33	Sensor ground	Exhaust Gas Temperature Sensor (EGTS) #2 for CPF		
34	Exhaust Gas Temperature Sensor (EGTS) #1 signal input	Exhaust Gas Temperature Sensor (EGTS) #1 [VGT]		
35	Sensor ground	Exhaust Gas Temperature Sensor (EGTS) #1 [VGT]		
36	Differential Pressure Sensor (DPS) signal input	Differential Pressure Sensor (DPS)		
37	Sensor ground	Differential Pressure Sensor (DPS)		
38	Brake Switch "Lamp" signal input	Brake Switch		
39	-			
40	Water Sensor siganl input	Water Sensor in Fuel Filter		
41				
42	Blower Switch Signal input	Blower Switch		
43	یتال حودرو سام <u>ا</u> نه (مسئولیت م	شرکت دیج		
44	Reference voltage (+5V)	Differential Pressure Sensor (DPS)		
45	Reference voltage (+5V)	Accelerator Position Sensor (APS) #1		
46	Reference voltage (+5V)	Accelerator Position Sensor (APS) #2		
47	Immobilizer Communication Line	Immobilizer Control Module		
48	Engine speed signal output	Tachometer (Cluster)		
49	Cruise Control "SET" Lamp control output	Cruise Control "SET" Lamp (Cluster)		
50	-			
51	Lambda Sensor Heater control output	Lambed Sesnor		
52	-	-		
53	-			
54	A/C Switch "ON" signal input	A/C Switch		
55	-			
56	Thermo Switch signal input	A/C Switch		
57	Gear Neutral Switch signal input (MT Only)	Gear Neutral Switch		
58	-			
59	-			
60	-			

Fuel System

Pin	Description	Connected to		
61	-			
62	-			
63	-			
64	Lambda Sensor Voltage "NERNST"	Lambda Sensor		
65	Lambda Sensor Current Pump	Lambda Sensor		
66	-			
67	-			
68	Malfunction Indicator Lamp (MIL) control output	Malfunction Indicator Lamp (MIL)		
69	Glow Time Indicator Lamp contorl output	Glow Time Indicator Lamp (Cluster)		
70	A/C Compressor Relay control output	A/C Compressor Relay		
71	Cooling Fan Relay [LOW] control output	Cooling Fan Relay		
72	Main Relay control output	Main Relay		
73	-			
74				
75	Vehi <mark>cle spee</mark> d signal <mark>in</mark> put	Vehicle Speed Sensor (VSS)		
76	- 00 0	0		
(77)	Feedback signal input	Throttle Control Actuator		
78	-			
79	Clutch Switch signal input	Clutch Switch		
80	Brake Switch "Redundant" signal input	Brake Switch		
81	MT/AT auto reconition signal input	M/T: Open, A/T: Ground		
82	-			
83	CAN [LOW]	Other Control Modules		
84	CAN [HIGH]	Other Control Modules		
85	-			
86	Lambda Sensor Virtual Ground	Lambda Sensor		
87	Lambda Sensor Current Adjust	Lambda Sensor		
88	-			
89	Intake Air Temperature Sensor (IATS) #1 signal input	Intake Air Temperature Sensor (IATS) #1 in MAFS		
90	Throttle Control Actuator control output	Throttle Control Actuator		
91	Cruise Control "MAIN" Lamp control output	Cruise Control "MAIN" Lamp (Cluster)		
92	Immobilizer Lamp control output	Immobilizer Lamp (Cluster)		
93	Glow Relay control output	Glow Relay		
94	PTC Heater Relay control output	PTC Heater Relay		

Engine Control System

FL-37

3. ECM TERMINAL INPUT/OUTPUT SIGNAL

CONNECTOR [C301-1]

011110				
Pin	Description	Туре	Vehicle State	Level
1	Injector (Cylinder #3) [HIGH] control output	Idle	Pulse	B+ ~ 80V
2	Injector (Cylinder #2) [HIGH] control output	ldle	Pulse	B+ ~ 80V
3	-	-	-	-
4	Battery power	ldle	DC	Vbatt
5	-	-	-	-
6	Sensor ground	ldle	DC	Max. 50mV
7	Sensor shield	Idle	DC	Max. 50mV
8	Sensor ground	Idle	DC	Max. 50mV
9	-	-	-	-
10	-	-	-	-
11	-	-	-	-
12	Crankshaft Position Sensor (CKPS) [-] signal input	Idle	Sine Wave	Vp_p : Min.1.0V
40		IG OFF	DC	Max. 0.5V
13	Reference voltage (±5V)	IG ON	DC	4.9 ~ 5.1V
14	م د د د د د د د د د د د د د د د د د د د	.		
15	ينان خودرو ساماحه رسسوديت مد	سرحت دیج	- 0-	-
16	Injector (Cylinder #1) [HIGH] control output	Idle	Pulse	Vbatt ∼ 80V
17	Injector (Cylinder #4) [HIGH] control output	Idle	Pulse	Vbatt ∼ 80V
18	-	-	-	-
40	Dettermination	IG OFF	DC	Max. 0.5 V
19	Battery power	IG ON		Vbatt
20	Sensor ground	Idle	DC	Max. 50 mV
21	-	-	-	-
22	-	-	-	-
23	Sensor ground	Idle	DC	Max. 50 mV
24	-	-	-	-
25	-	-	-	-
26	Reference voltage (+5V)	IG OFF	DC	Max. 0.5V
26		IG ON		4.9 ~ 5.1V
27	Crankshaft Position Sensor (CKPS) [+] signal i nput	Idle	Sine Wave	Vp_p : Min.1.0V
28	Reference voltage (+5V)	IG OFF	DC -	Max. 0.5V
				4.9 ~ 5.1V

Fuel System

Pin	Description	Туре	Vehicle State	Level
29	-	-	-	-
30	Motor [-] control output	Active	DC	Max.0.5V
31	Injector (Cylinder #2) [LOW] control output	ldle	Pulse	Peak Current : 19 ~ 2 1 A Hold Current : 11 ~ 13 A
32	-	-	-	-
33	Injector (Cylinder #4) [LOW] control output	ldle	Pulse	Peak Current : 19 ~ 2 1 A Hold Current : 11 ~ 13 A
34	Rail Pressure Regulator Valve control output	Idle	Pulse	Hi: Vbatt Lo: Max. 1.0V Freque- ncy = 1kHz ± 2%
35	• • •	00 -	0-	
36	یتال خودر و سام ا نه (مسئولیت م	شرکت دیج	- 0	
37	Reference frequency	ldle	Pulse	Hi: Vcc or Vbatt Lo: Max. 1.0V
38	عودرودر	رويين معادي	- 0	_
39	-	-	-	-
40	Boost Pressure Sensor (BPS) signal input	IG ON	Analog	0.5 ~ 4.5V
41	Sensor ground	Idle	DC	Max. 50 mV
42	Mass Air Flow Sensor (MAFS) signal input	Idle	Pulse	Hi: Vcc or Vbatt Lo: Max. 1.0V
	Rail Pressure Sensor (RPS) signal input	IG ON	Analog	Max. 1.0V
43		Idle		1.0 ~ 1.5 V
		3000 RPM		1.5 ~ 3.0 V
44	Sensor ground	Idle	DC	Max. 50 mV
45	Fuel Pump Relay output	Relay OFF	DC	Vbatt
		Relay ON		Max. 1.0V

FL-39

Pin	Description	Туре	Vehicle State	Level
46	Injector (Cylinder #3) [LOW] control output	ldle	Pulse	Peak Current : 19 ~ 2 1 A Hold Current : 11 ~ 13 A
47	Injector (Cylinder #1) [LOW] control output	ldle	Pulse	Peak Current : 19 ~ 2 1 A Hold Current : 11 ~ 13 A 19 ~ 21A 11 ~ 13A
48	-	-	-	-
49	Fuel Pressure Regulator Valve control output	Idle	Pulse	Hi: Vbatt Lo: Max. 1.0V
50	Camshaft Position Sensor (CMPS) signal input	Idle	Pulse	Hi: Vcc or Vbatt Lo: Max. 1.0V
51			- (0 - 1 -
52	• • •	-		-
53	Intake Air Temperature Sensor (IATS) #2 signal input	شرک _{اتا} دیج	Analog	0.5 ~ 4.5V
54	و در در تال تحمیر کلیان خمیر مدر	lalımıyılal	0-/	
55	ـ حيبيت وحسير ڪراو حودرو در			_
56	Position Sensor signal input	Idle	DC	0.5 ∼ 4.5V
57	-	-	-	-
58	Engine Coolant Temperature Sensor (ECTS) signal input	Idle	Analog	0.5 ∼ 4.5V
59	Electric EGR Control Valve control output	Idle	Pulse	Hi: Vbatt Lo: Max. 1.0V
60	Motor [+] control output	Active	Pulse	Hi: Vbatt Lo: Max. 1.0V

CONNECTOR [C301-2]

Pin	Description	Туре	Vehicle State	Level
1	Batter voltage supply after main relay	IG OFF	DC	Max. 1.0 V
'		IG ON	DC	Vbatt
2	Power ground	Idle	DC	Max. 50 mV
2	Detter veltage europy ofter main relev	IG OFF	DC	Max. 1.0 V
3	Batter voltage supply after main relay	IG ON	DC	Vbatt

Fuel System

Pin	Description	Туре	Vehicle State	Level
4	Power ground	Idle	DC	Max. 50 mV
F	Dette and the second of the second of	IG OFF	DC	Max. 1.0 V
5	Batter voltage supply after main relay	IG ON	DC	Vbatt
6	Power ground	Idle	DC	Max. 50 mV
7	Cooling For Polov II II Cl II control output	Relay OFF	DC	Vbatt
7	Cooling Fan Relay [HIGH] control output	Relay ON	DC	Max. 1.0V
8	Sensor ground	ldle	DC	Max. 50 mV
0	Accelerator Position Sensor (APS) #1 signal i-	C.T	Analog	0.3 ~ 0.9V
9	nput	W.O.T	Analog	4.0 ~ 4.8V
10	Sensor ground	Idle	DC	Max. 50 mV
11	Fuel Temperature Sensor (FTS) signal input	IG ON	Analog	0.5 ∼ 4.5V
12	Ground	Idle	DC	Max. 50 mV
13	A/C Pressure Transducer signal input	A/C On	Analog	Max. 4.8V
14	Ground	Idle	DC	Max. 50mV
15	Cruise Control "ACTIVATOR" signal input		-	0
16	Ground	Idle	DC	Max. 50 mV
17	- • •	· -	0-	-
18	یتال خودرو سام <u>ا</u> نه (مسئولیت م	شركت ديج	- 0-	
19	-	-		-
20	به دیجیتال تعمیرکاران خودرو در ا	اولین ساما		-
21	-	-	-	-
00	Deference voltage (LEX)	IG OFF	DC	Max. 0.5V
22	Reference voltage (+5V)	IG ON	DC	4.9 ~ 5.1V
23	-	-	-	-
0.4	Defended on (15)	IG OFF	D0	Max. 0.5V
24	Reference voltage (+5V)	IG ON	DC	4.9 ~ 5.1V
		When transmitti-		Hi: Min. Vbatt×80%
25	Diagnosis K-Line	ng	Pulse	Lo: Max. Vbatt×20%
		When receiving		Hi: Min. Vbatt×70% Lo: Max. Vbatt×30%
26	-	-	-	-
27	Fuel consumption signal output	ldle	Pulse	Hi: Vbatt or Vcc Lo: Max. 0.5V
20	Institute autitale aignal instit	IG OFF	DO.	Max. 1.0V
28	Ignition switch signal input	IG ON	DC	Vbatt

FL-41

Pin	Description	Туре	Vehicle State	Level
29	VGT Control Solenoid Valve control output	ldle	Pulse	Hi: Vbatt Lo: Max. 0.5V
30	Sensor ground	ldle	DC	Max. 50 mV
0.4	Accelerator Position Sensor (APS) #2 signal i-	C.T	A sa a La sa	0.3 ~ 0.9V
31	nput	W.O.T	Analog	1.5 ~ 3.0V
32	Exhaust Gas Temperature Sensor (EGTS) #2 signal input	Idle	Analog	0.5 ~ 4.5V
33	Sensor ground	ldle	DC	Max. 50 mV
34	Exhaust Gas Temperature Sensor (EGTS) #1 signal input	Idle	Analog	0.5 ~ 4.5V
35	Sensor ground	ldle	DC	Max. 50 mV
36	Differential Pressure Sensor (DPS) signal input	ldle	Analog	0.5 ~ 4.5V
37	Sensor ground	ldle	DC	Max. 50 mV
38	Proko Switch "Lamp" signal input	Release	DC	Max. 0.5V
30	Brake Switch "Lamp" signal input	Push	DC	Max. 0.5V Vbatt
39			-	0
40	Water Canage signal input	Full of Water	Angled	Vbatt
40	Water Sensor siganl input	No Water	Analog	Max. 1V
41	يتال خودرو سام <u>ا</u> نه (مسئوليت م	شرکت دیج	- 0-	
42	Player Cuitch Signal input	Blower Off	DC	Vbatt
42	Blower Switch Signal input	Blower On	DC	Max. 2V
43	-	-)	-
44	Deference veltage (+5)()	IG OFF	DC	Max. 0.5V
44	Reference voltage (+5V)	IG ON	ЪС	4.9 ~ 5.1V
45	Reference voltage (+5V)	IG OFF	DC	Max. 0.5V
45	Reference voltage (+5v)	IG ON	БС	4.9 ~ 5.1V
46	Reference voltage (+5V)	IG OFF	DC	Max. 0.5V
40	Reference voltage (+5v)	IG ON	БС	4.9 ~ 5.1V
		After IG ON wh-		Hi: Min. 8.5V
47	Immobilizer Communication Line	en communicati- ng	Pulse	Lo: Max. 3.5V
	Environment discolation	Idle	Pulse	Hi: Vbatt Lo: Max. 5V
48	Engine speed signal output			Frequency : 50~60Hz
48	Cruise Control "SET" Lamp control output	-		Frequency : 50~60Hz

Fuel System

Pin	Description	Туре	Vehicle State	Level
51	Lambda Sensor Heater control output	Vehicle Run	Pulse	Hi: Vbatt Lo: Max. 1.0V
52	-	-	-	-
53	-	-	-	-
F.4	A/O O situla IIONIII signad i sagat	A/C SW OFF	D0	Max. 1.0V
54	A/C Switch "ON" signal input	A/C SW ON	DC	Vbatt
55	-	-	-	-
50	T. 0 11 1 1 1	A/C OFF	D.C.	Max. 0.5V
56	Thermo Switch signal input	A/C ON	DC	Vbatt
57	Gear Neutral Switch signal input (MT Only)	SW OFF (Neutr- al)	DC	Vbatt
		SW ON (1st)		Max. 0.5V
58	-	-	-	-
59	-	-	-	-
60		-	-	-
61	30 3-		-	20-
62		2	0	
63	- " . lot o \ 4 \ \ l \ o \ . o \ \		-	
64	Lambda Sensor Voltage "NERNST"	Engine Run	Analog	Normal: 450 ± 50 mV Rich: Max. Normal + 150mV Lean: Min. Normal - 1 50mV
65	Lambda Sensor Current Pump	Engine Run	Analog	Normal : 0 ± 500 mV Rich : Min. Normal - 1. 5V Lean : Max. Normal + 1.5V
66	-	-	-	-
67	-	-	-	-
68	Malfunction Indicator Lamp (MIL) control outp-	Lamp OFF	DC	Vbatt
00	ut	Lamp ON	DC	Max. 1.0V
69	Glow Time Indicator Lamp control output	Glow OFF	DC	Vbatt
09	Glow Time indicator Lamp control output	Glow ON	DC	Max. 1.0V
70	A/C Compressor Relay control output	A/Con OFF	DC	Vbatt
	AC Compressor Relay Control output	A/Con ON	DC	Max. 1.0V
71	Cooling For Polov II OWI control cutruit	Relay OFF	DC	Vbatt
/ 1	Cooling Fan Relay [LOW] control output	Relay ON	DC	Max. 1.0V

FL-43

Pin	Description	Туре	Vehicle State	Level
70	Main Dalay, acretical autourt	Relay OFF	DC	Vbatt
72	Main Relay control output	Relay ON	DC	Max. 1.0V
73	-			
74	-	-	-	-
75	Vehicle speed signal input	Vehicle Run	Pulse	Hi: Min. 5.0V Lo: Max. 1.0V
76	-	-	-	-
77	Foodback signal input	Normal	DC	Vbatt
77	Feedback signal input	Abnormal	DC	Max. 0.5V
78	-	-	-	-
79	Clutch Switch cignal input	Release	DC	Max. 0.5V
79	Clutch Switch signal input	Push	DC	Vbatt
90	Droke Switch "Dedundent" cignal input	Release	DC	Vbatt
80	Brake Switch "Redundant" signal input	Push	DC	Max. 0.5V
0.1	MT/AT gute reconition signal input	MT	DC	Vbatt
81	MT/AT auto reconition signal input	AT	DC	Max. 0.5V
82	• • •	· ·	0-	-
83	يتال خودرو سامانه (مسودروسامانه) CAN [LOW]	Recessive	Pulse	2.0 ~ 3.0 V
03	CAN [LOW]	Dominant	Pulse	0.5 ~ 2.25 V
84	له دیجیتال تعمیرکاران خرد (CAN [HIGH]	Recessive	Pulse	2.0 ~ 3.0 V
04	CAN [nign]	Dominant	Pulse	2.75 ~ 4.5 V
85	-	-	-	-
86	Lambda Sensor Virtual Ground	Engine Run	Analog	2.4 ~ 2.6V
87	Lambda Sensor Current Adjust	Engine Run	Analog	Current Pump - Curr- ent Adjust < 0.2V
88	-	-	-	-
89	Intake Air Temperature Sensor (IATS) #1 signal input	ldle	Analog	0.5V ∼ 4.5V
90	Throttle Control Actuator control output	Key On/Key Off	Pulse	Hi: Vbatt Lo: Max. 1V
91	Cruise Control "MAIN" Lamp control output	-	-	-
00	Image hillings I come posted to the st	Lamp OFF	DO	Vbatt
92	Immobilizer Lamp control output	Lamp ON	DC	Max. 1.0V
00	Claus Balanca anthological	Relay OFF	50	Vbatt
93	Glow Relay control output	Relay ON	DC	Max. 1.0V

Fuel System

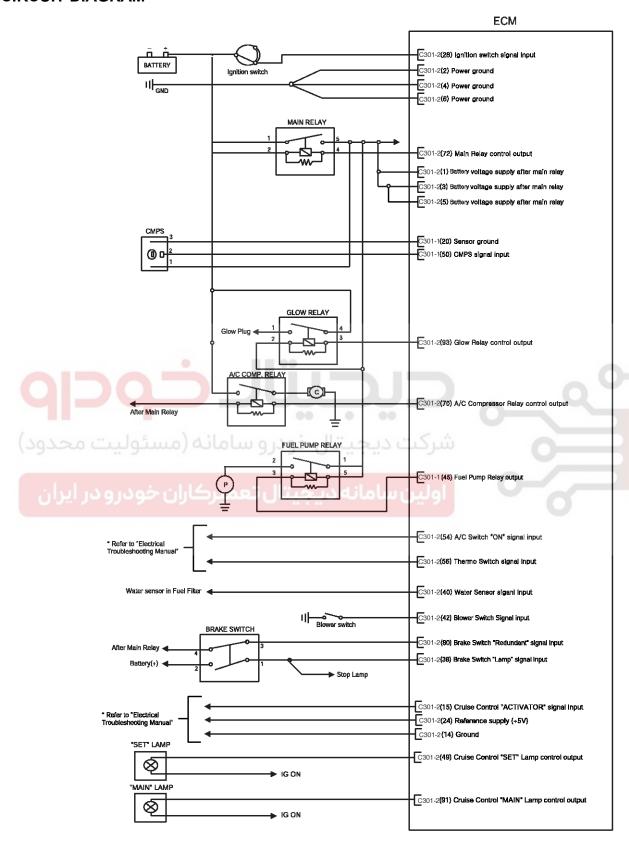
Pin	Description	Туре	Vehicle State	Level
04	DTC Hooter Polov central output	Relay OFF	20	Vbatt
94	PTC Heater Relay control output	Relay ON	DC	Max. 1.0V





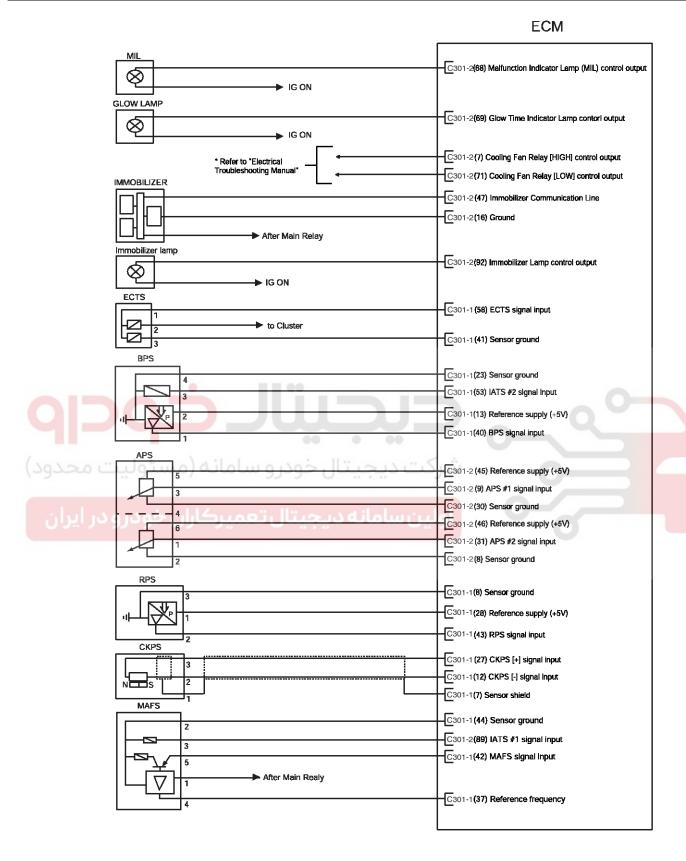
FL-45

CIRCUIT DIAGRAM



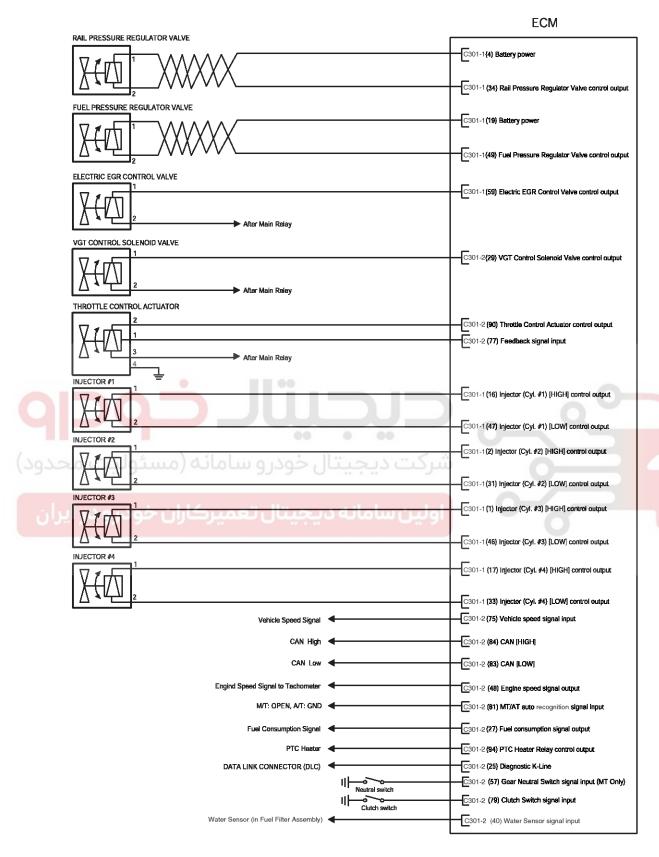
SMGFL6101L

Fuel System



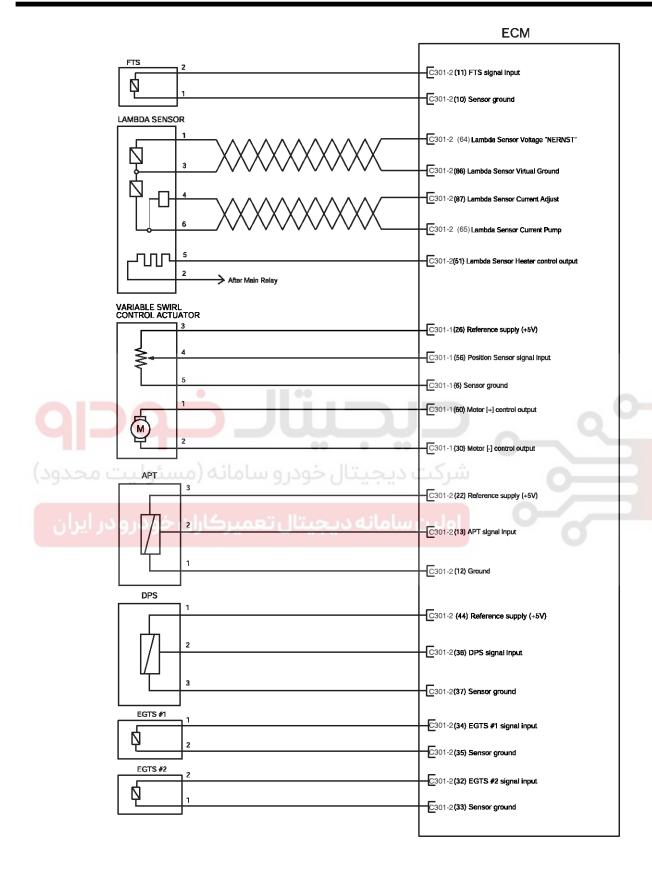
SMGFL6102L

FL-47



SMGFL6103L

Fuel System



SMGFL6104L

FL-49

ECM PROBLEM INSPECTION PROCEDURE

- 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.
- 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.
- 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)

نال خودرو سامانه (مسئولیت محدود

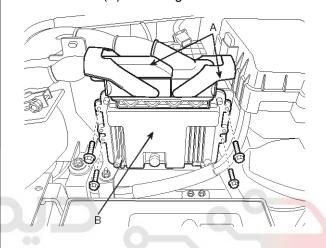
ه دیجیتال تعمیرکاران خودرو در ایران

REPLACEMENT

ACAUTION

After replacing an ECM, MUST input the vehicle mileage and the injector data (7 digit) of each cylinder into a new ECM.

- 1. Turn ignition switch OFF.
- 2. Remove the battery negative (-) cable from the battery.
- 3. Remove the battery and disconnect the ECM connector (A) in the engine room.



SMGFL6749A

- Remove the ECM (B) after unscrewing the four mounting bolts.
- 5. Install a new ECM in to the reverse order of step

ECM mounting bolts : 7.8 \sim 11.8 N·m (0.8 \sim 1.2 kgf·m, 5.8 \sim 8.7lbf·ft)

Fuel System

- 6. Connect a scan tool to Data Link Connector (DLC) and turn ignition switch on.
- 7. Proceed "ECM CHANGE" procedure.
 - 1) Select "ENGINE CONTROL".

KIA VEHICLE DIAGNOSIS

MODEL : OPTIMA / MAGENTIS

Ø1. ENGINE CONTROL

- 02. AUTOMATIC TRANSAXLE
- 03. BRAKE SYS(ABS/TCS/ESP)
- 04. SRS-ALRBAG
- 05. FULL AUTO AIR/CON.
- 06. 4 WHEEL DRIVE(4WD)
- 07. IMMOBILIZER
- 08. BODY ELECTRIC. SYS(ETACS)

SMGFL6105L

2) Select "MANUAL SELECTION MODE".

KIA VEHICLE DIAGNOSIS

MODEL : OPTIMA / MAGENTIS SYSTEM : ENGINE CONTROL

01. AUTO SEARCHING MODE

02. MANUAL SELECTION MODE

SMGFL6106L

3) Select "D 2.0L VGT DIESEL".

KIA VEHICLE DIAGNOSIS

MODEL : OPTIMA / MAGENTIS SYSTEM : ENGINE CONTROL

01 .	D 2.0L VGT DIESEL	
02.	2.0L DIESEL	ALL
03.	2.0L CVVT	EOBD
04.	2.0L CVVT	GEN
0 5.	2.0L CVVT	LEAD
0 6.	2.7L V6	EOBD
07.	2.7L V6	GEN
08.	2.7L V6	LEAD

SMGFL6107L

4) Select "COMPONET CHANGE ROUTNE"

1. KIA VEHICLE DIAGNOSIS

MODEL : OPTIMA / MAGENTIS

SYSTEM: 2005

ENGINE CONTROL

04. FLIGHT RECORD

05. ACTUATION TEST

06. SIMU-SCAN

07. ECU INFORMATION

08. INJECTOR CORRECTION

09. CPF SERVICE REGENERATION

10. COMPONENT CHANGE ROUTINE

11. COMPRESSION TEST

SMGFL6108L

Select "ECU CHANGE".

1.10 . COMPONENT CHANGE ROUTINE

MODEL : OPTIMA / MAGENTIS

SYSTEM : 2005

ENGINE CONTROL

01. ECU CHANGE

02. LAMBDA SENSOR CHANGE

03. RAIL PRESSURE SENSOR CHANGE

04. AIR FLOW SENSOR CHANGE

05. CPF CHANGE

06. D/PRESSURE SENSOR CHANGE

07. SWIRL CONTROL VALUE CHANGE

SMGFL6109L

6) Press "ENTER" key.

<ECU CHANGE>

1. IN PUT THE CURRENT ODO VALUES IN CLUSTER TO COUNT THE DRIFT SOOT VALUE INFORMATION OF CPF.

200000 Km

2. REFER TO PREVIOUS MENU TO SEE INJECTOR INFORMATION.

PRESS [ENTER] KEY.

LFIG108A

FL-51

7) Input the vehicle mileage and press "ENTER" key.

...... Im

PRESS [ENT], YOU RIGHT INPUT TO DISTANCE

PRESS [ENT], YOU RIGHT INPUT TO DISTANCE

IG KEY ON BEFORE IG KEY

OFF FOR 10SEC

8) Wait 10 seconds with IG ON.

- 9) Turn ignition switch off.
- 8. Turn ignition switch on.
- 9. Proceed "INJECTOR CORRECTION" procedure.
 - 1) Select "ENGINE CONTROL".

MODEL : OPTIMA / MAGENTIS

1. ENGINE CONTROL

2. AUTOMATIC TRANSAXLE

3. BRAKE SYS(ABS/TCS/ESP)

4. SRS-AIRBAG

5. FULL AUTO AIR/CON.

6. 4 WHEEL DRIVE(4WD)

7. IMMOBILIZER

8. BODY ELECTRIC. SYS(ETACS)

SMGFL6105L

LFIG109A

2) Select "MANUAL SELECTION MODE".

KIA VEHICLE DIAGNOSIS

MODEL : OPTIMA/MAGENTIS SYSTEM : ENGINE CONTROL

01. AUTO SEARCHING MODE

02. MANUAL SELECTION MODE

SMGFL6106L

3) Select "D 2.0L VGT DIESEL".

KIA VEHICLE DIAGNOSIS

MODEL : OPTIMA / MAGENTIS SYSTEM : ENGINE CONTROL

01. D Z	.OL VGT DIES	EL
02. 2.0	L DIESEL	ALL
03. 2.0	L CUUT	EOBD
04. 2.0	L CVVT	GEN
05. 2.0	L CVVT	LEAD
06. 2.7	L V6	EOBD
07. 2.7	L V6	GEN
08. 2.7	L V6	LEAD

SMGFL6107L

Select "INJECTOR CORRECTION".

1. KIA VEHICLE DIAGNOSIS

MODEL : OPTIMA/MAGENTIS

SYSTEM: 2005

ENGINE CONTROL

04. FLIGHT RECORD

05. ACTUATION TEST

06. SIMU-SCAN

07. ECU INFORMATION

Ø8. INJECTOR CORRECTION

09. CPF SERVICE REGENERATION

10. COMPONENT CHANGE ROUTINE

11. COMPRESSION TEST

SMGFL6110L

Fuel System

- 5) Press "ENTER" key.
- * CONDITION: IG. KEY ON(ENGINE STOP)
- 1. IF THE INJ. IS CHANGED, THE INJ. CORRECTION FUNC SHOULD BE PERFORM TO CONTROL THE NOR. FUEL INJ.
- 2. TO INPUT THE INJECTOR NUMBER, PRESS SHIFT KEY AND SELECT THE CYL. BY ARROW KEY AT THE SAME TIME. AND INPUT THE INJ. DATA BY [F1]~[F6], DIGIT KEY. PRESS [ENTER].
- 3. AFTER COMPLETE, TURN THE IG. KEY OFF AND CHECK THE SYSTEM AFTER 10 SEC.

LFIG111A

6) Input the injector data (7 digit) written on the top of each injector with function keys ([F1] \sim [F6]) and number keys.

INJECTOR 1	AAAAAA	•
INJECTOR 2	AAAAAA	
INJECTOR 3	AAAAAA	
INJECTOR 4	AAAAAA	و سامانه (

- SELECT THE CYLINDER BY SHIFT+ARROW

KEY AND INPUT THE DATA BY FI~F6

KEY AND PRESS [ENTER] KEY.

ABCD [EFGH | IJKL | MNOP | QR-U | UW-Z

INJECTOR 1	444444
INJECTOR 2	AAAAAAA
INJECTOR 3	АААААА
INJECTOR 4	AAAAAA

WRITING COMPLETE

ABCD EFGH IJKL MNOP QR-U VW-Z

LFIG112A

MNOTICE

When "WRITING FAIL" is displayed on the scan tool, input injector data (7 digits) of each cylinder into a new ECM again as prior procedure.

INJECTOR 1	444444
INJECTOR 2	AAAAAA
INJECTOR 3	AAAAAAA
INJECTOR 4	AAAAAA

WRITING FAIL

ABCD	EFGH	IJKL	MNOP	QR-U	VW-Z	
				_		_

LFIG113A

FL-53

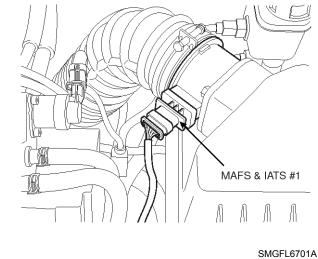
Mass Air Flow Sensor (MAFS)

INSPECTION

MAFS uses a hot-film type sensing element to measure the mass of intake air entering the engine, and send the signal to ECM.

A large amount of intake air represents acceleration or high load conditions while a small amount of intake air represents deceleration or idle.

The ECM uses this information to control the EGR solenoid valve and correct the fuel amount.



SPECIFICATION

*At intake air temperature = 20°C (68°F)

Air Flow (kg/h)	Frequency (kHz)
8	1.94 ~ 1.96
10	1.98 ~ 1.99
15	2.06 ~ 2.07
ىسئولى _ن ى محدود	2.72 ~ 2.75
160	3.36 ~ 3.41
ن خودر ₃₁₀ در ایران	4.44 ~ 4.53
640	7.66 ~ 8.01
800	10.13 ~ 11.17

*At intake air temperature = -15°C(5°F) or 80°C(176°F)

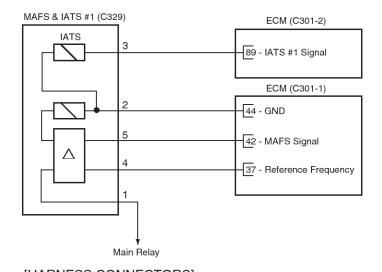
Air Flow (kg/h)	Frequency (kHz)
10	1.97 ~ 1.99
75	2.71 ~ 2.76
160	3.34 ~ 3.43
310	4.39 ~ 4.58

LFIG034A

Fuel System

CIRCUIT DIAGRAM

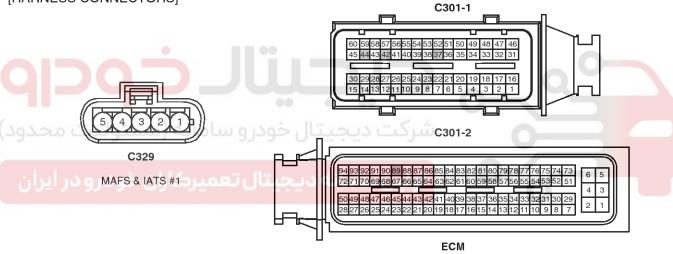
[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	Main Relay	Battery Voltage (B+)
2	ECM C301-1 (44)	Sensor Ground
3	ECM C301-2 (89)	IATS #1 Signal
4	ECM C301-1 (37)	Reference Frequency
5	ECM C301-1 (42)	MAFS Signal

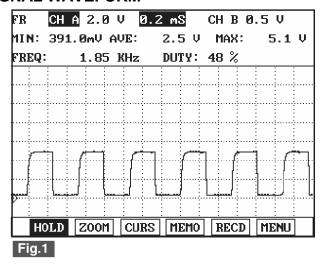




SMGFL6111L

FL-55

SIGNAL WAVEFORM



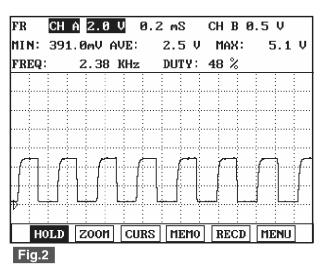


Fig.1) AFS signal waveform at IG KEY "ON". It shows digital signal of 50% duty, 1.8KHz.

Fig.2) AFS signal waveform at idle(790RPM, EGR actuator duty 5%, air flow for each cylinder 410mg/st). It shows digital signal of 50% duty, 2.2~2.7KHz.

LFIG222A

COMPONENT INSPECTION

- 1. Check the MAFS visually.
 - Mounting direction correct.
 - Any contamination, corrosion or damage on connector.
 - Air cleaner's clogging or wet.
 - MAFS cylinder's deforming or blocking by any foreign material.
- Check any leakage on intake system and intercooler system.



Fuel System

REPLACEMENT

MNOTICE

After replacing a Mass Air Flow Sensor (MAFS) or Intake Air Temperature Sensor (IATS)#1, MUST proceed below procedure.

- 1. Turn ignition switch OFF.
- 2. Connect a scan tool to Data Link Connector (DLC).
- 3. Turn ignition switch ON.
- 4. Select "ENGINE CONTROL".

MODEL : OPTIMA / MAGENTIS

Ø1. ENGINE CONTROL

- **02. AUTOMATIC TRANSAXLE**
- 03. BRAKE SYS(ABS/TCS/ESP)
- 04. SRS-ALRBAG
- 05. FULL AUTO AIR/CON.
- 06. 4 WHEEL DRIVE(4WD)
- 07. IMMOBILIZER
- 08. BODY ELECTRIC. SYS(ETACS)

SMGFL6105L

5. Select "MANUAL SELECTION MODE".

MODEL : OPTIMA / MAGENTIS
SYSTEM : ENGINE CONTROL

01. AUTO SEARCHING MODE

02. MANUAL SELECTION MODE

SMGFI 6106I

Select "D 2.0L VGT DIESEL".

KIA VEHICLE DIAGNOSIS

MODEL : OPTIMA / MAGENTIS SYSTEM : ENGINE CONTROL

01.	D 2.0L VGT DIESEL	
02.	2.0L DIESEL	ALL
0 3.	2.0L CVVT	EOBD
04.	2.0L CVVT	GEN
0 5.	2.0L CVVT	LEAD
06.	2.7L V6	EOBD
07.	2.7L V6	GEN
08.	2.7L V6	LEAD

SMGFL6107L

7. Select "COMPONET CHANGE ROUTNE"

1. KIA VEHICLE DIAGNOSIS

MODEL : OPTIMA / MAGENTIS

SYSTEM : 2005

ENGINE CONTROL

04. FLIGHT RECORD

05. ACTUATION TEST

06. SIMU-SCAN

07. ECU INFORMATION

08. INJECTOR CORRECTION

09. CPF SERVICE REGENERATION

10. COMPONENT CHANGE ROUTINE

11. COMPRESSION TEST

SMGFL6108L

8. Select "AIR FLOW SENSOR CHANGE".

1.10 . COMPONENT CHANGE ROUTINE

MODEL : OPTIMA / MAGENTIS

SYSTEM: 2005

ENGINE CONTROL

01. ECU CHANGE

02. LAMBDA SENSOR CHANGE

03. RAIL PRESSURE SENSOR CHANGE

04. AIR FLOW SENSOR CHANGE

05. CPF CHANGE

06. D/PRESSURE SENSOR CHANGE

07. SWIRL CONTROL VALUE CHANGE

SMGFL6112L

FL-57

9. Press "ENTER" key.

AIR FLOW SENSOR CHANGE

IN THIS MODE, CAN RESET THE STORED DRIFT VALUES OF HOT FILM AIR FLOW SENSOR IN EEPROM

PRESS [ENTER] KEY

AIR FLOW SENSOR CHANGE

IN THIS MODE, CAN RESET THE STORED DRIFT VALUES OF HOT FILM AIR FLOW SENSOR IN EEPROM

IG KEY ON BEFORE IG KEY

OFF FOR 10SEC

LFIG129A 10. Wait 10 seconds with IG ON.

11. Turn ignition switch off.



Fuel System

Intake Air Temperature Sensor (IATS)

INSPECTION

Intake Air Temperature Sensor (IATS) uses a Negative Temperature Characteristics (NTC) thermistor and senses intake air temperature. Two intake air temperature sensors are installed in this engine.

IATS #1 in Mass Air Flow Sensor (MAFS) and IATS #2 in Boost Pressure Sensor (BPS) are located in front of and behind turbo-charger respectively. IATS #1 senses air temperature entering turbo-charger and the other (IATS #2) does air temperature coming out from the turbo-charger.

Comparing these air temperature values from both sensors, more accurate sensing of intake air temperature is possible. ECM uses these air temperature signals to perform EGR control correction and fuel injection quantity correction.



SPECIFICATION IATS #1 in MAFS

Temperature [˚ℂ(˚F)]	Resistance (kΩ)
-40(-40)	35.14 ~ 43.76
-20(-4)	12.66 ~ 15.12
0(32)	5.12 ~ 5.89
20(68)	2.29 ~ 2.55
40(104)	1.10 ~ 1.24
60(140)	0.57 ~ 0.65
80(176)	0.31 ~ 0.37

IATS #2 in BPS

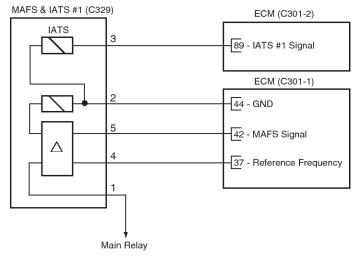
Temperature [˚℃(˚F)]	Resistance (kΩ)
-40(-40)	40.93 ~ 48.35
-20(-4)	13.89 ~ 16.03
0(32)	5.38 ~ 6.09
20(68)	2.31 ~ 2.57
40(104)	1.08 ~ 1.21
60(140)	0.54 ~ 0.62
80(176)	0.29 ~ 0.34

LFIG042A

FL-59

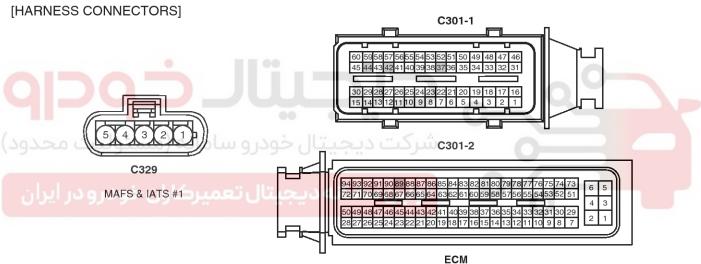
CIRCUIT DIAGRAM





[CONNECTION INFORMATION]

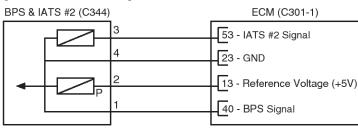
Terminal	Connected to	Function
1	Main Relay	Battery Voltage (B+)
2	ECM C301-1 (44)	Sensor Ground
3	ECM C301-2 (89)	IATS #1 Signal
4	ECM C301-1 (37)	Reference Frequency
5	ECM C301-1 (42)	MAFS Signal



SMGFL6111L

Fuel System

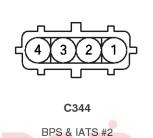


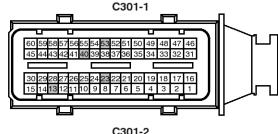


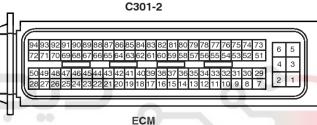
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C301-1 (40)	BPS Signal
2	ECM C301-1 (13)	Reference Voltage (+5V)
3	ECM C301-1 (53)	IATS #2 Signal
4	ECM C301-1 (23)	Sensor ground





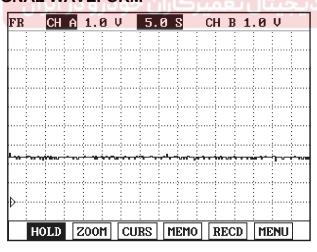




1 - - " | - - \ a'| - | - - - - - | | | | | - - - - - | |

SMGFL6113L

SIGNAL WAVEFORM



IATS signal should be smooth and continuous without any sudden changes.

After warmed-up, the IATS signal should not change significantly while ECTS signal drops.

COMPONENT INSPECTION

- 1. Turn ignition switch OFF.
- 2. Disconnect the MAFS (for IATS #1) or BPS (for IATS #2) connector.
- 3. Measure resistance between IATS signal terminal and sensor ground terminal.

LFIG043A

4. Check that the resistance is within the specification.

Specification: Refer to "SPECIFICATION".

FL-61

REPLACEMENT

MNOTICE

After replacing a Mass Air Flow Sensor (MAFS) or Intake Air Temperature Sensor (IATS)#1, MUST proceed below procedure.

- 1. Turn ignition switch OFF.
- 2. Connect a scan tool to Data Link Connector (DLC).
- 3. Turn ignition switch ON.
- 4. Select "ENGINE CONTROL".

05. FULL AUTO AIR/CON.

06. 4 WHEEL DRIVE(4WD)

07. IMMOBILIZER

08. BODY ELECTRIC. SYS(ETACS)

SMGFL6105L

5. Select "MANUAL SELECTION MODE".

KIA VEHICLE DIAGNOSIS

MODEL : OPTIMA / MAGENTIS
SYSTEM : ENGINE CONTROL

01. AUTO SEARCHING MODE

02. MANUAL SELECTION MODE

SMGFL6106L

Select "D 2.0L VGT DIESEL".

KIA VEHICLE DIAGNOSIS

MODEL : OPTIMA / MAGENTIS SYSTEM : ENGINE CONTROL

01.	D 2.0L VGT DIESEL	
02.	2.0L DIESEL	ALL
0 3.	2.0L CVVT	EOBD
04.	2.0L CVVT	GEN
0 5.	2.0L CVVT	LEAD
0 6.	2.7L V6	EOBD
07 .	2.7L V6	GEN
0 8.	2.7L V6	LEAD

SMGFL6107L

7. Select "COMPONET CHANGE ROUTNE"

	1. KIA VEHICLE DIAGNOSIS	A
MODEL	: OPTIMA / MAGENTIS	

SYSTEM: 2005

ENGINE CONTROL

04. FLIGHT RECORD

05. ACTUATION TEST

06. SIMU-SCAN

07. ECU INFORMATION

08. INJECTOR CORRECTION

09. CPF SERVICE REGENERATION

10. COMPONENT CHANGE ROUTINE

11. COMPRESSION TEST

SMGFL6108L

8. Select "AIR FLOW SENSOR CHANGE".

1.10 . COMPONENT CHANGE ROUTINE

MODEL : OPTIMA / MAGENTIS

SYSTEM: 2005

ENGINE CONTROL

01. ECU CHANGE

02. LAMBDA SENSOR CHANGE

03. RAIL PRESSURE SENSOR CHANGE

04. AIR FLOW SENSOR CHANGE

05. CPF CHANGE

06. D/PRESSURE SENSOR CHANGE

07. SWIRL CONTROL VALVE CHANGE

SMGFL6112L

Fuel System

9. Press "ENTER" key.

AIR FLOW SENSOR CHANGE

IN THIS MODE, CAN RESET THE STORED DRIFT VALUES OF HOT FILM AIR FLOW SENSOR IN EEPROM

PRESS [ENTER] KEY

AIR FLOW SENSOR CHANGE

IN THIS MODE, CAN RESET THE STORED DRIFT VALUES OF HOT FILM AIR FLOW SENSOR IN EEPROM

IG KEY ON BEFORE IG KEY

OFF FOR 10SEC

ودر و سامانه (مسئولیت محدود

LFIG129A

10. Wait 10 seconds with IG ON.

11. Turn ignition switch off.



FL-63

Engine Coolant Temperature Sensor (ECTS)

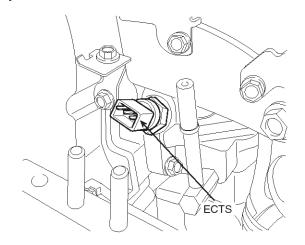
INSPECTION

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 5V in the ECM is supplied to the ECTS via a resistor in the ECM.

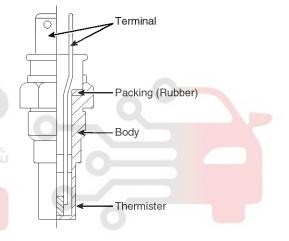
That is, the resistor in the ECM and the thermistor in the ECTS are connected in series. When the resistance value of the thermistor in the ECTS changes according to the engine coolant temperature, the output voltage also changes. During cold engine operation the ECM increases the fuel injection duration and controls the ignition timing using the information of engine coolant temperature to avoid engine stalling and improve drivability.

، دیچیتال خودر و سامانه (مسئولیت محدود

ساما<mark>نه دیجیتال تعمیرکاران خودرو در ایرا</mark>



LFIG008A



FGRF241A

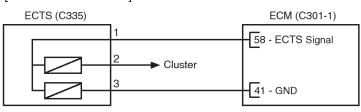
SPECIFICATION

Temperature [˚ℂ(˚F)]	Resistance(^{kΩ})
-40(-40)	48.14
-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

Fuel System

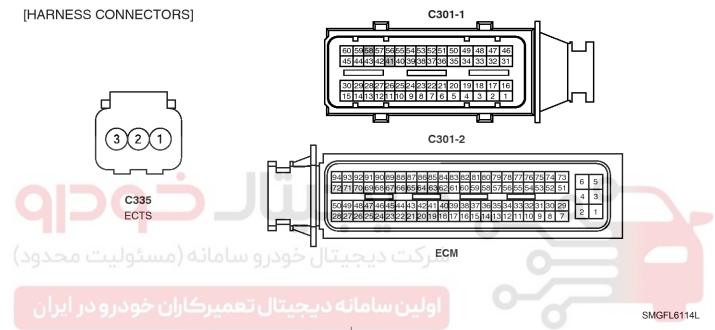
CIRCUIT DIAGRAM





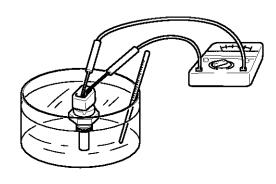
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C301-1 (58)	ECTS Signal
2	Cluster	-
3	ECM C301-1 (41)	Sensor ground



COMPONENT INSPECTION

- 1. Turn ignition switch OFF.
- 2. Disconnect the engine coolant temperature sensor connector.
- 3. Remove the sensor.
- After immersing the thermistor of the sensor into engine coolant, measure resistance between ECTS signal terminal and ground terminal.



EFNF541A

5. Check that the resistance is within the specification.

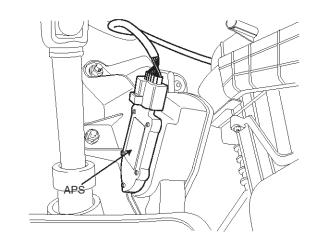
Specification: Refer to "SPECIFICATION".

FL-65

Accelerator Position Sensor (APS)

INSPECTION

On electronic injection systems, there is no longer a load lever that mechanically controls the fuelling. The flow is caculated by the ECM depending on a number of parameters, including pedal position, which is measured using a potentiometer. The pedal sensor has two potentio-meters whoses slides are mechanically solid. The two potentiometers are supplied from distinct and different power sources so there is built in redundancy of information giving reliable driver's request information. A voltage is generated across the potentiometer in the acceleration position sensor as a function of the accelerator-pedal setting. Using а peogrammed characteristic curve, the pedal's position is then calculated from this voltage.

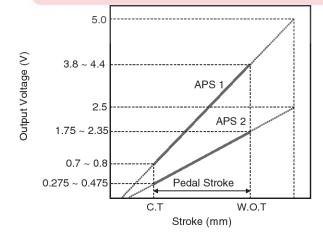


AFLG001A

SPECIFICATION

Took Condition	Output Voltage(V)	
Test Condition	APS 1	APS 2
Idle	0.7 ~ 0.8	0.275 ~ 0.475
Fully depressed	3.8 ~ 4.4	1.75 ~ 2.35

مانه (مسئو _{Item} s محدود)	Specification	
	APS 1	APS 2
Potentiometer Resistance (^{kΩ})	0.7 ~ 1.3	1.4 ~ 2.6

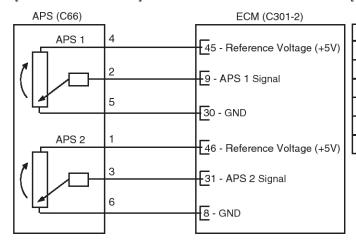


LFIG092A

Fuel System

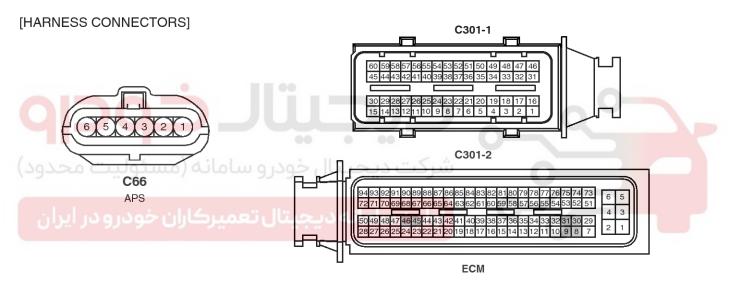
CIRCUIT DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C301-2 (31)	APS 2 Signal
2	ECM C301-2 (8)	APS 2 Ground
3	ECM C301-2 (9)	APS 1 Signal
4	ECM C301-2 (30)	APS 1 Ground
5	ECM C301-2 (45)	APS 1 Reference Voltage (+5V)
6	ECM C301-2 (46)	APS 2 Reference Voltage (+5V)



SMGFL6117L

FL-67

SIGNAL WAVEFORM

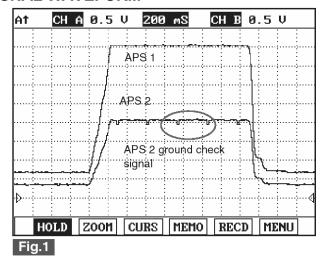


Fig.1) APS 1 and APS 2 signals are measured simultaneously, Check if output value is rising and APS 2 is 1/2 of APS 1 signal.

LFIG541A

COMPONENT INSPECTION

- 1. Turn ignition switch OFF.
- 2. Disconnect the accelerator position sensor connector.
- 3. Measure resistance between voltage supply terminal and ground terminal of APS1.
- 4. Measure resistance between voltage supply terminal and ground terminal of APS2.

Specification: Refer to "SPECIFICATION".



Fuel System

Heated Oxygen Sensor (HO2S)

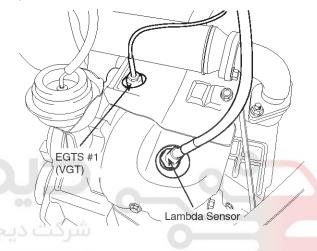
INSPECTION

Lambda Sensor is installed on exhaust manifold and is a linear oxygen sensor. It senses oxygen density of exhaust gas in order to control EGR acculately through fuel correction and also limits smoke which is generated by reach air-fuel mixture at high engine load condition. ECM controls pumping current in order to fit λ -value from linear lambda sensor to 1.0.

Lean air-fuel mixture(1.0 < λ < 1.1): ECM supplies pumping current to lambda sensor (+pumping current) and activates it for lambda sensor to have the characteristic at λ =1.0 (0.0 pumping current). With the value of pumping current supplied to lambda sensor, ECM detects lambda density of exhaust gas.

Rich air-fuel mixture(0.9 < λ < 1.0): ECM takes away pumping current from lambda sensor (-pumping current) and deactivates it for lambda sensor to have the characteristic at λ =1.0 (0.0 pumping current). With the value of pumping current taken away from lambda sensor, ECM detects lambda density of exhaust gas.

This performance is the most active and fast at normal operating temperature ($450^{\circ}\text{C} \sim 600^{\circ}\text{C}$) thus, in order to reach normal operating temp. and last at that temperature, a heater (heating coil) is integrated with lambda sensor. The heater coil is controlled by ECM as Pulse With Modulator (PWM). The resistance of heater coil is low when coil is cold thus, current through it increases while resistance is high when coil is hot thus, current decreases. With this principle, temperature of lambda sensor is measured and lambda sensor heater operation varies based on the data.



SMGFL6129L

ولین سامانه دیجیتال تعمیرکاران خودSPECIFICATION

Sensor	
λ Value (A/F Ratio)	Pumping Current (A)
0.65	-2.22
0.70	-1.82
0.80	-1.11
0.90	-0.50
1.01	0.00
1.18	0.33
1.43	0.67
1.70	0.94
2.42	1.38
Air (Atmosphere)	2.54

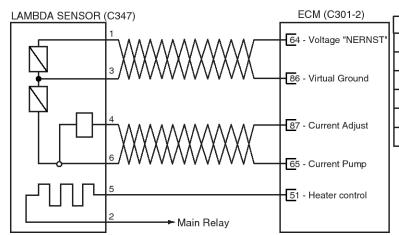
Temperature [°C(°F)]	Heater Resistance(Ω)
20 (68)	9.2
100 (212)	10.7
200 (392)	13.1
300 (572)	14.6
400 (752)	17.7
500 (932)	19.2
600 (1,112)	20.7
700 (1,292)	22.5

LFIG062A

FL-69

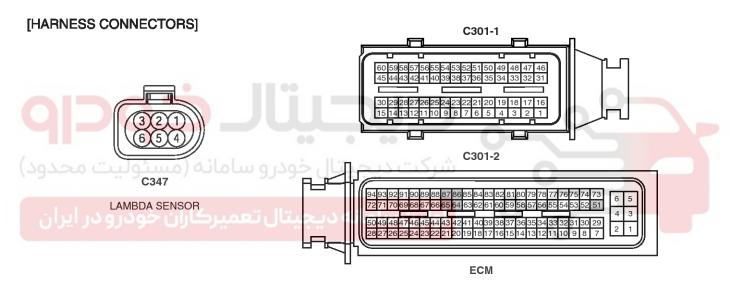
CIRCUIT DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

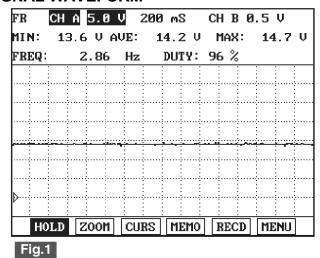
Terminal	Connected to	Function
1	ECM C301-2 (64)	Voltage "NERNST"
2	Main Relay	Battery Voltage (B+)
3	ECM C301-2 (86)	Virtual Ground
4	ECM C301-2 (87)	Current Adjust
5	ECM C301-2 (51)	Heater control
6	ECM C301-2 (65)	Current Pump

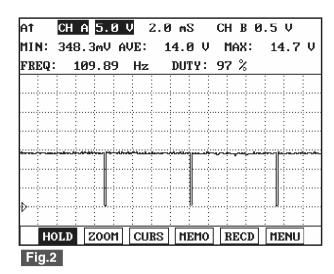


SMGFL6130L

Fuel System

SIGNAL WAVEFORM





- Fig.1) Waveform of Lambda sensor heater power. It is battery voltage.
- Fig.2) Waveform of Lambda sensor heater control at cold idle.(duty increases to approx. 40% at heater operation.)

LFIG200A



سرحت حيجيتان حودرو ساسان محتوديت تتحدود

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران



FL-71

REPLACEMENT

MNOTICE

After replacing a Lambda Sensor, MUST proceed below procedure.

- 1. Turn ignition switch OFF.
- 2. Connect a scan tool to Data Link Connector (DLC).
- 3. Turn ignition switch ON.
- 4. Select "ENGINE CONTROL".

MIA VEHICLE DIAGNOSIS

MODEL : OPTIMA / MAGENTIS

1. ENGINE CONTROL

2. AUTOMATIC TRANSAXLE

- 04. SRS-ALRBAG
- 05. FULL AUTO AIR/CON.
 06. 4 WHEEL DRIVE(4WD)
- 07. IMMOBILIZER
- 08. BODY ELECTRIC. SYS(ETACS)

03. BRAKE SYS(ABS/TCS/ESP)

SMGFL6105L

5. Select "MANUAL SELECTION MODE".

MODEL : OPTIMA / MAGENTIS

SYSTEM : ENGINE CONTROL

01. AUTO SEARCHING MODE

02. MANUAL SELECTION MODE

SMGFL6106L

Select "D 2.0L VGT DIESEL".

KIA VEHICLE DIAGNOSIS

MODEL : OPTIMA / MAGENTIS SYSTEM : ENGINE CONTROL

01. D 2.0L VGT D) I ESEL
02. 2.0L DIESEL	ALL
03. 2.0L CVVT	EOBD
04. 2.0L CVVT	GEN
05. 2.0L CVVT	LEAD
06. 2.7L V6	EOBD
07. 2.7L V6	GEN
Ø8. 2.7L U6	LEAD

SMGFL6107L

7. Select "COMPONET CHANGE ROUTNE"

1. KIA VEHICLE DIAGNOSIS

MODEL : OPTIMA / MAGENTIS

SYSTEM: 2005

ENGINE CONTROL

- **04. FLIGHT RECORD**
- **05. ACTUATION TEST**
- 06. SIMU-SCAN
- 07. ECU INFORMATION
- **08. INJECTOR CORRECTION**
- 09. CPF SERVICE REGENERATION

10. COMPONENT CHANGE ROUTINE

11. COMPRESSION TEST

SMGFL6108L

8. Select "LAMBDA SENSOR CHANGE".

1.10 . COMPONENT CHANGE ROUTINE

MODEL : OPTIMA / MAGENTIS

SYSTEM: 2005

ENGINE CONTROL

01. ECU CHANGE

02. LAMBDA SENSOR CHANGE

- 03. RAIL PRESSURE SENSOR CHANGE
- 04. AIR FLOW SENSOR CHANGE
- 05. CPF CHANGE
- 06. D/PRESSURE SENSOR CHANGE
- 07. SWIRL CONTROL VALUE CHANGE

SMGFL6131L

Fuel System

9. Press "ENTER" key.

LAMBDA SENSOR CHANGE(LSU)

IN THIS MODE, CAN SET ZERO THE LAMBDA SENSOR PARAMETERS FOR THE CHANGED SENSOR.

PRESS [ENTER] KEY

LAMBDA SENSOR CHANGE(LSU)

IN THIS MODE, CAN SET ZERO THE LAMBDA SENSOR PARAMETERS FOR THE CHANGED SENSOR.

IG KEY ON BEFORE IG KEY

OFF FOR 10SEC

LFIG125A

10. Wait 10 seconds with IG ON.

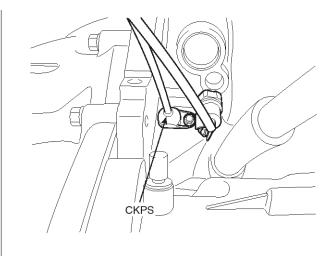
11. Turn ignition switch off.

FL-73

Crankshaft Position Sensor (CKPS)

INSPECTION

Piston position on combustion chamber is the substantial to define the starting of injection timing. All engine pistons are connected to crankshaft by connecting rod. Sensor on crankshaft can supply the informations concerning all piston positions, revolution speed is defined by revolution perminute of crankshaft. Prior input variable is determined at ECM by using signal induced from crankshaft position sensor.



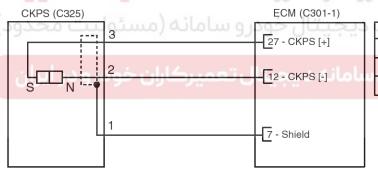
LFIG046A

SPECIFICATION

Items	Specification
Coil Resistance (Ω)	774 ~ 946Ω [20˚C (68˚F)]

CIRCUIT DIAGRAM

[CIRCUIT DIAGRAM]

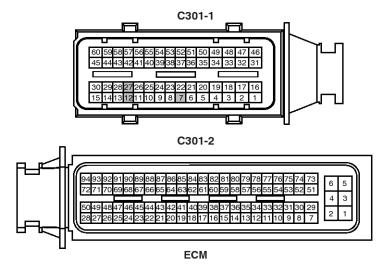


[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C301-1 (7)	Sensor Shield
2	ECM C301-1 (12)	CKPS [-] Signal
3	ECM C301-1 (27)	CKPS [+] Signal

[HARNESS CONNECTORS]

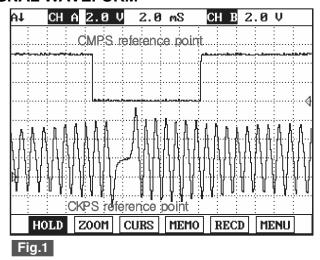




Fuel System

SMGFL6116L

SIGNAL WAVEFORM



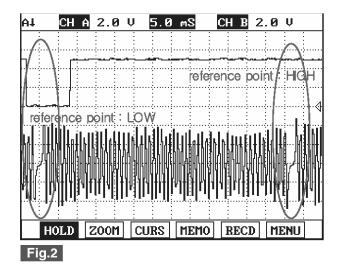


Fig.1) This shows waveform of Crank Shaft Position Sensor and Cam Shaft Position Sensor simulatneously. The middle area indicates reference points of Crank Shaft Position Sensor and Cam Shaft Position Sensor.

Fig.2) Crank Shaft Position Sensor and Cam Shaft Position Sensor signal are measured simultaneously. Cam Shaft Position Sensor

signal is outputted once when Crank Shaft Position sensor signal is outputted twice. LOW and HIGH output of Cam Shaft Position sensor reference point is detected at Crank Shaft Position sensor reference point.

(Injection sequence is determined based on LOW and HIGH signal of Cam Shaft Position Sensor reference point as detecting cylinder position.)

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

LFIG299A

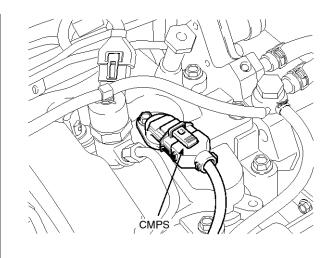
ولین سامانه دیجیتال تعمیرکاران خودرو در ایران

FL-75

Camshaft Position Sensor (CMPS)

INSPECTION

Camshaft Position Sensor (CMPS) is a hall sensor and detects the camshaft position by using a hall element. It is related with Crankshaft Position Sensor (CKPS) and detects the piston position of the each cylinder which the CKPS can't detect. The two CMPS are installed on engine head cover and uses a target wheel installed on the camshaft. This sensor has a hall-effect IC which output voltage changes when magnetic field is made on the IC with current flow. So the sequential injection of the 4 cylinders is impossible without CMPS signal.



LFIG010A

SPECIFICATION

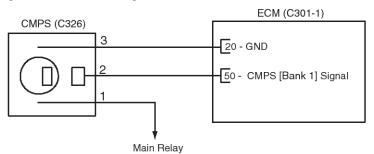
Level	Output Pulse (V)	
High	12V	
Low	0V	
Items	Specification	
Air Gap	1.5 ± 0.1 mm	

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

Fuel System

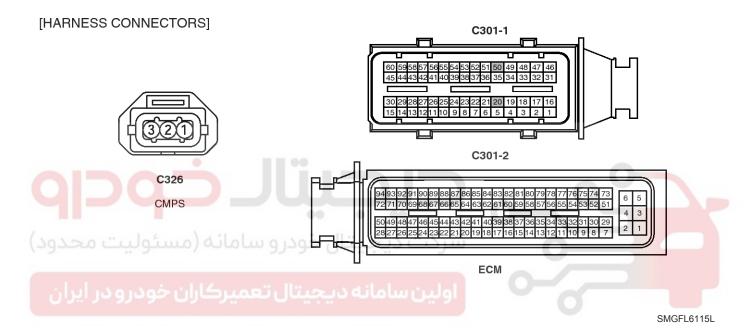
CIRCUIT DIAGRAM





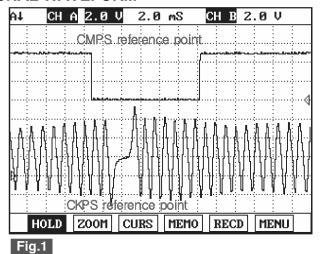
[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	Main Relay	Battery Voltage
2	ECM C301-1 (50)	CMPS Signal
3	ECM C301-1 (20)	GND



FL-77

SIGNAL WAVEFORM



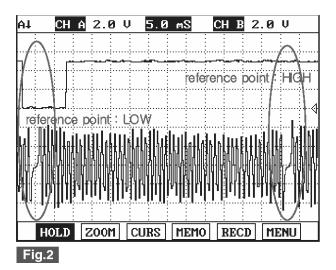


Fig.1) This shows waveform of Crank Shaft Position Sensor and Cam Shaft Position Sensor simulatneously. The middle area indicates reference points of Crank Shaft Position Sensor and Cam Shaft Position Sensor.

Fig.2) Crank Shaft Position Sensor and Cam Shaft Position Sensor signal are measured simultaneously.

Cam Shaft Position Sensor

signal is outputted once when Crank Shaft Position sensor signal is outputted twice. LOW and HIGH output of Cam Shaft Position sensor reference point is detected at Crank Shaft Position sensor reference point.

(Injection sequence is determined based on LOW and HIGH signal of Cam Shaft Position Sensor reference point as detecting cylinder position.)

LFIG299A

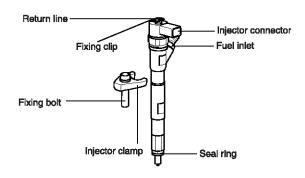
شرکت دیجیتال خودرو سامانه (مسئولیت محدود

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

Fuel System

Injector

DESCRIPTION

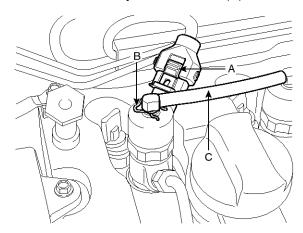


LFIG101A

REMOVAL

WARNING

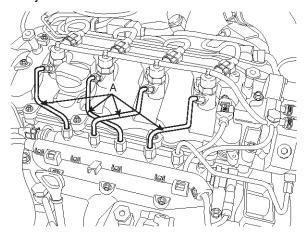
- Common Rail Fuel Injection System is subject to extremely high pressure (Approximately 1,600 bar)
- Never perform any work on injection system with engine running or within 30 seconds after the engine stops.
- Always pay attention to safety precaution.
- Ensure the absolute cleanliness.
- It is not recommended to remove the injectors without any notice.
- 1. Disconnect the injector connector (A).



LFIG084A

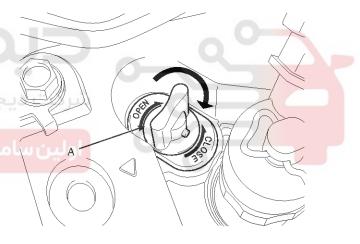
2. After removing the clip (B), disconnect the retun hose (C) from the injectors

3. Disconnect the high pressure pipe (A) connecting the injectors with the common rail.



LFIG085A

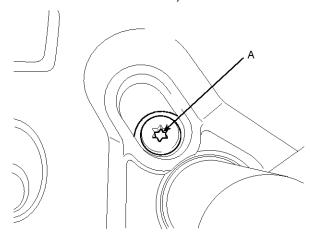
4. Rotate the lever (A) clockwise and pull it upward.

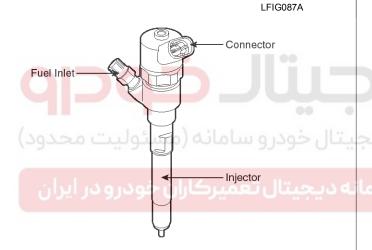


SMGFL6142L

FL-79

 Unscrew the clamp tightening bolt (A) and pull the injector upward with the "Injector Remover" and the "Injector Remover Adapter" (Refer to "SPECIAL SERVICE TOOL" section).





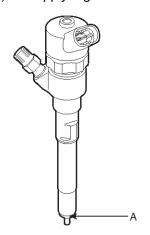
LFIG088A

INSTALLATION

 Install the injector according to the reverse order of "REMOVAL" procedure.

MOTICE

When installing the injector, MUST REPLACE the O-ring (A) and apply a grease to that.



LFIG089A

MOTICE

When installing the high pressure pipe, apply the specified tightening torques to the flange nuts of the injectors and the common rail side with SST (Refer to below table).

Item	Dimension SST N			
Flange Nut (Inj - ector Side)	14 mm (0.551 in)	09314-27110		
Flange Nut (Co- mmon Rail Side)	17 mm (0.669 in)	09314-27120		

- \cdot Injector clamp mounting bolts: 24.5 $^{\sim}$ 28.4 N·m (2.5 $^{\sim}$ 2.9 kgf·m, 18.1 $^{\sim}$ 20.1 lbf·ft)
- \cdot High pressure pipe flange nuts (Injectors \leftrightarrow Common Rail): 24.5 \sim 28.4 N·m (2.5 \sim 2.9 kgf·m, 18.1 \sim 20.1 lbf·ft)

Fuel System

REPLACEMENT

ACAUTION

After replacing (an) injector(s), MUST input the injector data (7 digit) into the ECM.

- 1. Turn ignition switch OFF.
- 2. Replace the injector with a new one according to the "REMOVAL" and "INSTALLATION" procedures.
- 3. Connect a scan tool to Data Link Connector (DLC) and turn ignition switch on.
- 4. Select "ENGINE CONTROL".

MODEL : OPTIMA / MAGENTIS 01. ENGINE CONTROL 02. AUTOMATIC TRANSAXLE 03. BRAKE SYS(ABS/TCS/ESP) 04. SRS-AIRBAG 05. FULL AUTO AIR/CON. 06. 4 WHEEL DRIVE(4WD) 07. IMMOBILIZER

SMGFL6105L

5. Select "MANUAL SELECTION MODE".

KIA VEHICLE DIAGNOSIS

08. BODY ELECTRIC. SYS(ETACS)

MODEL : OPTIMA / MAGENTIS
SYSTEM : ENGINE CONTROL

01. AUTO SEARCHING MODE

02. MANUAL SELECTION MODE

SMGFL6106L

6. Select "D 2.0L VGT DIESEL".

MODEL : OPTIMA / MAGENTIS
SYSTEM : ENGINE CONTROL

01.	D Z.ØL VGT DIESEL	
02.	2.0L DIESEL	ALL
03.	2.0L CVVT	EOBD
04.	2.0L CVVT	GEN
0 5.	2.0L CVVT	LEAD
0 6.	2.7L V6	EOBD
07.	2.7L V6	GEN
0 8.	2.7L V6	LEAD

SMGFL6107L

7. Select "INJECTOR CORRECTION".

7. Select INJECTOR CORRECTION.	
1. KIA VEHICLE DIAGNOSI	S 🛦
MODEL : OPTIMA/MAGENTIS	
SYSTEM : 2005	
ENGINE CONTROL	
04. FLIGHT RECORD	
05. ACTUATION TEST	
06. SIMU-SCAN	
07. ECU INFORMATION	
08. INJECTOR CORRECTION	
09. CPF SERVICE REGENERATI	ON
10. COMPONENT CHANGE ROUTI	NE

SMGFL6143L

- 8. Press "ENTER" key.
- * CONDITION: IG. KEY ON(ENGINE STOP)

11. COMPRESSION TEST

- 1. IF THE INJ. IS CHANGED, THE INJ. CORRECTION FUNC SHOULD BE PERFORM TO CONTROL THE NOR. FUEL INJ.
- 2. TO INPUT THE INJECTOR NUMBER, PRESS SHIFT KEY AND SELECT THE CYL. BY ARROW KEY AT THE SAME TIME. AND INPUT THE INJ. DATA BY [F1]~[F6], DIGIT KEY. PRESS [ENTER].
- AFTER COMPLETE, TURN THE IG. KEY OFF AND CHECK THE SYSTEM AFTER 10 SEC.

LFIG135A

FL-81

9. Input the injector data (7 digit) written on the top of each injector with function keys ([F1] \sim [F6]) and number keys.

INJECTOR 1	AAAAAA	
INJECTOR 2	AAAAAA	
INJECTOR 3	AAAAAA	
INJECTOR 4	AAAAAA	

- SELECT THE CYLINDER BY SHIFT+ARROW KEY AND INPUT THE DATA BY FI~F6 KEY AND PRESS [ENTER] KEY.

ABCD [EFGH] [IJKL] [MNOP] [QR-U] [VW-Z]

			7
INJECTOR 1	600000		
INJECTOR 2	AAAAAAA		
INJECTOR 3	AAAAAAA	•	
INJECTOR 4	AAAAAAA		
(محدود	ITING COMP	درو سامانهرا	•• • • ت ديجيتال خو
ABCD EFGH] IJKL MNC	P QR-U VW-Z	ن سامانه دیجیت

LFIG136A

MOTICE

When "WRITING FAIL" is displayed on the scan tool, input injector data (7 digits) of each cylinder into a new ECM again as prior procedure.

INJECTOR 1	AAAAAA				
INJECTOR 2	AAAAAAA				
INJECTOR 3	АААААА				
INJECTOR 4	AAAAAAA				
WRITING FAIL					
ABCD EFGI	I JKL MNO	P QR-U VW-Z			

LFIG137A

Fuel System

INSPECTION USING HI-SCAN(PRO)

Test mode

- COMPRESSION TEST
- IDLE SPEED COMPARISON
- INJECT QUANTITY COMPARISON

TEST PROCEDURE

 Connect Scan tool to the DLC and select "Vehicle" and "Engine Test Function".

1. HYUNDAI/KIA VEHICLE DIAGNOSIS

MODEL : VEHICLE NAME SYSTEM : ENGINE(DIESEL)

- 01. DIAGNOSISTIC TROUBLE CODE
- 02. CURRENT DATA
- 03. FLIGHT RECORD
- 04. ACTUATION TEST
- 05. SIMU-SCAN
- 06. IDENTIFICATION CHECK

07. ENGINE TEST FUNCTION

08. DATA SETUP(UNIT CONV.)

LFIG090A

2. Information for ECM version is displayed as below.

1.7. COMPRESSION TEST

SYSTEM IMFORMATION

P/N: ***** - ***** S/W: ******

This function is available

If you ready, press [ENTER].

<Available system>

1.7. COMPRESSION TEST

SYSTEM IMFORMATION

P/N: **** - **** S/W: ******

This function is not available.

Not all ECM version support

this function

If you ready, press [ENTER].

<Not available system>

LFIF660B

After pressing "[ENTER]" select "COMPRESSION TEST" mode and press "[ENTER]".

1.7. COMPRESSION TEST

01. COMPRESSION TEST

02. IDLE SPEED COMPARISON03. INJECT. QUANTITY COMPARISON

LFIF660D

4. Set the test condition described as below screen and then, crank engine. When engine stop message being appeared, stop cranking.

7.1. COMPRESSION TEST

This test is used for detecting cylinder specific engine speed without injection.

- * Test condition
 - Shift lever : P or N
 - Engine : Stop (IGN. ON)
 - Electrical Load : OFF

If you ready, now cranking, and stop cranking when stop message appear on the screen. Press [ENTER].

LFIF660E

FL-83

5. Press "ANAL" and the test result is appeared.

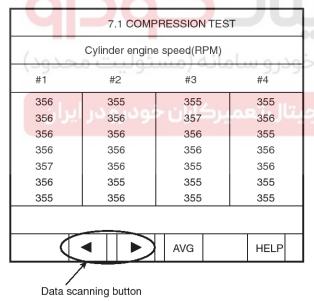
7.1 COMPRESSION TEST							
	Cylinder engine speed(RPM)						
#1	#1 #2 #3 #4						
356	355	355	355				
356	356	357	356				
356	356	356	355				
356	356	356	356				
357	356	355	356				
356	355	355	355				
355	356	355	355				
ANAL							

When the stop message appear, stop cranking.

LFIF660F

MOTICE

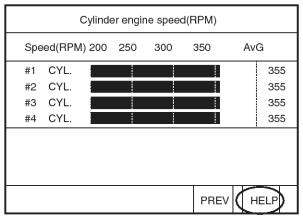
During cranking engine does not start.



LFIF660G

6. Press "AVG" and the data average of each cylinder is appeared.

Press "HELP" and description of the data is appeared.





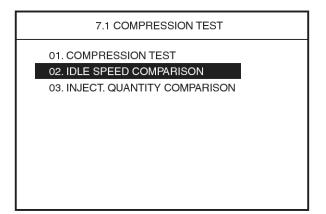
7.1 COMPRESSION TEST

- *The higher cylinder engine speed:
- >The low compression pressure.
- *It can help to identify the mechanical defects.

LFIF660H

PREV

7. After pressing "ESC", select "IDLE SPEED COMPARISON" and press "[ENTER]".



LFIF002A

Fuel System

8. Set the test condition described as below screen and press "[ENTER]".

7.2. IDLE SPEED COMPARISON

This test is used for detecting cylinder specific engine speed with injector energizing.
(Cylinder balancing function is deactivated.)

* Test condition

- Compression test: Normal

- Shift lever : P or N

- Engine : Idle

- Electrical Load: OFF

If you ready, Press [ENTER].

LFIF660J

9. The rpm data of each cylinder is appeared.

7.2 IDLE SPEED COMPARISON								
Cylinder engine speed(RPM)								
#1 #2 #3 #4								
790	790 800 752 770							
796	772							
794	794 800 752 770							
794	794 802 754 772							
794	802	754	770					
794	802	756	774					
792	802	752	772					
Analyze the test result.								
ANAL								



7.2 IDLE SPEED COMPARISON					
Cylinder engine speed(RPM)					
#1 #2 #3 #4					
784	774	788	764		
786	786 778 788		766		
786	776	788	766		
788	780	790	768		
784	776	786	764		
788	780	792	770		
786	786 776 788 766				
■ AVG HELP					

I FIF660I

10. Press "AVG" and teh data average of each cylinder is appeared.

Press "HELP" and description of the data is appeared.

Cylinder engine speed(RPM)					
Speed(RPM) 650 700 750 800 AVG.					
#1 CYL.					793
#2 CYL.					800
#3 CYL.					753
#4 CYL.					771
PREV HELP					



7.2 IDLE SPEED COMPARISON

- *The lower engine speed:
- ->The injector injects less quantity than other injectors.
- *The higher engine speed:
- ->The injector injects more quantity than other injectors.

LFIF660M

PREV

FL-85

11. After pressing "ESC", select "INJECT QUANTITY COMPARISON" and press "[ENTER]".

7.2 IDLE SPEED COMPARISON

01. COMPRESSION TEST

02. IDLE SPEED COMPARISON

03. INJECT. QUANTITY COMPARISON

FIF700A

12. Set the test condition described as below screen and press "[ENTER]".

7.3 INJECT. QUANTITY COMPARISON

This test is used for detecting cylinder specific quantity with individual energizing of injector. (Cylinder balancing function is activated.)

* Test condition

- Compression test : Normal

- Shift lever : P or N

- Engine : Idle

- Electrical Load : OFF

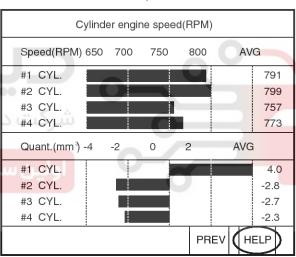
If you ready, Press [ENTER].

LFIF660O

13. The data of each cylinder about RPM and compensating injection quantity is appeared.

	7.3 INJECT. QUANTITY COMPARISON						
Eng. Speed(RPM)		Injection quantity(mm3)			mm3)		
#1	#2	#3	#4	#1	#2	#3	#4
792	800	758	774	4.0	-2.9	-2.8	-2.4
788	798	760	774	4.0	-2.9	-2.7	-2.4
794	802	758	776	4.0	-2.9	-2.7	-2.4
792	798	758	774	4.0	-2.8	-2.7	-2.4
788	798	758	772	4.0	-2.8	-2.6	-2.4
794	802	758	772	4.0	-2.8	-2.8	-2.5
790	798	754	770	4.0	-2.9	-2.8	-2.5
	Analyze the test result.						
AN	ANAL						





<Abnormal state>

LFIF660P

Fuel System

14. Press "HELP" and description of the data is displayed as below.

7.3 INJECT. QUANTITY COMPARISON

- *The positive correction value:
- ->The fuel injection of the cylinder is less than that of other cylinder.
- *The negative correction value:
- ->The fuel injection of the cylinder is more than that of other cylinder.
- *Extreme correction value identifies a problematic injector.

After replacinga injector with new one, reset & confirm the engine condition.

LFIF660R

15. Replace the default injector, and then repeat previous test modes to check if the injector is normal.

COMPONENT INSPECTION

- 1. Turn ignition switch OFF.
- 2. Disconnect the injector connector.
- 3. Measure resistance between terminal 1 and 2.

Specification : 0.33Ω at 20 °C (68°F)

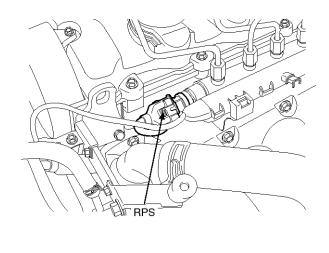


FL-87

Rail Pressure Sensor (RPS)

INSPECTION

Rail Pressure Sensor (RPS) is installed at the end of the common rail and measures the instantaneous fuel pressure in the common rail by using its diaphragm. Its sensing element (semiconductor device) mounted on the diaphragm converts the fuel pressure to an electric signal.



LFIG017A

SPECIFICATION

Test Condition	Rail pressure (bar)	Output Voltage (V)
Idle	220 ~ 320	Below 1.7
Fully depressed	1,800	Approx. 4.5

CIRCUIT DIAGRAM



RPS (C348)

3

8 - GND

1
28 - Reference Voltage (+5V)

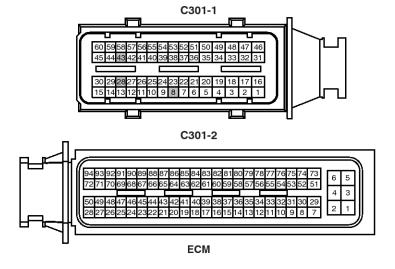
2
43 - RPS Signal

[CONNECTION INFORMATION]

Terminal	Connected to	Function
· 101	ECM C301-1 (28)	Reference Voltage (+5V)
2	ECM C301-1 (43)	RPS Signal
3	ECM C301-1 (8)	Sensor Signal

[HARNESS CONNECTORS]

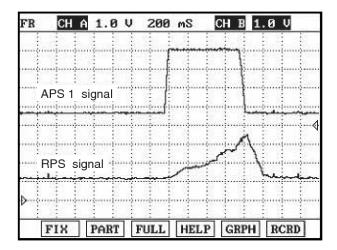




SMGFL6118L

Fuel System

SIGNAL WAVEFORM



Rail Pressure Sensor (RPS) is to provide to the ECM the voltage signal corresponding to rail pressure. The change in resistance is preportional to the rail pressure acting upon the diaphragm and rail pressure increases as load increases.

EFNF550A



اولین سامانه دیچیتال تعمیرکاران خودرو در ایران



FL-89

REPLACEMENT

MNOTICE

After replacing a Rail Pressure Sensor (RPS), MUST proceed below procedure.

- 1. Turn ignition switch OFF.
- 2. Connect a scan tool to Data Link Connector (DLC).

KIA VEHICLE DIAGNOSIS

- 3. Turn ignition switch ON.
- 4. Select "ENGINE CONTROL".

07. IMMOBILIZER

MODEL : OPTIMA / MAGENTIS

01. ENGINE CONTROL

02. AUTOMATIC TRANSAXLE

03. BRAKE SYS(ABS/TCS/ESP)

04. SRS-AIRBAG

05. FULL AUTO AIR/CON.

06. 4 WHEEL DRIVE(4WD)

SMGFL6105L

5. Select "MANUAL SELECTION MODE".

KIA VEHICLE DIAGNOSIS

08. BODY ELECTRIC. SYS(ETACS)

MODEL : OPTIMA / MAGENTIS SYSTEM : ENGINE CONTROL

01. AUTO SEARCHING MODE

02. MANUAL SELECTION MODE

SMGFL6106L

6. Select "D 2.0L VGT DIESEL".

KIA VEHICLE DIAGNOSIS

MODEL : OPTIMA / MAGENTIS SYSTEM : ENGINE CONTROL

01.	D 2.0L VGT DIESEL	
02.	2.0L DIESEL	ALL
0 3.	2.0L CUUT	EOBD
04.	2.0L CVVT	GEN
0 5.	2.0L CVVT	LEAD
06 .	2.7L V6	EOBD
07.	2.7L V6	GEN
0 8.	2.7L V6	LEAD

SMGFL6107L

7. Select "COMPONET CHANGE ROUTNE"

1. KIA VEHICLE DIAGNOSIS

: OPTIMA / MAGENTIS

SYSTEM : 2005

MODEL

ENGINE CONTROL

04. FLIGHT RECORD

05. ACTUATION TEST

06. SIMU-SCAN

07. ECU INFORMATION

08. INJECTOR CORRECTION

09. CPF SERVICE REGENERATION

10. COMPONENT CHANGE ROUTINE

11. COMPRESSION TEST

SMGFL6108L

8. Select "RAIL PRESSURE SENSOR CHANGE".

1.10 . COMPONENT CHANGE ROUTINE

MODEL : OPTIMA / MAGENTIS

SYSTEM: 2005

ENGINE CONTROL

01. ECU CHANGE

02. LAMBDA SENSOR CHANGE

03. RAIL PRESSURE SENSOR CHANGE

04. AIR FLOW SENSOR CHANGE

05. CPF CHANGE

06. D/PRESSURE SENSOR CHANGE

07. SWIRL CONTROL VALVE CHANGE

SMGFL6112L

Fuel System

9. Press "ENTER" key.

RAIL PRESSURE SENSOR CHANG(RPS)

IN THIS MODE, CAN SET THE FMA (FUEL MEAN ADAPTATION) VALUES AND ZERO SET THE ADAPTATION TIME FOR THE CHANGED RAIL PRESSURE SENSOR.

PRESS [ENTER] KEY

RAIL PRESSURE SENSOR CHANG(RPS)

IN THIS MODE, CAN SET THE FMA (FUEL MEAN ADAPTATION) VALUES AND ZERO SET THE ADAPTATION TIME FOR THE CHANGED RAIL PRESSURE SENSOR.

IG KEY ON BEFORE IG KEY

OFF FOR 10SEC

LFIG127A

10. Wait 10 seconds with IG ON.

11. Turn ignition switch off.

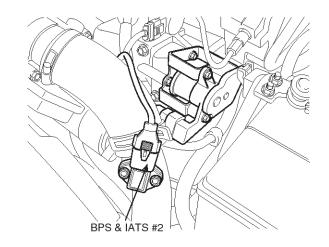


FL-91

Boost Pressure Sensor (BPS)

INSPECTION

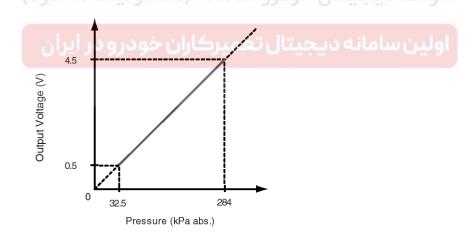
Boost pressure sensor (BPS) is installed on surge tank to measure the absolute intake manifold pressure. BPS input voltage is changed in proportion with absolute pressure in manifold. This information is used to control Variable Geometery Turbocharger (VGT) by ECM.



LFIG044A

SPECIFICATION

Pressure (kPa)	Output Voltage (V)
70	1.02 ~ 1.17
140	2.13 ~ 2.28
210	3.25 ~ 3.40
270	4.20 ~ 4.35

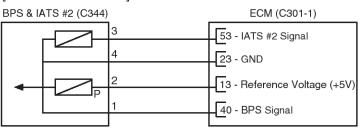


LFIG038A

Fuel System

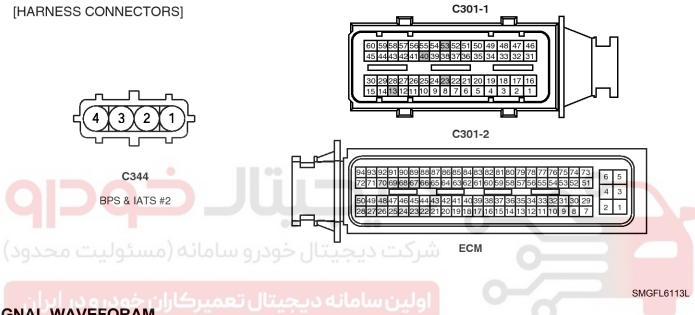
CIRCUIT DIAGRAM



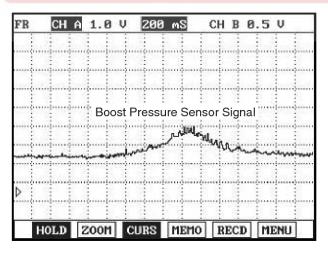


[CONNECTION INFORMATION]

Terminal Connected to		Function
1	ECM C301-1 (40)	BPS Signal
2	ECM C301-1 (13)	Reference Voltage (+5V)
3	ECM C301-1 (53)	IATS #2 Signal
4	ECM C301-1 (23)	Sensor ground



SIGNAL WAVEFORAM



This illustration represents waveform of BPS when accelerating and decelerating.

LFIG040A

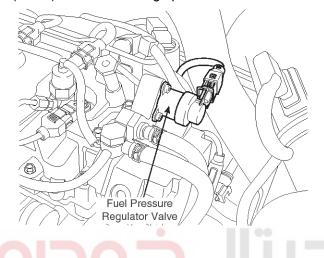
FL-93

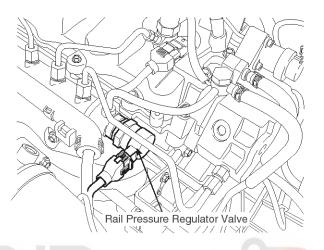
Rail Pressure Regulator Valve

INSPECTION

The Fuel Pressure Regulator Valve and the Rail Pressure Regulator Valve are installed on high pressure pump and common rail respectively. These valves control fuel inlet (feed) from fuel tank via fuel filter and outlet (return) to fuel tank of high pressure fuel circuit.

This system is called "Dual Fuel Pressure Control System" and can precisely and quickly control the fuel pressure in accordance with various engine conditions by controlling the fuel inlet and outlet simultaneously.





SPECIFICATION

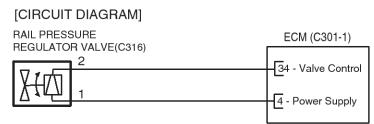
LFIG114A

(NON SOUTH OF STREET ST	Specification
Coil Resistance (Ω)	3.42 ~ 3.78Ω [20°C (68°F)]

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Fuel System

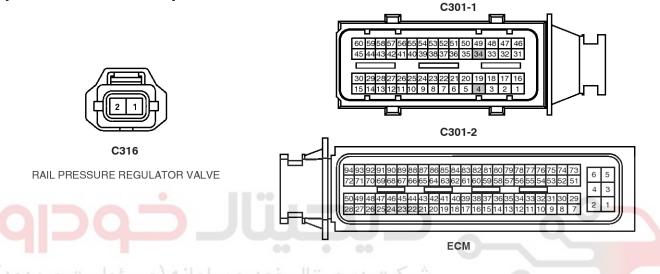
CIRCUIT DIAGRAM



[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C301-1 (4)	Battery Voltage (B+)
2	ECM C301-1 (34)	Valve Control





SIGNAL WAVEFORM

SMGFL6121L

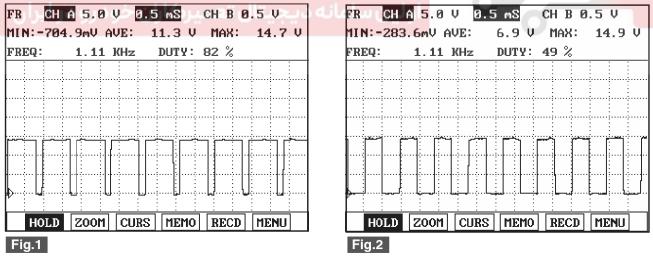


Fig.1) Waveform of rail pressure regulator valve at idle. It shows approx. 17% duty((-) duty.

Fig.2) Waveform of rail pressure regulator valve as accelerating. Approx. 50% duty is outputted as engine load increases. (When rail pressure increases as accelerating, rail pressure regulator valve duty(current) rises.)

LFIG377A

COMPONENT INSPECTION

- 1. Turn ignition switch OFF.
- Disconnect the rail pressure regulator valve connector.
- 3. Measure resistance between terminal 1 and 2 of the valve.

Specification: Refer to "SPECIFICATION".

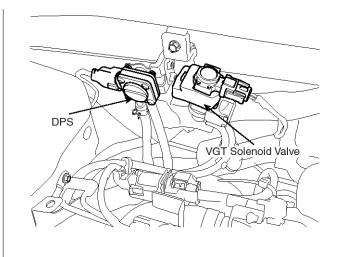
FL-95

VGT Control Solenoid Valve

INSPECTION

Variable Geometry Turbo-charger (VGT) is used to charge additional air into combustion chamber for improvement of combustion efficiency.

ECM controls the VGT with controlling duty of the VGT control solenoid valve according to engine load.



SMGFL6144L

SPECIFICATION

Items	Specification
Coil Resistance (Ω)	14.7 ∼ 16.1Ω [20°C(68°F)]

CIRCUIT DIAGRAM

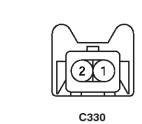
[CIRCUIT DIAGRAM]

[CONNECTION INFORMATION]

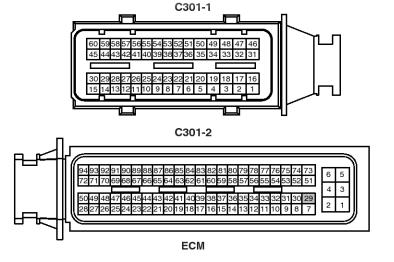


Terminal	Connected to	Function
1	ECM C301-2 (29)	Valve Control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]



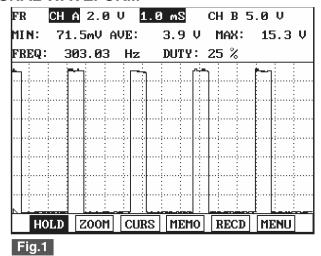
VGT CONTROL SOLENOID VALVE



SMGFL6128L

Fuel System

SIGNAL WAVEFORM



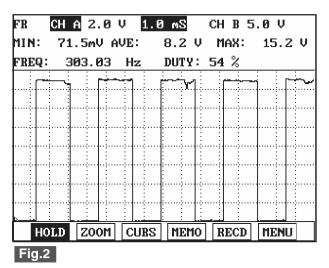


Fig.1) VGT actuator output waveform at 76% duty((-)duty. Duty decreases as boost pressure increases.

Fig.2) VGT actuator duty((-)duty) decreases as accelerating.

LFIG369A

COMPONENT INSPECTION

- 1. Turn ignition switch OFF.
- 2. Disconnect the VGT control solenoid valve connector.
- 3. Measure resistance between terminal 1 and 2 of the

Specification: Refer to "SPECIFICATION".

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FL-97

Throttle Flap Control Solenoid Valve

INSPECTION

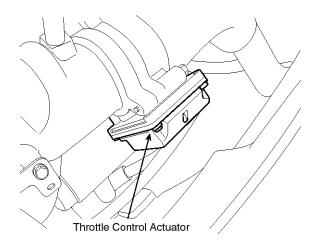
The Throttle Control Actuator is mounted on throttle body of diesel engine and controls throttle valve according to PWM (Pulse With Modulation) signal from ECM.

It consists of:

- a DC motor which actuates the throttle valve.
- a 2-step gear (transmission ratio = 1:40) which is located in between the DC motor and the throttle valve and increases torque of the DC motor,
- a position sensor which is a hall-effect sensor and detects status of the throttle valve.
- an electric control unit which is a micro-controller and drives the DC motor by the PWM (Pulse With Modulation) signal from the ECM,
- and a reset spring which resets the de-energized throttle valve to its open position.

Its function is described below:

- Anti-judder function: When engine is shut off, the ECM can prevent intake air from entering to intake manifold by fully closing the throttle valve for 1.5 seconds (95% < Duty < 97%) to reduce engine vibration.
- 2. Intake air control for EGR: When exhaust gas pressure is equal to or lower than intake air pressure (for example, when low engine speed), the exhaust gas would not enter to the intake manifold. At this time, the ECM partially closes the throttle valve (5% < Duty < 94%) to reduce the intake air quantity. The intake air pressure thus is lower than the exhaust gas pressure.
- 3. Exhaust gas temperature control for CPF regeneration: When the Catalyzed Particulate Filter (CPF) is need to regenerate, the ECM partially closes the throttle valve (5% < Duty < 94%) to reduce the intake air quantity. At this time, the air-fuel ratio would become rich and the exhaust gas temperature would be high enough to burn the soot inside the CPF.



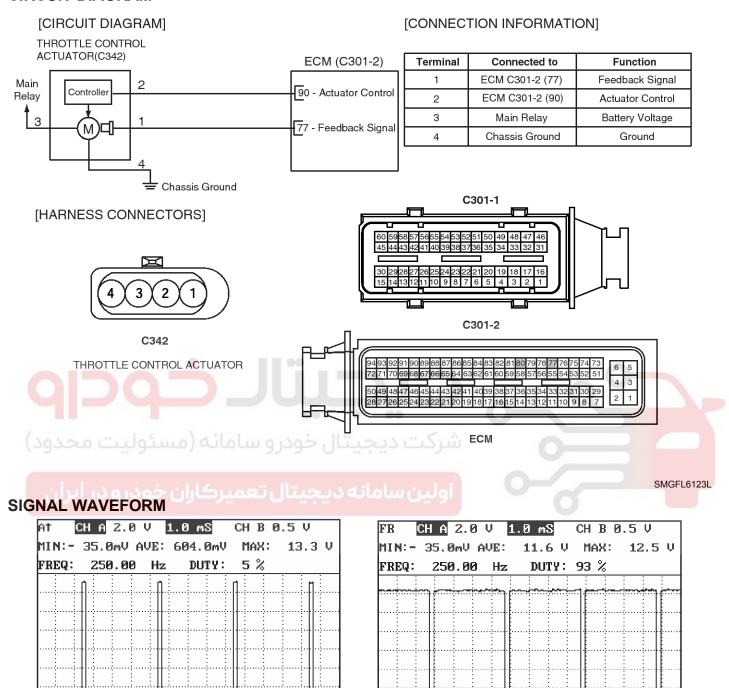
LFIG021A

SPECIFICATION

Duty (%)	Throttle Valve Position	
5	Open	
5~94	Normal operation (Partially open in proportion to duty value)	
94	Closed	
94 ~ 95	Maintaining the last valid position	
95 ~ 97	Fully closed	

Fuel System

CIRCUIT DIAGRAM



HOLD ZOOM

Fig.2

CURS R-ST RECD

Fig.1) Waveform of Throttle control actuator at wide open(at idle): At IG KEY "ON", ENGINE "ON", 5% duty is outputted continuously.

RECD

Fig.2) Waveform of Throttle control actuator at closed position : At IG KEY "OFF", 93% duty is outputted for about 1 sec.

R-ST

LFIG529A

HOLD

Fig.1

ZOOM

CURS

FL-99

COMPONENT INSPECTION

- 1. Turn ignition switch OFF.
- 2. Disconnect the electric throttle control actuator connector.
- 3. Measure resistance between terminal 1 and 2 of the valve.

Specification: Refer to "SPECIFICATION".



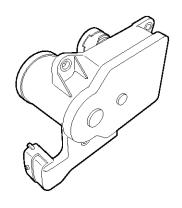
Fuel System

Variable Swirl Actuator

DESCRIPTION

Variable Swirl Control Actuator consists of DC motor and position sensor which detects the position of the swirl valve.

At idle or below 3000rpm, the swirl valve is closed. This swirl effect increases air flow rate.



SZZF19100D

	Low and Middle Load	High Load
Engine speed	Below 3000rpm	Above 3000rpm
Valve operation	CLOSE	OPEN
Description illustration		
Fail-safe	Fully o	ppened

MOTICE

To prevent the swirl valve and the shaft from being stuck by foreign material and to learn max opening and closing position of the valve, the ECM fully opens and closes the valve twice when engine is being stopped.

SPECIFICATION

Motor

Items	Specification
Coil Resistance (Ω)	3.4 ~ 4.4♀ [20℃(68°F)]

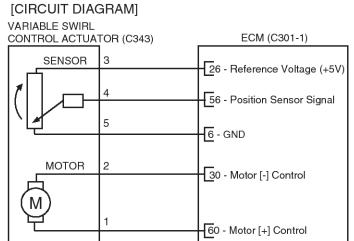
Position Sensor

Items	Specification	
Coil Resistance (Ω)	3.44 ~ 5.16 Ω [20℃(68°F)]	

LFIG058A

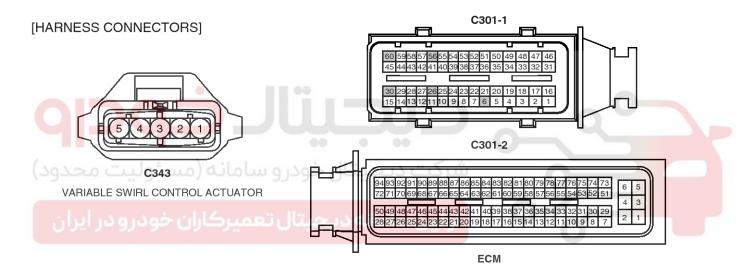
FL-101

CIRCUIT DIAGRAM



[CONNECTION INFORMATION]

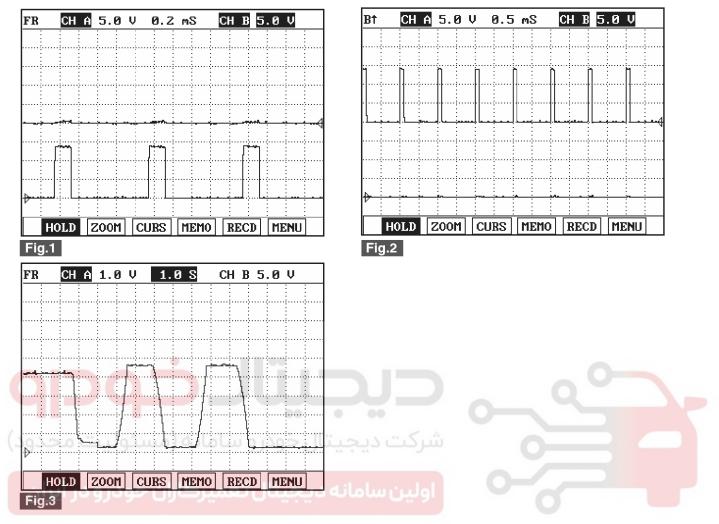
Terminal	Connected to	Function
1	ECM C301-1 (60)	Motor [+] Control
2	ECM C301-1 (30)	Motor [-] Control
3	ECM C301-1 (26)	Reference Voltage (+5V)
4	ECM C301-1 (56)	Position Signal
5	ECM C301-1 (6)	Sensor Ground



SMGFL6124L

Fuel System

SIGNAL WAVEFORM



- Fig.1) Waveform when variable swirl valve closed at idle. Terminal 1 is (+) and 2 is (-).
- Fig. 2) Waveform when variable swirl valve opened at above 3000RPM. Terminal 1 is (-) and 2 is (+).
- Fig. 3) Waveform of variable swirl control actuator motor position sensor at the point of turning engine OFF.
 - 4.3V at swirl valve closed and 0.3V at swirl valve opened. Swirl valve is opened and closed twice at engine "OFF".

LFIG512A

COMPONENT INSPECTION

- 1. Turn ignition switch OFF.
- 2. Disconnect the electric EGR control valve connector.
- 3. Check that swirl valve is stuck by foreign material.
- 4. Measure resistance between motor (+) and (-) control terminals.

Specification: Refer to "SPECIFICATION".

5. Measure resistance between voltage supply terminal and ground terminal of position sensor.

Specification: Refer to "SPECIFICATION".

FL-103

REPLACEMENT

MNOTICE

After replacing a Variable Swirl Actuator, MUST proceed below procedure.

- 1. Turn ignition switch OFF.
- 2. Connect a scan tool to Data Link Connector (DLC).

KIA VEHICLE DIAGNOSIS

- 3. Turn ignition switch ON.
- 4. Select "ENGINE CONTROL".

MODEL : OPTIMA / MAGENTIS

01. ENGINE CONTROL

02. AUTOMATIC TRANSAXLE

03. BRAKE SYS(ABS/TCS/ESP)

04. SRS-AIRBAG

05. FULL AUTO AIR/CON.

06. 4 WHEEL DRIVE(4WD)

07. IMMOBILIZER

08. BODY ELECTRIC. SYS(ETACS)

SMGFL6105L

5. Select "MANUAL SELECTION MODE".

KIA VEHICLE DIAGNOSIS

MODEL : OPTIMA / MAGENTIS SYSTEM : ENGINE CONTROL

01. AUTO SEARCHING MODE

02. MANUAL SELECTION MODE

SMGFL6106L

6. Select "D 2.0L VGT DIESEL".

MODEL : OPTIMA / MAGENTIS

SYSTEM: ENGINE CONTROL

01.	D 2.0L VGT DIESEL	
02.	2.0L DIESEL	ALL
03.	2.0L CUUT	EOBD
04.	2.0L CVVT	GEN
0 5.	2.0L CVVT	LEAD
0 6.	2.7L V6	EOBD
07.	2.7L V6	GEN
0 8.	2.7L V6	LEAD

SMGFL6107L

7. Select "COMPONET CHANGE ROUTNE"

1. KIA VEHICLE DIAGNOSIS A
: OPTIMA / MAGENTIS

SYSTEM: 2005

MODEL

ENGINE CONTROL

04. FLIGHT RECORD

05. ACTUATION TEST

06. SIMU-SCAN

07. ECU INFORMATION

08. INJECTOR CORRECTION

09. CPF SERVICE REGENERATION

10. COMPONENT CHANGE ROUTINE

11. COMPRESSION TEST

SMGFL6108L

8. Select "SWIRL CONTROL VALVE CHANGE".

1.10 . COMPONENT CHANGE ROUTINE MODEL : OPTIMA / MAGENTIS

SYSTEM : 2005

ENGINE CONTROL

01. ECU CHANGE

02. LAMBDA SENSOR CHANGE

03. RAIL PRESSURE SENSOR CHANGE

04. AIR FLOW SENSOR CHANGE

05. CPF CHANGE

06. D/PRESSURE SENSOR CHANGE

07. SWIRL CONTROL VALVE CHANGE

SMGFL6125L

Fuel System

9. Press "ENTER" key.

SWIRL CONTROL VALVE CHANGE(VSA)

IN THIS MODE, CAN INITIATE OFFSET LEARNING FOR NEW VARIABLE SWIRL ACTUATOR.

PRESS [ENTER] KEY

SWIRL CONTROL VALVE CHANGE(VSA)

IN THIS MODE, CAN INITIATE OFFSET LEARNING FOR NEW VARIABLE SWIRL ACTUATOR.

IG KEY ON BEFORE IG KEY

OFF FOR 10SEC

10. Wait 10 seconds with IG ON.

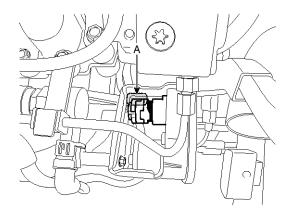
11. Turn ignition switch off.



FL-105

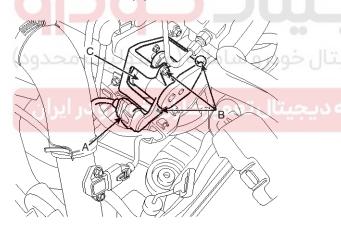
REMOVAL

- 1. Disconnect the battery (-) terminal.
- 2. Mark painting on the top (A) of the variable swirl actuator coupling of the intake manifold side.



SZZF19101D

- 3. Disconnect the variable swirl actuator connector (A).
- 4. Remove the variable swirl actuator (C) after removing the installation bolt (B).



SZZF19102D

INSTALLATION

1. Installation is the reverse order of removal.

Variable swirl actuator installation bolt: 9.8 \sim 11.8 N.m (1.0 \sim 1.2 kgf.m, 7.2 \sim 8.7 lb-ft)

⚠CAUTION

If the coupling of the intake manifold side is rotated a 180-degree turn, a real gap between the port and the flap in the intake manifold may be different from measuring it.

Install the actuator after confirming the mark on the top of the coupling.

2. Confirm normal operation of the actuator more than 3 times when the ignition switch OFF after full warm up (Engine Coolant Temperature > 70 °C).

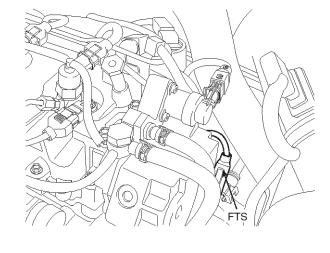


Fuel System

Fuel Temperature Sensor (FTS)

INSPECTION

Fuel Temperature Sensor(FTS) is installed in fuel supplying line and senses the termperature of fuel supplied to high pressure pump. Fuel temperature is limmited to protect fuel such as high pressure pump and injectors from damages due to rapid deterioration by vapor-lock which can occur at high temperature or destruction of oil membrance.



LFIG051A

SPECIFICATION

Temperature [°C(°F)]	Resistance (kΩ)	
-30 (-22)	27.00	
-20 (-4)	15.67	
-10 (14)	9.45	
0 (32)	5.89	
20 (68)	ال ^{2.27} ~ 2.73	

Temperature [°C(°F)]	Resistance (kΩ)
40 (104)	1.17
50 (122)	0.83
60 (140)	0.60
70 (158)	0.43
80 (176)	0.30 ~ 0.32

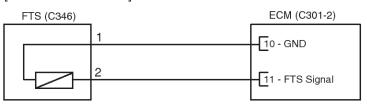
LFIG052A

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FL-107

CIRCUIT DIAGRAM



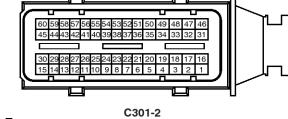


[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C301-2 (10)	Sensor ground
2	ECM C301-2 (11)	FTS Signal







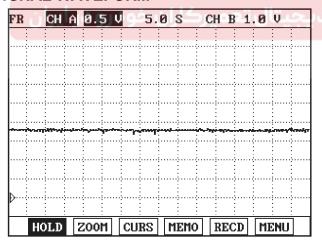
C301-1

FTS



SMGFL6119L

SIGNAL WAVEFORM



This illustration shows the waveform of fuel temperature sensor at 50℃.

The higher fuel temperature rises, the lower signal voltage becomes.

LGJF502I

COMPONENT INSPECTION

- 1. Turn ignition switch OFF.
- 2. Disconnect the fuel temperature sensor connector.
- 3. Measure resistance between sensor signal terminal and ground terminal.

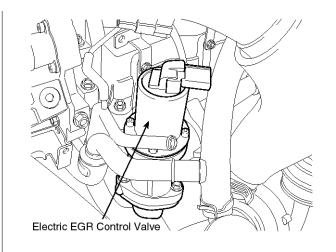
Specification: Refer to "SPECIFICATION".

Fuel System

EGR (Exhaust Gas Recirculation) Valve

INSPECTION

The Exhaust Gas Recirculation (EGR) system is used to add the exhaust gas to intake air in order to reduce an excess of air and the temperature in the combustion chamber. The Electric EGR valve is controlled by ECM's duty control signal depending on engine load and the need of intake air and is operated by solenoid valve not vacuum valve.



LFIG022A

SPECIFICATION

Items	Specification
Coil Resistance (Ω)	7.3 ~ 8.3Ω [20°C(68°F)]

CIRCUIT DIAGRAM

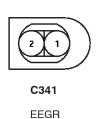
[CIRCUIT DIAGRAM]

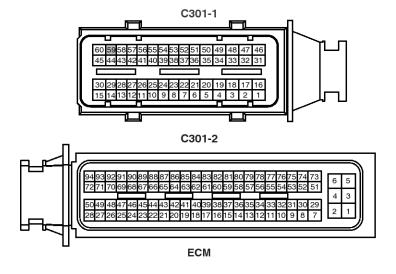
[CONNECTION INFORMATION]



Terminal	Connected to	Function
1	ECM C301-1 (59)	EEGR Control
2	Main Relay	Battery Voltage (B+)

[HARNESS CONNECTORS]

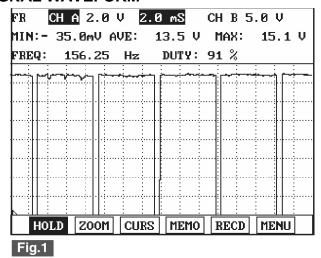




SMGFL6122L

FL-109

SIGNAL WAVEFORM



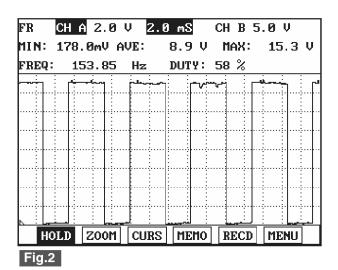


Fig.1) Approx. 10% duty((-)duty) signal waveform of EEGR actuator (with EEGR valve closed)

Fig.2) Approx. 40% duty((-)duty) signal waveform of EEGR actuator(with EEGR valve opened)

LFIG414A

COMPONENT INSPECTION

- 1. Turn ignition switch OFF.
- 2. Disconnect the electric EGR control valve connector.
- 3. Measure resistance between terminal 1 and 2 of the valve.

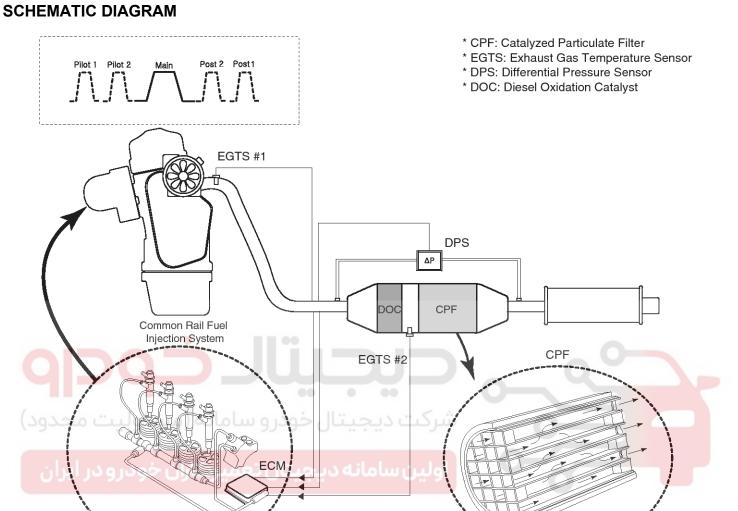
Specification: Refer to "SPECIFICATION".

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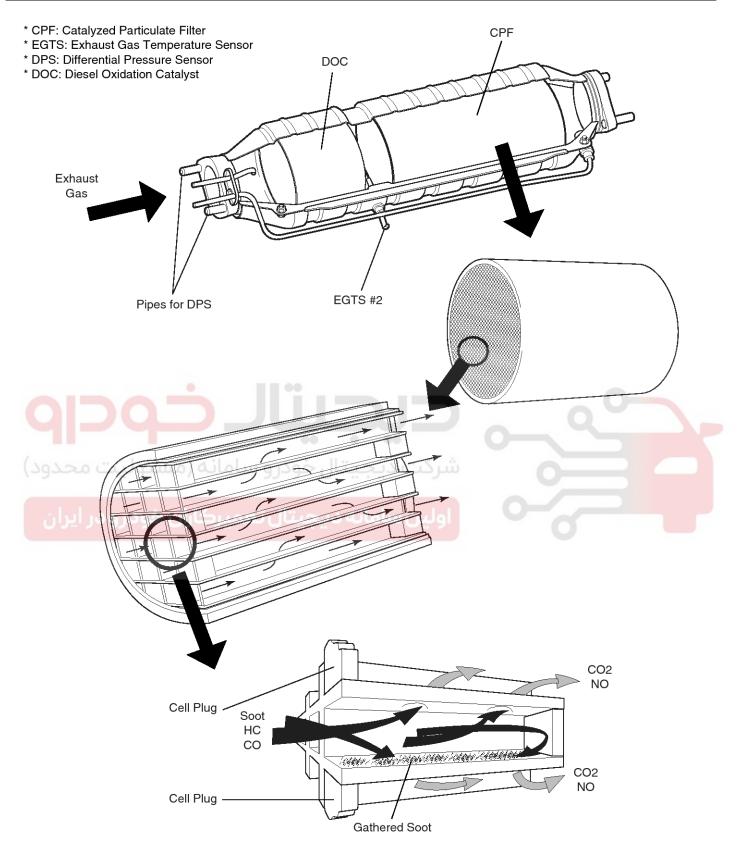
Fuel System

CPF (Catalyzed Particulate Filter)



LFIG116A

FL-111



LFIG117A

Fuel System

DESCRIPTION

The Catalyzed Particulate Filter (CPF) system prevents Particulate Matter (PM) from being discharged to the atmosphere and consists of a filter assembly, two Exhaust Gas Temperature Sensor (EGTS) and a Differential Pressure Sensor (DPS). The filter is integrated in the catalytic converter assembly and has honeycomb cell structure which can filter the PM in the exhaust gas. While the exhaust gas passes the CPF, the PM is gathered in the CPF and the others (CO2, NO, etc.) are discharged to the atmosphere via muffler. This gathered PM in CPF is called "soot".

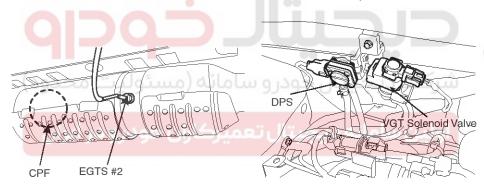
[CPF Regeneration]

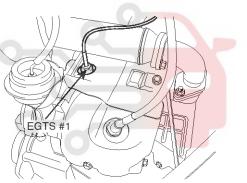
If there are much soot in the CPF, the CPF must be regenerated. ECM can calculate amount of the soot by using the DPS signal, vehicle mileage or simulation data. If the ECM determines the CPF is need to regenerate, it will perform "Regeneration Procedure" when the vehicle condition is corresponded with the predetermined one (Regeneration Mode).

To burn the soot, the ECM injects additional fuel in the cylinders during exhaust stroke (two Post Injection) and increases the exhaust gas temperature to burning temperature of the soot (above $600\,^{\circ}$ C). At this time, the soot are burn and its ash remains in the CPF as a result of the combustion.

[Regeneration Mode]

- 1. Mileage > 1,000km
- 2. Engine Speed: 1,000 \sim 4,000rpm
- 3. Engine Load = About 0.7bar [8mg/st]
- 4. Vehicle Speed > 5km/h
- 5. Engine Coolant Temperature > 40 °C





SMGFL6137L

CPF REGENERATION

This procedures is to forcibly regenerate the CPF with scan tool when the CPF doesn't have been regenerated during driving. For example, if the vehicle has repeated "Low speed driving" or "Short distance driving", the CPF regeneration procedure cannot be proceeded because "Regeneration Mode" doesn't made.

FL-113

FORCIBLY REGENERATION CONDITION

- Engine coolant temperature: about 70 ℃
- Engine at idle
- P-range (A/T) or Neutral (M/T)
- Normal battery voltage
- Electrical fully load (A/C ON if equipped, Blower ON with maximum speed, Head Lamp ON, Wiper ON, Other Lamps ON, etc.)
- 1. Turn ignition switch OFF.
- 2. Connect a scan tool to Data Link Connector (DLC).
- 3. Start engine at idle and P-range (A/T) or neutral (M/T).
- 4. Apply electrical fully load to the vehicle (A/C ON, Blower ON with maximum speed, Head Lamp ON, Wiper ON, and Other Lamps ON, etc.)
- 5. Select "ENGINE CONTROL".

KIA VEHICLE DIAGNOSIS ▼
MODEL : OPTIMA / MAGENTIS
•
01. ENGINE CONTROL
02. AUTOMATIC TRANSAXLE
03. BRAKE SYS(ABS/TCS/ESP)
04. SRS-AIRBAG
05. FULL AUTO AIR/CON.
06. 4 WHEEL DRIVE(4WD)
07. IMMOBILIZER
08. BODY ELECTRIC. SYS(ETACS)

SMGFL6105L

6. Select "MANUAL SELECTION MODE".

KIA VEHICLE DIAGNOSIS
MODEL : OPTIMA / MAGENTIS
SYSTEM : ENGINE CONTROL
01. AUTO SEARCHING MODE
02. MANUAL SELECTION MODE

SMGFL6106L

7. Select "D 2.0L VGT DIESEL".

KIA VEHICLE DIAGNOSIS MODEL : OPTIMA / MAGENTIS SYSTEM: ENGINE CONTROL

01.	D 2.0L VGT DIESEL	
02.	2.0L DIESEL	ALL
0 3.	2.0L CVVT	EOBD
04.	2.0L CVVT	GEN
0 5.	2.0L CVVT	LEAD
06.	2.7L V6	EOBD
07.	2.7L V6	GEN
08.	2.7L V6	LEAD

SMGFL6107L

8. Select "CPF SERVICE REGENERATION".

1. 1	KIA VEHICL	E DIAGNOSIS	

MODEL : OPTIMA / MAGENTIS SYSTEM: 2005

ENGINE CONTROL

04. FLIGHT RECORD

05. ACTUATION TEST

06. SIMU-SCAN

07. ECU INFORMATION

08. INJECTOR CORRECTION

09. CPF SERVICE REGENERATION

10. COMPONENT CHANGE ROUTINE

11. COMPRESSION TEST

SMGFI 6138I

9. Press "ENTER" key after looking around data memorized in ECM.

1.9 . CPF SERVICE REGENERATION

TOTAL DRIVEN DISTANCE : ******km

DRIVEN DISTANCE SINCE REGEN: ******km

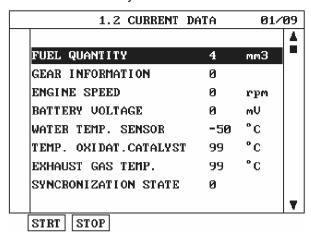
COVERAGE DRIVEN LENGTH : ******km

ENG ON TIME : *****hr

LFIG119A

Fuel System

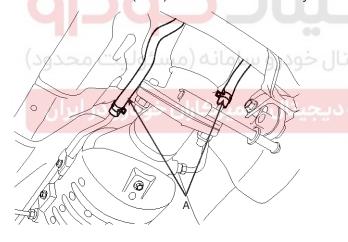
10. Press "STRT" key.



LFIG120A

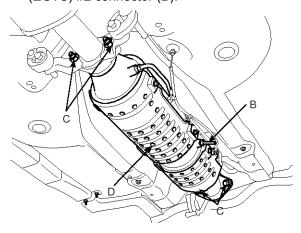
REMOVAL

- 1. Turn ignition switch off.
- 2. Lift the vehicle and support CPF assembly with a jack.
- 3. Disconnect the hoses (A) connected with Differential Pressure Sensor (DPS) from the CPF assembly.



SMGFL6735A

4. Disconnect the Exhaust Gas Temperature Sensor (EGTS) #2 connector (B).



SMGFL6736A

5. Linscrew the mounting nuts (C) and remove the CPF (D) from the vehicle.

INSTALLATION

 Install the CPF in the reverse order of "REMOVAL" procedure.

CPF Mounting Nuts: $39.2 \sim 58.9 \text{N·m}$ ($4.0 \sim 6.0 \text{ kgf·m}$, $28.9 \sim 43.4 \text{lbf·ft}$)

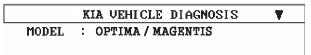
FL-115

REPLACEMENT

MNOTICE

After replacing a CPF, MUST proceed below procedure.

- 1. Turn ignition switch OFF.
- 2. Connect a scan tool to Data Link Connector (DLC).
- 3. Turn ignition switch ON.
- 4. Select "ENGINE CONTROL".



01. ENGINE CONTROL

- **02. AUTOMATIC TRANSAXLE**
- 03. BRAKE SYS(ABS/TCS/ESP)
- 04. SRS-AIRBAG
- 05. FULL AUTO AIR/CON.
- 06. 4 WHEEL DRIVE(4WD)
- 07. IMMOBILIZER
- 08. BODY ELECTRIC. SYS(ETACS)

SMGFL6105L

Select "MANUAL SELECTION MODE".

KIA VEHICLE DIAGNOSIS

MODEL : OPTIMA / MAGENTIS

SYSTEM : ENGINE CONTROL

01. AUTO SEARCHING MODE

02. MANUAL SELECTION MODE

SMGFL6106L

6. Select "D 2.0L VGT DIESEL".

MODEL

KIA VEHICLE DIAGNOSIS

: OPTIMA / MAGENTIS SYSTEM: ENGINE CONTROL

01. D 2.0L VGT DIESEL	
02. 2.0L DIESEL	ALL
03. 2.0L CVVT	EOBD
04. 2.0L CVVT	GEN
05. 2.0L CVVT	LEAD
06. 2.7L V6	EOBD
07. 2.7L V6	GEN
08. 2.7L V6	LEAD

SMGFL6107L

7. Select "COMPONET CHANGE ROUTNE"

	1. KIA VEHICLE DIAGNOSIS	A
MODEL	: OPTIMA / MAGENTIS	

SYSTEM: 2005

ENGINE CONTROL

04. FLIGHT RECORD

05. ACTUATION TEST

06. SIMU-SCAN

07. ECU INFORMATION

08. INJECTOR CORRECTION

09. CPF SERVICE REGENERATION

10. COMPONENT CHANGE ROUTINE

11. COMPRESSION TEST

SMGFI 61081

8. Select "CPF CHANGE".

1.10	COMPONENT	CHANGE	ROUTINE
4,40	AALIT ALITHIT	OHIII II IMM	TIVOLILIA

MODEL : OPTIMA/MAGENTIS

SYSTEM: 2005

ENGINE CONTROL

01. ECU CHANGE

02. LAMBDA SENSOR CHANGE

03. RAIL PRESSURE SENSOR CHANGE

04. AIR FLOW SENSOR CHANGE

05. CPF CHANGE

06. D/PRESSURE SENSOR CHANGE

07. SWIRL CONTROL VALVE CHANGE

SMGFL6139L

Fuel System

9. Press "ENTER" key.

CPF CHANGE

IN THIS MODE, CAN RESET THE DISTANCE OF LAST CHANGED CPF AND OTHERS RELATED PARAMETERS.

PRESS [ENTER] KEY

CPF CHANGE

IN THIS MODE, CAN RESET THE DISTANCE OF LAST CHANGED CPF AND OTHERS RELATED PARAMETERS.

IG KEY ON BEFORE IG KEY

OFF FOR 10SEC

LFIG122A

10. Wait 10 seconds with IG ON.

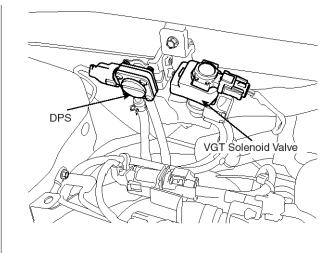
11. Turn ignition switch off.

FL-117

CPF Differential Pressure Sensor

INSPECTION

Differential Pressure Sensor (DPS) measures difference pressure between upstream and downstream exhaust gas of CPF. The ECM can calculate quantity of soot deposited in CPF with value from this sensor.



SMGFL6144L

SPECIFICATION

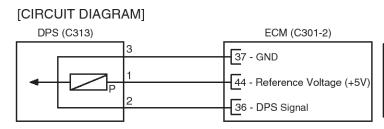
Differential Pressure[▲P] (kPa)	Output Voltage (V)
0	1.00
10	1.35
20	1.70
30	2.05
انه (مسئواهیت محدود	ئال خر2.40 سام
50	2.75

Differential Pressure[▲P] (kPa)	Output Voltage (V)
60	3.10
70	3.45
80	3.80
90	4.15
100شرکت دیا	4.50

LFIG068A

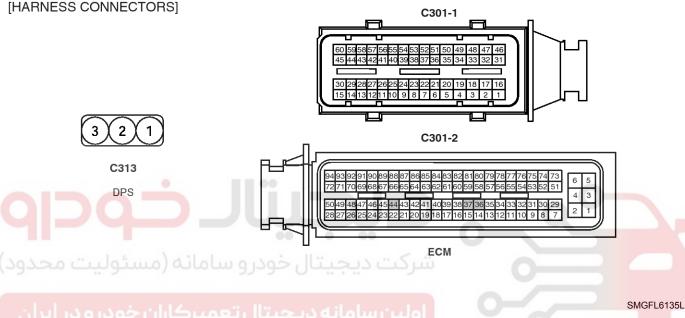
Fuel System

CIRCUIT DIAGRAM

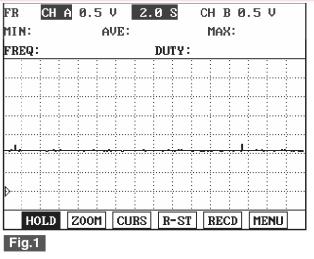


[CONNECTION INFORMATION]

Terminal	Connected to Function	
1	ECM C301-2 (44)	Reference Voltage (+5V)
2	2 ECM C301-2 (36) DPS Signal	
3	ECM C301-2 (37)	Sensor ground



SIGNAL WAVEFORM



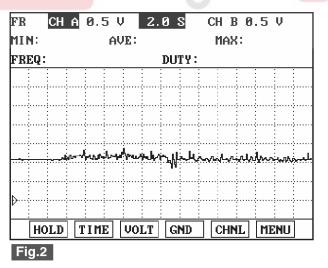


Fig1). This is the signal waveform of DPS at idle state. When CPF is new, $1.0 \sim 1.2 \text{V}$ is outputted normally.

Fig2). This is the waveform of DPS as accelerating.

LFIG423A

FL-119

REPLACEMENT

MOTICE

After replacing a Differential Pressure Sensor (DPS), MUST proceed below procedure.

- 1. Turn ignition switch OFF.
- 2. Connect a scan tool to Data Link Connector (DLC).
- 3. Turn ignition switch ON.
- 4. Select "ENGINE CONTROL".

07. IMMOBILIZER

SMGFL6105L

5. Select "MANUAL SELECTION MODE".

KIA VEHICLE DIAGNOSIS

08. BODY ELECTRIC. SYS(ETACS)

MODEL : OPTIMA / MAGENTIS SYSTEM : ENGINE CONTROL

01. AUTO SEARCHING MODE

02. MANUAL SELECTION MODE

SMGFL6106L

6. Select "D 2.0L VGT DIESEL".

KIA VEHICLE DIAGNOSIS

MODEL : OPTIMA / MAGENTIS SYSTEM : ENGINE CONTROL

01.	D 2.0L VGT DIESEL	
02.	2.0L DIESEL	ALL
03.	2.0L CUUT	EOBD
04.	2.0L CVVT	GEN
0 5.	2.0L CVVT	LEAD
06.	2.7L V6	EOBD
07.	2.7L V6	GEN
0 8.	2.7L V6	LEAD

SMGFL6107L

7. Select "COMPONET CHANGE ROUTNE"

1. KIA VEHICLE DIAGNOSIS

MODEL : OPTIMA / MAGENTIS

SYSTEM: 2005

ENGINE CONTROL

04. FLIGHT RECORD

05. ACTUATION TEST

06. SIMU-SCAN

07. ECU INFORMATION

08. INJECTOR CORRECTION

09. CPF SERVICE REGENERATION

10. COMPONENT CHANGE ROUTINE

11. COMPRESSION TEST

SMGFL6108L

8. Select "D/PRESSURE SENSOR CHANGE".

1.10 . COMPONENT CHANGE ROUTINE

MODEL : OPTIMA / MAGENTIS

SYSTEM: 2005

ENGINE CONTROL

01. ECU CHANGE

02. LAMBDA SENSOR CHANGE

03. RAIL PRESSURE SENSOR CHANGE

04. AIR FLOW SENSOR CHANGE

05. CPF CHANGE

06. D/PRESSURE SENSOR CHANGE

07. SWIRL CONTROL VALVE CHANGE

SMGFL6136L

Fuel System

9. Press "ENTER" key.

D/PRESSURE SENSOR CHANGE(DPS)

IN THIS MODE, CAN RESET THE DIFFER-ENTIAL PRESSURE SENSOR PARAMETERS.

PRESS [ENTER] KEY

D/PRESSURE SENSOR CHANGE(DPS)

IN THIS MODE, CAN RESET THE DIFFER-ENTIAL PRESSURE SENSOR PARAMETERS.

IG KEY ON BEFORE IG KEY

OFF FOR 10SEC

LFIG131A

10. Wait 10 seconds with IG ON.

11. Turn ignition switch off.

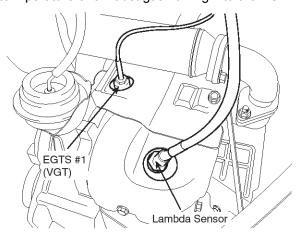


FL-121

Exhaust Gas Temperature Sensor

INSPECTION

Exhaust Gas Temperature Sensor (EGTS) #1 for VGT is installed on exhaust manifold and senses the termperature of exhaust gas flowing into the VGT.



SPECIFICATION

Temperature [˚ℂ(˚F)]	Resistance(^{kΩ})
100(212)	289.0 ~ 481.0
300(572)	5.30 ~ 6.61
600(1,112)	0.35 ~ 0.38
900(1,652)	0.08 ~ 0.09

SMGFL6129L

CIRCUIT DIAGRAM



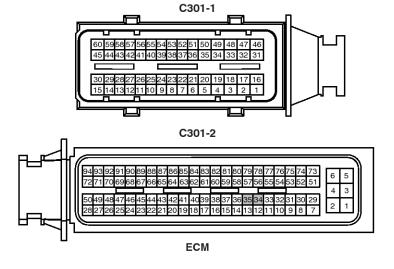


[CONNECTION INFORMATION]

Ŀ	Terminal	Connected to	Function
	1	ECM C301-2 (34)	EGTS #1 Signal
	2	ECM C301-2 (35)	Sensor ground
Ī			

[HARNESS CONNECTORS]





SMGFL6132L

Fuel System

SIGNAL WAVEFORM

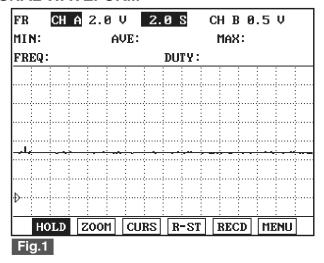


Fig.1) 4.8V is outputted at EGTS output signal circuit, when exhaust gas temp. is approx.150 °C. when exhaust gas temp. is 550~600 °C at CPF regeneration, output voltage drops to 0.3~0.4V.

LFIG448A

COMPONENT INSPECTION

- 1. Turn ignition switch OFF.
- 2. Disconnect the exhaust gas temperature sensor #1 connector.
- 3. Measure resistance between sensor signal terminal and ground terminal.

Specification: Refer to "SPECIFICATION".

ولین سامانه دیجیتال تعمیرکاران خودرو در ایران

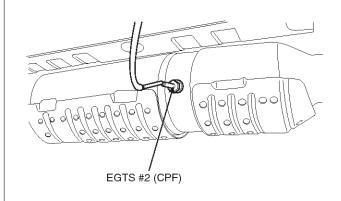


FL-123

INSPECTION

Exhaust Gas Temperature Sensor (EGTS) #2 for CPF is installed on Catalyzed Particulate Filter (CPF) assembly and senses the temperature of exhaust gas flowing into the CPF.

When pre-determined engine condition is set, ECM burns soot gathered in CPF with exhaust gas. At this time, the exhaust gas temperature is an important factor of engine condition.



SMGFL6133L

SPECIFICATION

Temperature [˚ℂ(˚F)]	Resistance(^{kΩ})
100(212)	289.0 ~ 481.0
300(572)	5.30 ~ 6.61
600(1,112)	0.35 ~ 0.38
900(1,652)	0.08 ~ 0.09

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

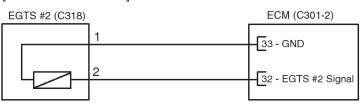
اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

Fuel System

CIRCUIT DIAGRAM

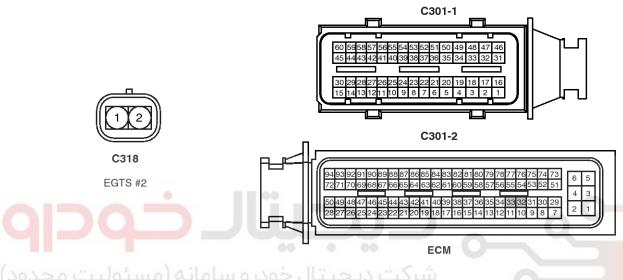


[CONNECTION INFORMATION]



Terminal	Connected to	Function
1	ECM C301-2 (33)	Sensor ground
2	ECM C301-2 (32)	EGTS #2 Signal

[HARNESS CONNECTORS]



SIGNAL WAVEFORM

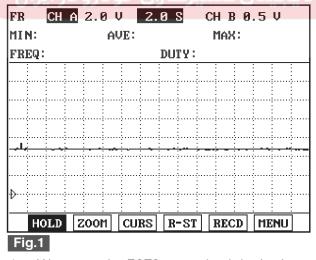


Fig.1) 4.8V is outputted at EGTS output signal circuit, when exhaust gas temp. is approx.150℃. when exhaust gas temp. is 550~600℃ at CPF regeneration, output voltage drops to 0.3~0.4V.

LFIG448A

SMGFL6134L

1. Turn ignition switch OFF.

COMPONENT INSPECTION

- 2. Disconnect the exhaust gas temperature sensor #2 connector.
- 3. Measure resistance between sensor signal terminal and ground terminal.

Specification: Refer to "SPECIFICATION".

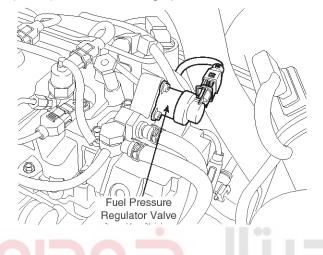
FL-125

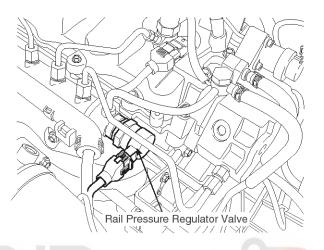
Fuel Pressure Control Valve

INSPECTION

The Fuel Pressure Regulator Valve and the Rail Pressure Regulator Valve are installed on high pressure pump and common rail respectively. These valves control fuel inlet (feed) from fuel tank via fuel filter and outlet (return) to fuel tank of high pressure fuel circuit.

This system is called "Dual Fuel Pressure Control System" and can precisely and quickly control the fuel pressure in accordance with various engine conditions by controlling the fuel inlet and outlet simultaneously.





SPECIFICATION

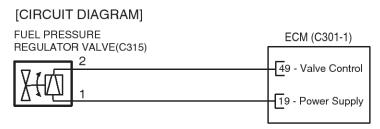
LFIG114A

00 0		
(And an including litems, including a literal litems, including a literal litems, including a literal	Specification	
Coil Resistance (Ω)	2.9 ~ 3.15Ω [20°C (68°F)]	

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

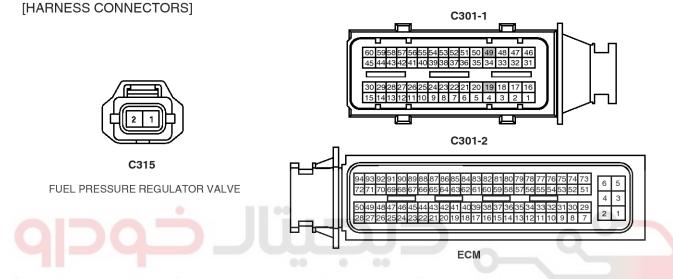
Fuel System

CIRCUIT DIAGRAM



[CONNECTION INFORMATION]

Terminal	Connected to	Function
1	ECM C301-1 (19)	Battery Voltage (B+)
2	ECM C301-1 (49)	Valve Control



SIGNAL WAVEFORM

SMGFL6120L

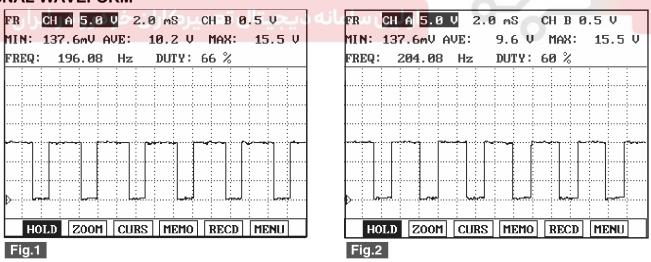


Fig.1) Waveform of fuel pressure regulator valve at idle. It shows approx. 34% duty((-)duty).

Fig.2) Waveform of fuel pressure regulator valve as accelerating. approx. 38% duty((-)duty) is outputted as engine load increases.

LFIG396A

FL-127

COMPONENT INSPECTION

- 1. Turn ignition switch OFF.
- 2. Disconnect the fuel pressure regulator valve connector.
- 3. Measure resistance between terminal 1 and 2 of the valve.

Specification: Refer to "SPECIFICATION".



Fuel System

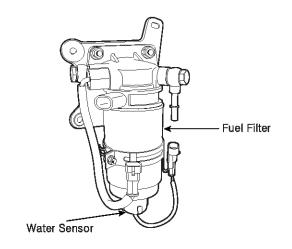
Water Sensor

INSPECTION

Water Sensor is installed on bottom end of fuel filter and detects presence of water in fuel. When the water level reaches the lower level of the upper electrode, the "WATER" lamp in cluster should flash. If the water level decreases below the lower electrode, the lamp should turn off.

MOTICE

Without presence of water, the lamp should flash for 2 seconds and turn off afterward in order that this system has normal condition.



SMGFL6126L

SPECIFICATION

Items	Specification
Warning Level of Water Presence (cc)	40 ~ 60

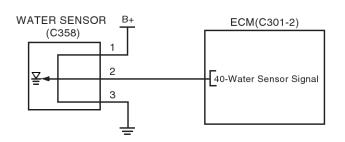




FL-129

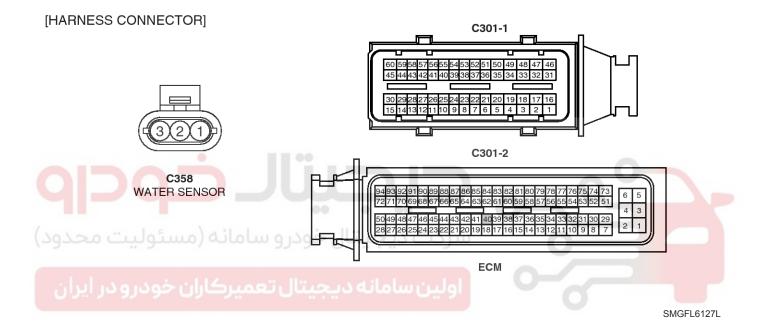
CIRCUIT DIAGRAM

[CIRCUIT DIAGRAM]



[CONNECTION INFORMATION]

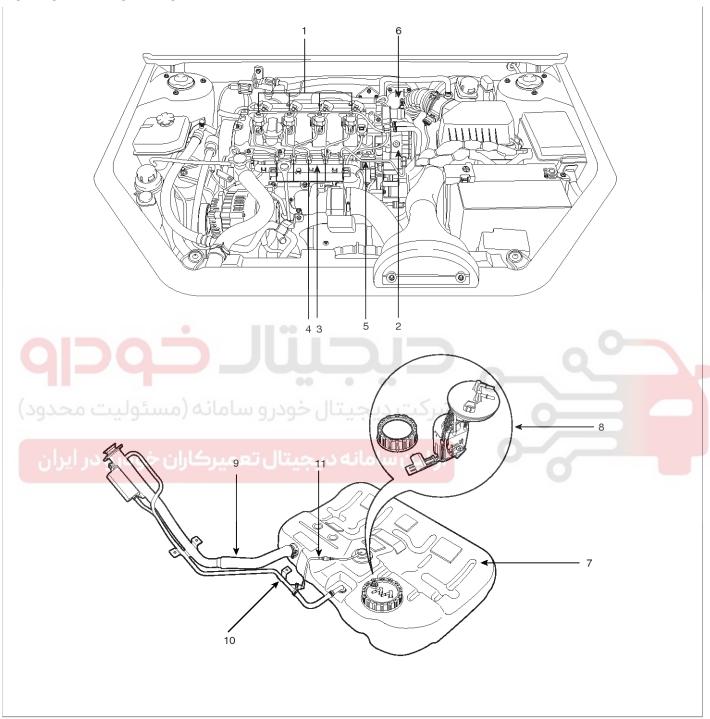
Terminal	Connected to	Function
1	Main Relay	Battery voltage(B+)
2 ECM C301-2 (40)		Sensor Signal
3 Chassis ground		Sensor ground



Fuel System

Fuel Delivery System

COMPONENT LOCATION



- 1. Injector
- 2. High Pressure Fuel Pump
- 3. Common Rail
- 4. High Pressure Pipe (Injector → Common Rail)
- 5. High Pressure Pipe (Common Rail → High Pressure Fuel Pump)
- Fuel Filter

- 7. Fuel Tank
- 8. Fuel Pump (Low Pressure)
- 9. Fuel Filler Hose
- 10. Leveling Hose
- 11. Ventilation Hose

SMGFL6140L

Fuel Delivery System

FL-131

ACAUTION

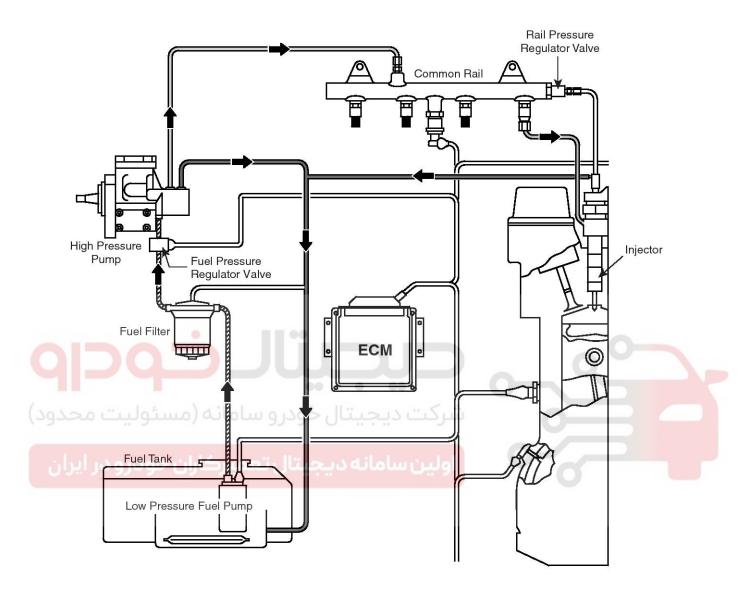
- Common Rail Fuel Injection System is subject to extremely high pressure (Approximately 1,600 bar)
- Never perform any work on injection system with engine running or within 30 seconds after the engine stops.
- · Always pay attention to safety precaution.
- · Ensure the absolute cleanliness.
- It is not recommended to remove the injectors without any notice.





Fuel System

SCHEMATIC DIAGRAM





LFIG701A

Fuel Delivery System

FL-133

COMPONENTS

The fuel pump is either an electric fuel pump with pre-filter, or a gear-type fuel pump. The pump draws the fuel from the fuel tank and continually delivers the required quantity of fuel in the direction of the high-pressure pump.

Inadequate filtering can lead to damage at the pump components, delivery valves, and injector nozzles. The fuel filter cleans the fuel before it reaches the high-pressure pump, and thereby prevents premature wear at the pump's sensitive components.

HIGH PRESSURE FUEL SYSTEM COMPONENTS

The high-pressure pump pressurizes the fuel to a system pressure of up to 1,600bar. This pressurized fuel then passes through a high-pressure line and into the tubular common rail.

Even after an injector has taken fuel from the rail in order to inject it, the fuel pressure inside the rail remains practically constant. This is due to the accumulator effect arising from the fuel's inherent elasticity. Fuel pressure is measured by the rail pressure sensor and maintained at the desired level by the pressure-control valve.

The nozzles of these injectors open when the solenoid valve is triggered and permit the flow of fuel. They inject the fuel directly into the engine's combustion chamber. The excess fuel which was needed for opening the injector nozzles flows back to the tank through a collector line. The return fuel from the fuel pressure control valve and from the low-pressure stage is also led into this collector line together with the fuel used to lubricate the high-pressure pump.

These High Pressure Pipes carry the high-pressure fuel. They must therefore be able to permanently withstand the maximum system pressure and, during the pauses in injection, the sometimes high-frequency pressure fluctuations which occur. They are therefore manufactured from steel tubing.

Normally, they have an outside diameter of about 6.35mm and an internal diameter of about 3.0mm. The injection lines between the common rail and the injectors must all be of the same length. The differences in length between the common rail and the individual injectors are compensated for by using slight or pronounced bends in the individual lengths of tubing. Nevertheless, the injection lines should be kept as short as possible.



Fuel System

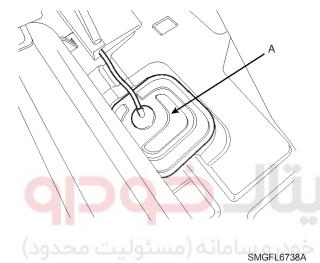
Fuel Tank

REMOVAL

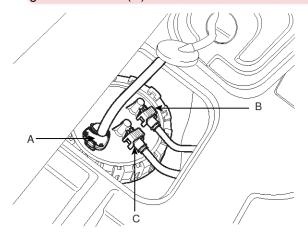
WARNING

When lifting up or downing the vehicle, be sure to place blocks between the vehicle and lifter to prevent fuel tank from being damaged.

- 1. Remove the mufflers and the Catalyzed Particulate Filter (CPF) assembly passing under the fuel tank (Refer to group "EM" in this Shop Manual).
- 2. Open the service covers (A) in the trunk.

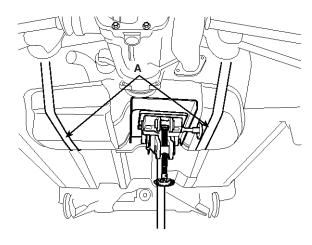


3. Disconnet the fuel pump connector (A), the fuel feed tube quick-connector (B) and the return tube guick-connector (C).



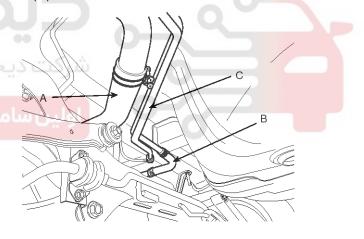
SMGFL6739A

4. Support the fuel tank with a jack, and then remove the two fuel tank band (A).



LFIG100A

5. Lift the vehicle and disconnect the fuel filler hose (A), the fuel leveling hose (B) and the ventilation hose



SMGFI 6741A

6. Remove the fuel tank from (B) the vehicle with setting down the jack.

INSTALLATION

1. Install the fuel tank in the reverse order of "REMOVAL" procedure.

Fuel tank band mounting bolts: 39.2 \sim 53.9 N·m (4.0 \sim 5.5 kgf·m, 28.9 \sim 39.8 lbf·ft)

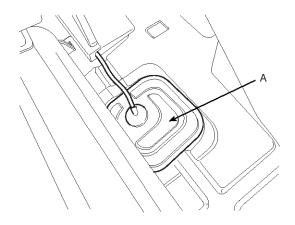
Fuel Delivery System

FL-135

Fuel Pump

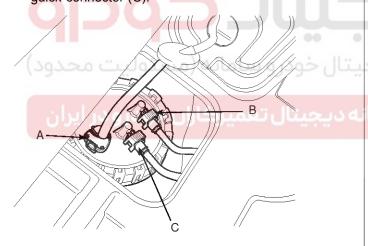
REMOVAL

1. Open the service cover in the trunk (A).



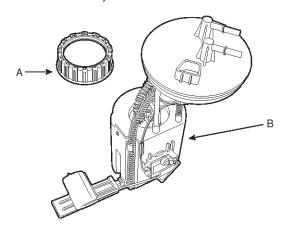
SMGFL6742A

2. Disconnet the fuel pump connector (A), the fuel feed tube quick-connector (B), the return tube guick-connector (C).



SMGFL6743A

3. Remove the fuel pump assembly (B) after unscrwing the fuel pump plate cover (A) with SST (NO: 09310-2B100)



SMGFL6744A

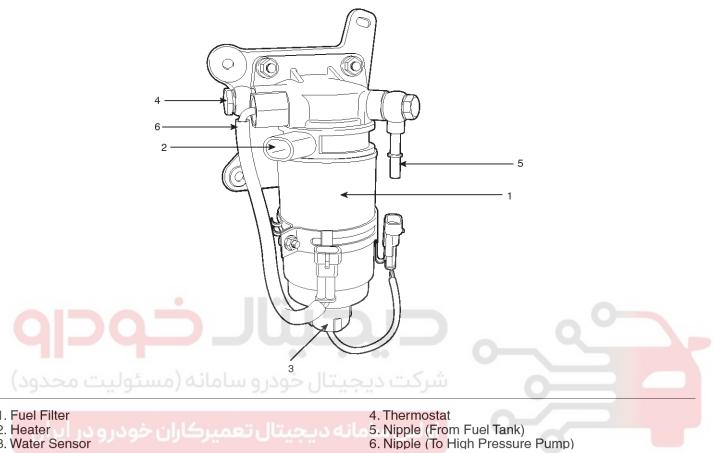
INSTALLATION

 Install the fuel pump in the reverse order of "REMOVAL" procedure.

Fuel pump plate cover : $58.9 \sim 68.7 \text{ N} \cdot \text{m} (6.0 \sim 7.0 \text{ kgf·m}, 43.4 \sim 50.6 \text{ lbf·ft})$

Fuel System

Fuel Filter COMPONENTS



- 1. Fuel Filter
- 2. Heater
- 3. Water Sensor

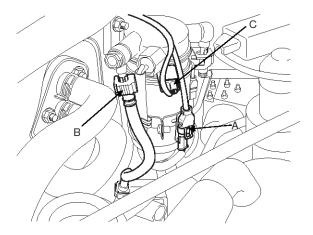
SMGFL6141L

Fuel Delivery System

FL-137

REMOVAL

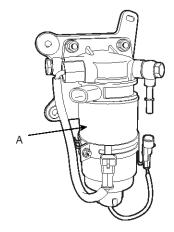
1. Disconnect the thermostat connector (A), the fuel output quick-connector (B) and the heater connector (C).



SMGFL6746A

2. Disconnet the fuel input quick-connector (A) and the (B)

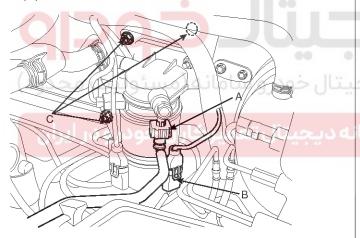
4. Remove the fuel filter assembly (A).



SMGFL6753A

INSTALLATION

1. Install the fuel filter in the reverse order of "REMOVAL" procedure.



SMGFL6747A

3. Unscrew the mounting bolts (C).



Fuel System

Common Rail

DESCRIPTION

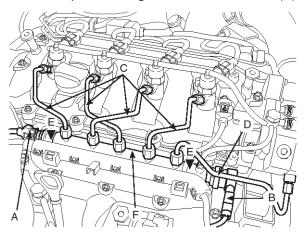
In order to comply with the wide variety of engine installation conditions, the common rail with its flow limiters and the provistions for attaching rail pressure sensor, fuel pressure control valve, and pressure limiter valve is available in a number of different designs.

The available common rail volume is permanently filled with pressurized fuel. The compressibility of the fuel resulting from the high pressure is utilized to achieve the accumulator effect. When fuel leaves the rail for injection, the pressure variations resulting from the pulsating fuel supply from the high-pressure pump are compensated for.

REMOVAL

WARNING

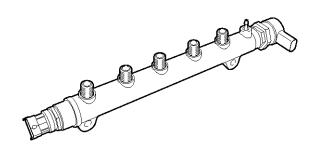
- Common Rail Fuel Injection System is subject to extremely high pressure (Approximately 1,600 bar)
- Never perform any work on injection system with engine running or within 30 seconds after the engine stops.
- Always pay attention to safety precaution.
- Ensure the absolute cleanliness.
- It is not recommended to remove the injectors without any notice.
- 1. Disconnect the rail pressure sensor connector (A) and rail pressure regulator valve connector (B).



LFIG082A

- 2. Disconnect the high pressure pipe (C) connecting the injectors with the common rail.
- 3. Disconnect the high pressure pipe (D) connecting the common rail with the high pressure fuel pump.

4. Unscrew the two mounting bolts (E) and remove the common rail (F).



LFIG083A

INSTALLATION

 Install the common rail according to the reverse order of "REMOVAL" procedure.

UNOTICE

When installing the high pressure pipe, apply the specified tightening torques to the flange nuts of the injectors, the high pressure pipe, and the common rail side with SST (Refer to below table).

	ltem	Dimension	SST No.
	Flange Nut (Inj - ector Side)	14 mm (0.551 in)	09314-27110
	Flange Nut (HP Pump Side)	14 11111 (0.551 111)	
	Flange Nut (Co- mmon Rail Side)	17 mm (0.669 in)	09314-27120

- \cdot Common rail mounting bolts: 19.6 \sim 26.5 N·m (2.0 \sim 2.7 kgf·m, 14.5 \sim 19.5 lbf·ft)
- \cdot High pressure pipe flange nuts (Injectors \leftrightarrow Common Rail): 24.5 \sim 28.4 N·m (2.5 \sim 2.9 kgf·m, 18.1 \sim 20.1 lbf·ft)
- · High pressure pipe flange nuts (Common Rail \leftrightarrow HP Pump): 24.5 \sim 28.4 N·m (2.5 \sim 2.9 kgf·m, 18.1 \sim 20.1 lbf·ft)

Fuel Delivery System

FL-139

High Pressure Pump

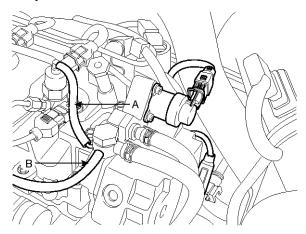
DESCRIPTION

The high-pressure pump is the interface between the low pressure and the high-pressure stages. Under all operating conditions, it is responsible for providing adequate high-pressure fuel through out the vehicle's complete service life. This also includes the provision of extra as needed for rapid starting and for rapid build-up of pressure in the rail. The high pressure pump continually generates the system pressure as needed in the high-pressure accumulator (common rail). This means therefore, that in contrast to conventional systems, the fuel does not have to be specially compressed for each individual injection process.

REMOVAL

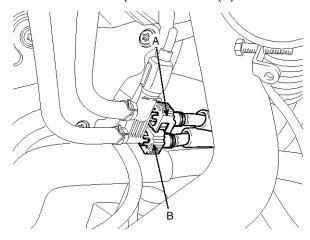
WARNING

- Common Rail Fuel Injection System is subject to extremely high pressure (Approximately 1,600 bar)
- Never perform any work on injection system with engine running or within 30 seconds after the engine stops.
- Always pay attention to safety precaution.
- Ensure the absolute cleanliness.
- It is not recommended to remove the injectors without any notice.
- 1. Remove the air cleaner assembly (Refer to group "EM" in this Shop Manual).
- 2. Disconnect the return hoses (A,B) connected with the injectors and the common rail.



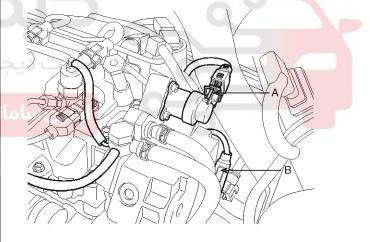
LFIG076A

3. Disconnet the fuel feed hose quick-connector (A) and the return hose quick-connector (B).



LFIG077A

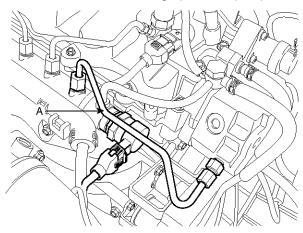
4. Disconnect the fuel pressure regulator valve connector (A) and the fuel temperature sensor connector (B).



LFIG078A

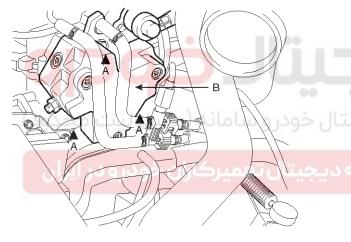
Fuel System

5. Disconenct the high pressure pipe (A) connecting the common rail with the high pressure pump.

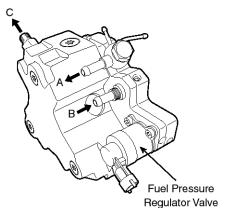


LFIG079A

6. Unscrew the mounting bolts (A) and remove the high pressure fuel pump (B) from the engine.



LFIG080A



A : To Fuel Tank (Return Line)

B : From Fuel Tank

C: To High Pressure Fuel Pump

LFIG081A

INSTALLATION

1. Install the high pressure fuel pump according to the reverse order of "REMOVAL" procedure.

MOTICE

When installing the high pressure pipe, apply the specified tightening torques to the flange nuts of the high pressure pipe side and the common rail side with SST (Refer to below table).

Item	Dimension	SST No.
Flange Nut (HP Pump Side)	14 mm (0.551 in)	09314-27110
Flange Nut (Co- mmon Rail Side)	17 mm (0.669 in)	09314-27120

High pressure fuel pump mounting bolts: 19.6 $^{\sim}$ 26.5 N·m (2.0 $^{\sim}$ 2.7 kgf·m, 14.5 $^{\sim}$ 19.5 lbf·ft)

High pressure pipe flange nuts (Common Rail \leftrightarrow HP Pump): 24.5 \sim 28.4 N·m (2.5 \sim 2.9 kgf·m, 18.1 \sim 20.1 lbf·ft)

