

# General Information

## FLA-3

### General Information

#### Specifications

##### Fuel Delivery System

Items	Specification	
Fuel Tank	Capacity	55 lit. (14.5 U.S.gal., 58.1 U.S.qt., 48.4 Imp.qt.)
Fuel Filter	Type	Paper type
Fuel Pressure Regulator	Regulated Fuel Pressure	324 ~ 363 kPa (3.3 ~ 3.7 kgf/cm <sup>2</sup> , 46.9 ~ 52.6 psi)
Fuel Pump	Type	Electrical, in-tank type
	Driven by	Electric motor

#### Sensors

##### Manifold Absolute Pressure Sensor (MAPS)

▷ Type: Piezo-resistive pressure sensor type

▷ Specification

Pressure (kPa)	Output Voltage (V)
20.0	0.79
46.7	1.84
101.3	4.0

##### Intake Air Temperature Sensor (IATS)

▷ Type: Thermistor type

▷ Specification

Temperature [°C (°F)]	Resistance (kΩ)
-40(-40)	40.93 ~ 48.35
-20(-4)	13.89 ~ 16.03
0(32)	5.38 ~ 6.09
10(50)	3.48 ~ 3.90
20(68)	2.31 ~ 2.57
40(104)	1.08 ~ 1.21
50(122)	0.76 ~ 0.85
60(140)	0.54 ~ 0.62
80(176)	0.29 ~ 0.34

##### Engine Coolant Temperature Sensor (ECTS)

▷ Type: Thermistor type

▷ 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

##### Throttle Position Sensor (TPS) [integrated into ETC Module]

▷ Type: Variable resistor type

▷ Specification

Throttle Angle(°)	Output Voltage (V)	
	TPS1	TPS2
0	0	5.0
10	0.48	4.52
20	0.95	4.05
30	1.43	3.57
40	1.90	3.10
50	2.38	2.62
60	2.86	2.14
70	3.33	1.67
80	3.81	1.19
90	4.29	0.71

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## Fuel System

Throttle Angle(°)	Output Voltage (V)	
	TPS1	TPS2
100	4.76	0.24
105	5.0	0
C.T (6~15°)	0.29 ~ 0.71	4.29 ~ 4.71
W.O.T (93~102°)	4.43 ~ 4.86	0.14 ~ 0.57

Item	Resistance (kΩ)
TPS1	0.875 ~ 1.625 [20°C (68°F)]
TPS2	0.875 ~ 1.625 [20°C (68°F)]

## Crankshaft Position Sensor (CKPS)

▷ Type: Hall effect type

## Camshaft Position Sensor (CMPS)

▷ Type: Hall effect type

## Knock Sensor (KS)

▷ Type: Piezo-electricity type

▷ Specification

Item	Specification
Capacitance (pF)	850 ~ 1,150

## Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1]: With EURO 5

▷ Type: Zirconia (ZrO2) [Linear] type

▷ Specification

Item	Specification
Heater Resistance (Ω)	2.5 ~ 4.0 [20°C (69.8°F)]

## Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1]: With EURO 4

▷ Type: Zirconia (ZrO2) [Binary] Type

▷ Specification

A/F Ratio (λ)	Output Voltage(V)
RICH	Approx. 0.9
LEAN	Approx. 0.04

Item	Specification
Heater Resistance (Ω)	3.3 ~ 4.1 [21°C (69.8°F)]

## Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2]: With EURO 4/5

▷ Type: Zirconia (ZrO2) [Binary] Type

▷ Specification

A/F Ratio (λ)	Output Voltage(V)
RICH	Approx. 0.9
LEAN	Approx. 0.04

Item	Specification
Heater Resistance (Ω)	3.3 ~ 4.1 [21°C (69.8°F)]

## Accelerator Position Sensor (APS)

▷ Type: Variable resistor type

▷ Specification

Accelerator Position	Output Voltage (V)	
	APS1	APS2
C.T	0.7 ~ 0.8	0.29 ~ 0.46
W.O.T	3.85 ~ 4.35	1.93 ~ 2.18

# General Information

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### Actuators

#### Injector

##### ▷ Specification

Item	Specification
Coil Resistance ( $\Omega$ )	13.8 ~ 15.2 [20°C (68°F)]

#### ETC Motor [integrated into ETC Module]

##### ▷ Specification

Item	Specification
Coil Resistance ( $\Omega$ )	1.2 ~ 1.8 [20°C (68°F)]

#### Purge Control Solenoid Valve (PCSV)

##### ▷ Specification

Item	Specification
Coil Resistance ( $\Omega$ )	19.0 ~ 22.0 [20°C (68°F)]

#### CVVT Oil Control Valve (OCV)

##### ▷ Specification

Item	Specification
Coil Resistance ( $\Omega$ )	6.9 ~ 7.9 [20°C (68°F)]

#### Variable Intake Solenoid (VIS) Valve

##### ▷ Specification

Item	Specification
Coil Resistance ( $\Omega$ )	30.0 ~ 35.0 [20°C (68°F)]

#### Ignition Coil

##### ▷ Type: Stick type

##### ▷ Specification

Item	Specification
1st Coil Resistance ( $\Omega$ )	$0.62 \pm 10\%$ [20°C (68°F)]
2nd Coil Resistance ( $k\Omega$ )	$7.0 \pm 15\%$ [20°C (68°F)]



## FLA-6

## Fuel System

## Service Standard

Item		Specification	
Ignition Timing (°)		BTDC $8 \pm 10$	
Idle Speed (rpm)	A/C OFF	Neutral, N, P-range	$620 \pm 100$
		D-range	$620 \pm 100$
	A/C ON	Neutral, N, P-range	$620 \pm 100$
		D-range	$620 \pm 100$

## Tightening Torques

## Engine Control System

Item	kgf.m	N.m	lb-ft
ECM installation bolt	0.4 ~ 0.6	3.9 ~ 5.9	2.9 ~ 4.3
ECM bracket installation bolt	2.2 ~ 3.3	21.6 ~ 32.4	15.9 ~ 23.9
ECM bracket installation nut	1.0 ~ 1.5	9.8 ~ 14.7	7.2 ~ 10.9
Manifold absolute pressure sensor installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
Crankshaft position sensor installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
Crankshaft position sensor protector installation bolt (M8)	1.9 ~ 2.4	18.6 ~ 23.5	13.7 ~ 17.4
Crankshaft position sensor protector installation bolt (M6)	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
Camshaft position sensor (Bank 1 / Intake) installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
Camshaft position sensor (Bank 1 / Exhaust) installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
Knock sensor installation bolt	1.9 ~ 2.4	18.6 ~ 23.5	13.7 ~ 17.4
Heated oxygen sensor (Bank 1 / sensor 1) installation	4.5 ~ 5.0	44.1 ~ 49.1	32.6 ~ 36.2
Heated oxygen sensor (Bank 1 / sensor 2) installation	4.5 ~ 5.0	44.1 ~ 49.1	32.6 ~ 36.2
Electronic throttle body installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
Purge control solenoid valve bracket installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
CVVT oil control valve (Bank 1 / Intake) installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
CVVT oil control valve (Bank 1 / Exhaust) installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
Ignition coil installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7

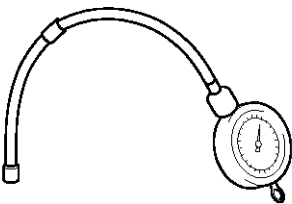
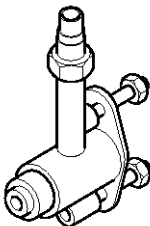

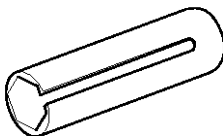
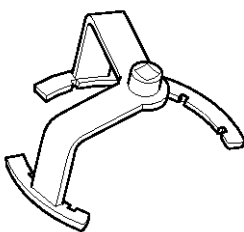
## Fuel Delivery System

Item	kgf.m	N.m	lb-ft
Fuel tank installation bolt	4.0 ~ 5.5	39.2 ~ 54.0	28.9 ~ 39.8
Fuel pump plate cover tightening	6.0 ~ 7.0	58.9 ~ 68.7	43.4 ~ 50.6
Filler-neck assembly bracket installation nut	0.4 ~ 0.6	3.9 ~ 5.9	2.9 ~ 4.3
Accelerator pedal module installation bolt	0.8 ~ 1.2	7.8 ~ 11.8	7.2 ~ 8.7
Accelerator pedal module installation nut	1.7 ~ 2.6	16.7 ~ 25.5	12.3 ~ 18.8
Delivery pipe installation bolt	1.9 ~ 2.4	18.6 ~ 23.5	13.7 ~ 17.4
Delivery pipe installation nut (↔ Fuel feed tube)	0.8 ~ 1.0	7.8 ~ 9.8	5.8 ~ 7.2

# General Information

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### Special Service Tools



Tool (Number and Name)	Illustration	Application
Fuel Pressure Gauge (09353-24100)	 EFDA003A	Measuring the fuel line pressure
Fuel Pressure Gauge Adapter (09353-38000)	 BF1A025D	Connection between the delivery pipe and the fuel feed line
Fuel Pressure Gauge Connector (09353-24000)	 EFDA003C	Connection between the Fuel Pressure Gauge (09353-24100) and the Fuel Pressure Gauge Adapter (09353-38000)
Heated Oxygen Sensor Socket Wrench (09392-2H100)	 SFDEM8050L	Removal and installation of the heated oxygen sensor
Fuel Pump Plate Cover Remover (09310-2S100)	 SSLF11000L	Removal and installation of the fuel pump (or sub fuel sender) plate cover

## FLA-8

## Fuel System

## Basic Troubleshooting

## Basic Troubleshooting Guide

1	Bring Vehicle to Workshop
2	Analyze Customer's Problem <ul style="list-style-type: none"> <li>Ask the customer about the conditions and environment relative to the issue. (Use CUSTOMER PROBLEM ANALYSIS SHEET).</li> </ul>
3	Verify Symptom, and then Check DTC and Freeze Frame Data <ul style="list-style-type: none"> <li>Connect the GDS to Diagnostic Link Connector (DLC).</li> <li>Record the DTC and Freeze Frame Data.</li> </ul> <p> <b>NOTE</b></p> <p>To erase DTC and Freeze Frame Data, refer to Step 5.</p>
4	Confirm the Inspection Procedure for the System or Part <ul style="list-style-type: none"> <li>Using the SYMPTOM TROUBLESHOOTING GUIDE CHART, choose the correct inspection procedure for the system or part to be checked.</li> </ul>
5	Erase the DTC and Freeze Frame Data <p> <b>WARNING</b></p> <p><b>NEVER erase DTC and Freeze Frame Data before completing Step 2 : MIL/DTC in CUSTOMER PROBLEM ANALYSIS SHEET.</b></p>
6	Inspect Vehicle Visually <ul style="list-style-type: none"> <li>Go to Step 11, if you recognize the problem.</li> </ul>
7	Recreate (Simulate) Symptoms of the DTC <ul style="list-style-type: none"> <li>Try to recreate or simulate the symptoms and conditions of the malfunction as described by customer.</li> <li>If DTC(s) is/are displayed, simulate the condition according to troubleshooting procedure for the DTC.</li> </ul>
8	Confirm Symptoms of Problem <ul style="list-style-type: none"> <li>If DTC(s) is/are not displayed, go to Step 9.</li> <li>If DTC(s) is/are displayed, go to Step 11.</li> </ul>
9	Recreate (Simulate) Symptom <ul style="list-style-type: none"> <li>Try to recreate or simulate the condition of the malfunction as described by the customer.</li> </ul>
10	Check the DTC <ul style="list-style-type: none"> <li>If DTC(s) does(do) not occur, refer to INTERMITTENT PROBLEM PROCEDURE in BASIC INSPECTION PROCEDURE.</li> <li>If DTC(s) occur(s), go to Step 11.</li> </ul>
11	Perform Troubleshooting Procedure for DTC
12	Adjust or repair the vehicle
13	Confirmation test
14	END

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## General Information

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## Customer Problem Analysis Sheet

## 1. VEHICLE INFORMATION

VIN No.		Transmission	<input type="checkbox"/> M/T <input type="checkbox"/> A/T <input type="checkbox"/> CVT <input type="checkbox"/> etc.
Production date		Driving type	<input type="checkbox"/> 2WD (FF) <input type="checkbox"/> 2WD (FR) <input type="checkbox"/> 4WD
Odometer Reading	_____km/mile	DPF (Diesel Engine)	<input type="checkbox"/> With DPF <input type="checkbox"/> Without DPF

## 2. SYMPTOMS

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

## 3. ENVIRONMENT

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

## 4. MIL/DTC

MIL (Malfunction Indicator Lamp)		<input type="checkbox"/> Remains ON <input type="checkbox"/> Sometimes lights up <input type="checkbox"/> Does not light
DTC	Normal check (Pre-check)	<input type="checkbox"/> Normal <input type="checkbox"/> DTC (_____ ) <input type="checkbox"/> Freeze Frame Data
	Check mode	<input type="checkbox"/> Normal <input type="checkbox"/> DTC (_____ ) <input type="checkbox"/> Freeze Frame Data

## 5. ECM/PCM INFORMATION

ECM/PCM Part No.	
ROM ID	

SCMF10001L

## FLA-10

## Fuel System

### Basic Inspection Procedure

#### Measuring Condition of Electronic Parts' Resistance

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

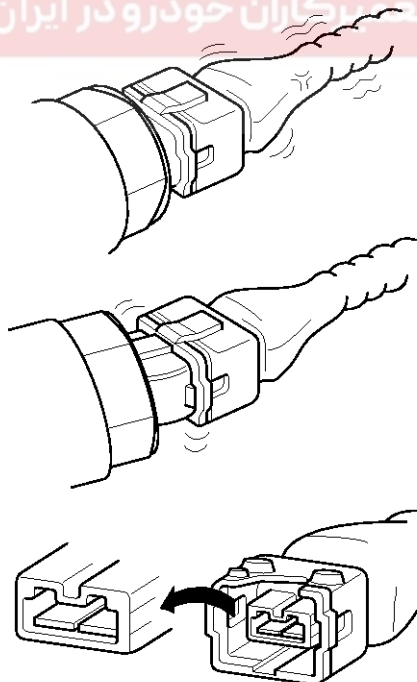
#### NOTICE

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

### Intermittent Problem Inspection Procedure

Sometimes the most difficult case in troubleshooting is when a problem symptom occurs but does not occur again during testing. An example would be if a problem appears only when the vehicle is cold but has not appeared when warm. In this case, 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).
2. Inspect connector connection, and check terminal for poor connections, loose wires, bent, broken or corroded pins, and then verify that the connectors are always securely fastened.



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

#### ● Simulating Vibration

- a. Sensors and Actuators

: Slightly vibrate sensors, actuators or relays with finger.

#### ⚠ WARNING

**Strong vibration may break sensors, actuators or relays**

- b. Connectors and Harness

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

#### ● Simulating Heat

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

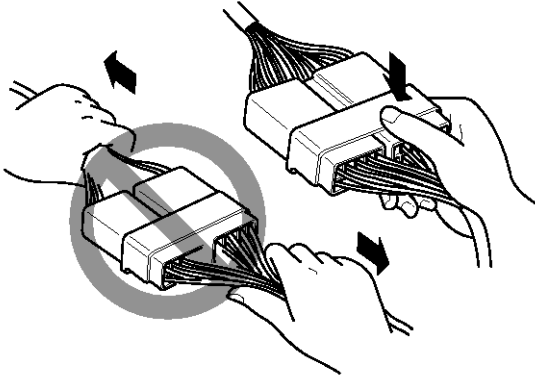
## General Information

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### Connector Inspection Procedure

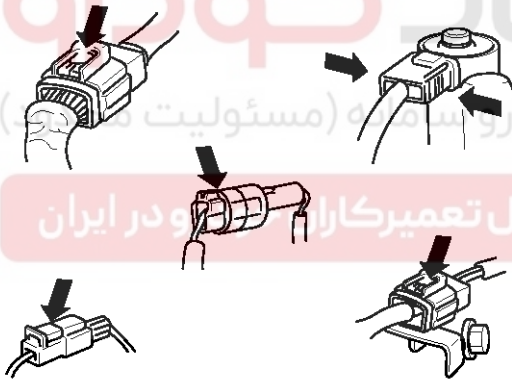
#### 1. Handling of Connector

- a. Never pull on the wiring harness when disconnecting connectors.



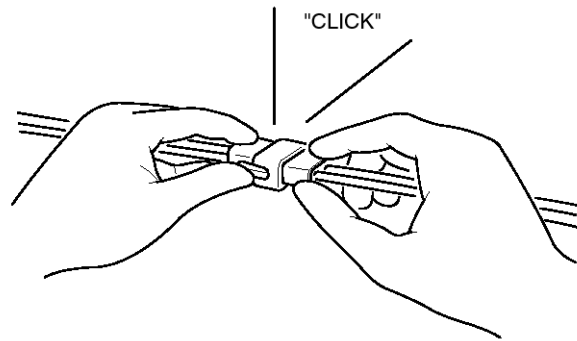
BFGE015F

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



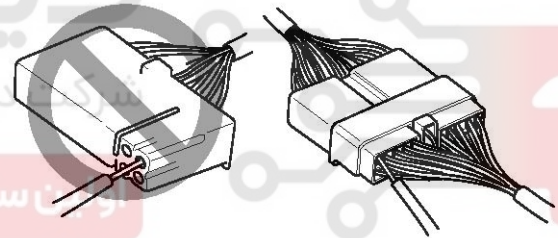
BFGE015G

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



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

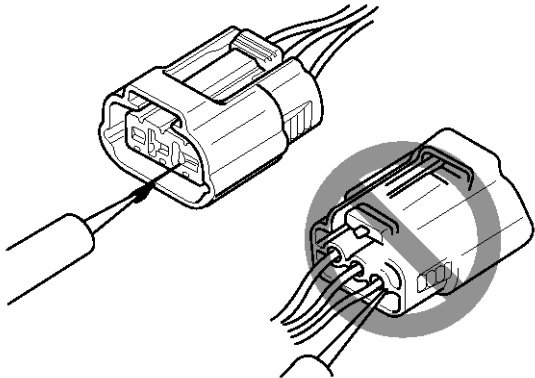


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## Fuel System

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



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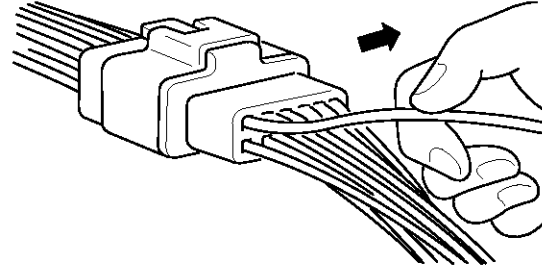
**NOTICE**

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

## 2. Checking Point for Connector

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

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



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## 3. Repair Method of Connector Terminal

- a. Clean the contact points using air gun and/or shop rag.

**NOTICE**

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

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

**Wire Harness Inspection Procedure**

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

# General Information

## FLA-13

### Electrical Circuit Inspection Procedure

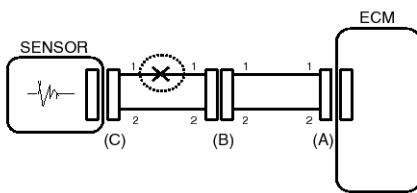
#### ● Check Open Circuit

##### 1. Procedures for Open Circuit

- Continuity Check
- Voltage Check

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

FIG 1



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##### 2. Continuity Check Method

#### NOTICE

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

#### Specification (Resistance)

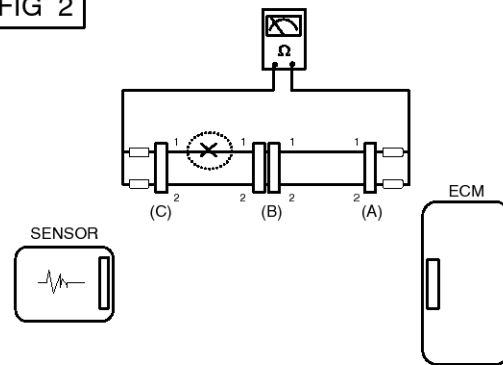
1Ω or less → Normal Circuit

1MΩ or Higher → Open Circuit

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

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

FIG 2

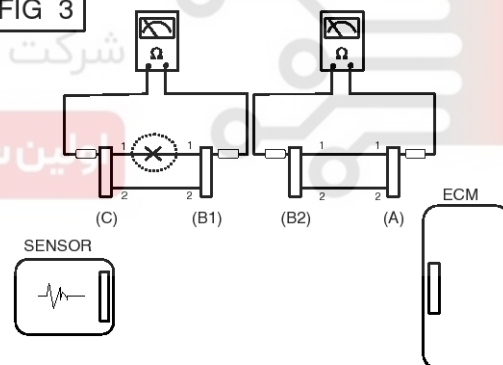


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- Disconnect connector (B), and measure for resistance between connector (C) and (B1) and between (B2) and (A) as shown in [FIG. 3].

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

FIG 3



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## FLA-14

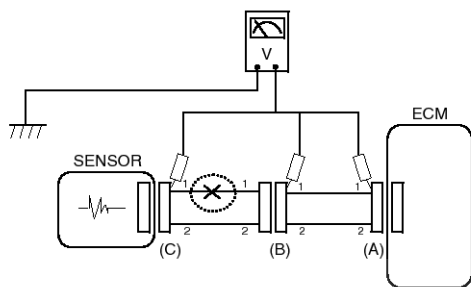
## Fuel System

## 3. Voltage Check Method

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

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

FIG 4



BFG501D

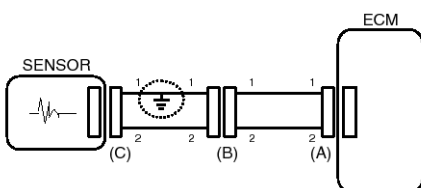
## ● Check Short Circuit

## 1. Test Method for Short to Ground Circuit

- Continuity Check with Chassis Ground

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

FIG 5



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

## NOTICE

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

## Specification (Resistance)

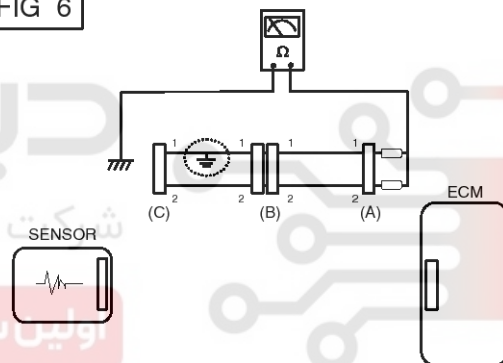
1Ω or less → Short to Ground Circuit

1MΩ or Higher → Normal Circuit

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

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

FIG 6



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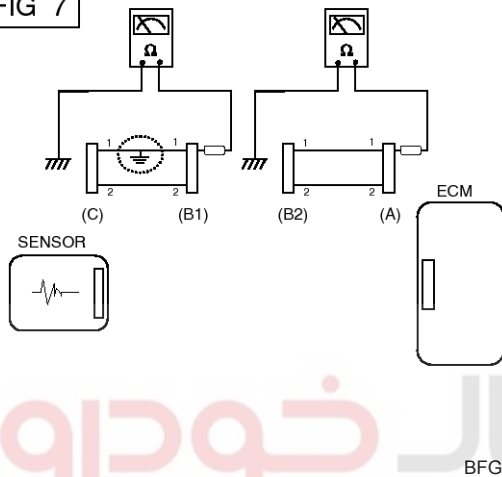
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- b. Disconnect connector (B), and measure the resistance between connector (A) and chassis ground, and between (B1) and chassis ground as shown in [FIG. 7].

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

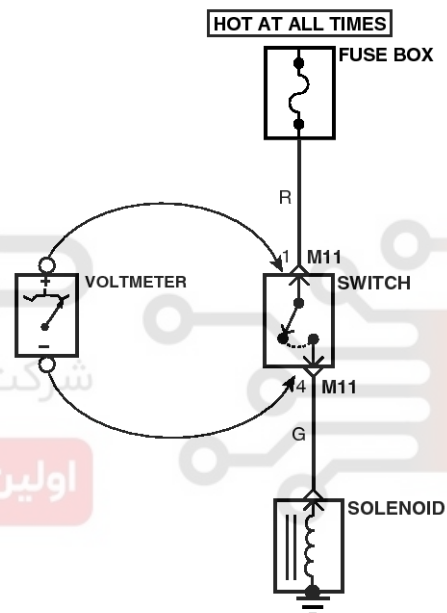
FIG 7



### ● Testing For Voltage Drop

This test checks for voltage drop along a wire, or through a connection or switch.

- Connect the positive lead of a voltmeter to the end of the wire (or to the side of the connector or switch) closest to the battery.
- Connect the negative lead to the other end of the wire. (or the other side of the connector or switch)
- Operate the circuit.
- The voltmeter will show the difference in voltage between the two points. A difference, or drop of more than 0.1 volts (50mV in 5V circuits), may indicate a problem. Check the circuit for loose or dirty connections.



SHMFL9331N

## FLA-16

## Fuel System

## Symptom Troubleshooting Guide Chart

Main symptom	Diagnostic procedure	Also check for
Unable to start (Engine does not turn over)	<ol style="list-style-type: none"> <li>1. Test the battery</li> <li>2. Test the starter</li> <li>3. Inhibitor switch (A/T) or clutch start switch (M/T)</li> </ol>	
Unable to start (Incomplete combustion)	<ol style="list-style-type: none"> <li>1. Test the battery</li> <li>2. Check the fuel pressure</li> <li>3. Check the ignition circuit</li> <li>4. Troubleshooting the immobilizer system (In case of immobilizer lamp flashing)</li> </ol>	<ul style="list-style-type: none"> <li>• DTC</li> <li>• Low compression</li> <li>• Intake air leaks</li> <li>• Slipped or broken timing belt</li> <li>• Contaminated fuel</li> </ul>
Difficult to start	<ol style="list-style-type: none"> <li>1. Test the battery</li> <li>2. Check the fuel pressure</li> <li>3. Check the ECT sensor and circuit (Check DTC)</li> <li>4. Check the ignition circuit</li> </ol>	<ul style="list-style-type: none"> <li>• DTC</li> <li>• Low compression</li> <li>• Intake air leaks</li> <li>• Contaminated fuel</li> <li>• Weak ignition spark</li> </ul>
Poor idling (Rough, unstable or incorrect Idle)	<ol style="list-style-type: none"> <li>1. Check the fuel pressure</li> <li>2. Check the Injector</li> <li>3. Check the long term fuel trim and short term fuel trim (Refer to CUSTOMER DATASTREAM)</li> <li>4. Check the idle speed control circuit (Check DTC)</li> <li>5. Inspect and test the Throttle Body</li> <li>6. Check the ECT sensor and circuit (Check DTC)</li> </ol>	<ul style="list-style-type: none"> <li>• DTC</li> <li>• Low compression</li> <li>• Intake air leaks</li> <li>• Contaminated fuel</li> <li>• Weak ignition spark</li> </ul>
Engine stall	<ol style="list-style-type: none"> <li>1. Test the Battery</li> <li>2. Check the fuel pressure</li> <li>3. Check the idle speed control circuit (Check DTC)</li> <li>4. Check the ignition circuit</li> <li>5. Check the CKPS Circuit (Check DTC)</li> </ol>	<ul style="list-style-type: none"> <li>• DTC</li> <li>• Intake air leaks</li> <li>• Contaminated fuel</li> <li>• Weak ignition spark</li> </ul>
Poor driving (Surge)	<ol style="list-style-type: none"> <li>1. Check the fuel pressure</li> <li>2. Inspect and test Throttle Body</li> <li>3. Check the ignition circuit</li> <li>4. Check the ECT Sensor and Circuit (Check DTC)</li> <li>5. Test the exhaust system for a possible restriction</li> <li>6. Check the long term fuel trim and short term fuel trim (Refer to CUSTOMER DATASTREAM)</li> </ol>	<ul style="list-style-type: none"> <li>• DTC</li> <li>• Low compression</li> <li>• Intake air leaks</li> <li>• Contaminated fuel</li> <li>• Weak ignition spark</li> </ul>
Knocking	<ol style="list-style-type: none"> <li>1. Check the fuel pressure</li> <li>2. Inspect the engine coolant</li> <li>3. Inspect the radiator and the electric cooling fan</li> <li>4. Check the spark plugs</li> </ol>	<ul style="list-style-type: none"> <li>• DTC</li> <li>• Contaminated fuel</li> </ul>
Poor fuel economy	<ol style="list-style-type: none"> <li>1. Check customer's driving habits <ul style="list-style-type: none"> <li>· A/C on full time or the defroster mode on?</li> <li>· Are tires at correct pressure?</li> <li>· Is excessively heavy load being carried?</li> <li>· Is acceleration too much, too often?</li> </ul> </li> <li>2. Check the fuel pressure</li> <li>3. Check the injector</li> <li>4. Test the exhaust system for a possible restriction</li> <li>5. Check the ECT sensor and circuit</li> </ol>	<ul style="list-style-type: none"> <li>• DTC</li> <li>• Low compression</li> <li>• Intake air leaks</li> <li>• Contaminated fuel</li> <li>• Weak ignition spark</li> </ul>

## General Information

## FLA-17

Main symptom	Diagnostic procedure	Also check for
Hard to refuel (Overflow during refueling)	<ol style="list-style-type: none"> <li>1. Test the canister close valve</li> <li>2. Inspect the fuel filler hose/pipe <ul style="list-style-type: none"> <li>· Pinched, kinked or blocked?</li> <li>· Filler hose is torn</li> </ul> </li> <li>3. Inspect the fuel tank vapor vent hose between the EVAP. canister and air filter</li> <li>4. Check the EVAP. canister</li> </ol>	<ul style="list-style-type: none"> <li>• Malfunctioning gas station filling nozzle (If this problem occurs at a specific gas station during refueling)</li> </ul>

# دیجیتال خودرو

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران



# FLA-18

# Fuel System

## Engine Control System

### Description

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

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

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

### NOTICE

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

### Malfunction Indicator Lamp (MIL)

#### [EOBD]

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

Faults with the following items will illuminate the MIL.

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

### NOTICE

Refer to "Inspection Chart For Diagnostic Trouble Codes (DTC)" for more information.

# Engine Control System

## FLA-19

### [NON-EOBD]

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

Faults with the following items will illuminate the MIL

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

### NOTICE

Refer to "Inspection Chart For Diagnostic Trouble Codes (DTC)" for more information.

### [INSPECTION]

1. After turning ON the ignition key, ensure that the light illuminates for about 5 seconds and then goes out.
2. If the light does not illuminate, check for an open circuit in the harness, a blown fuse or a blown bulb.

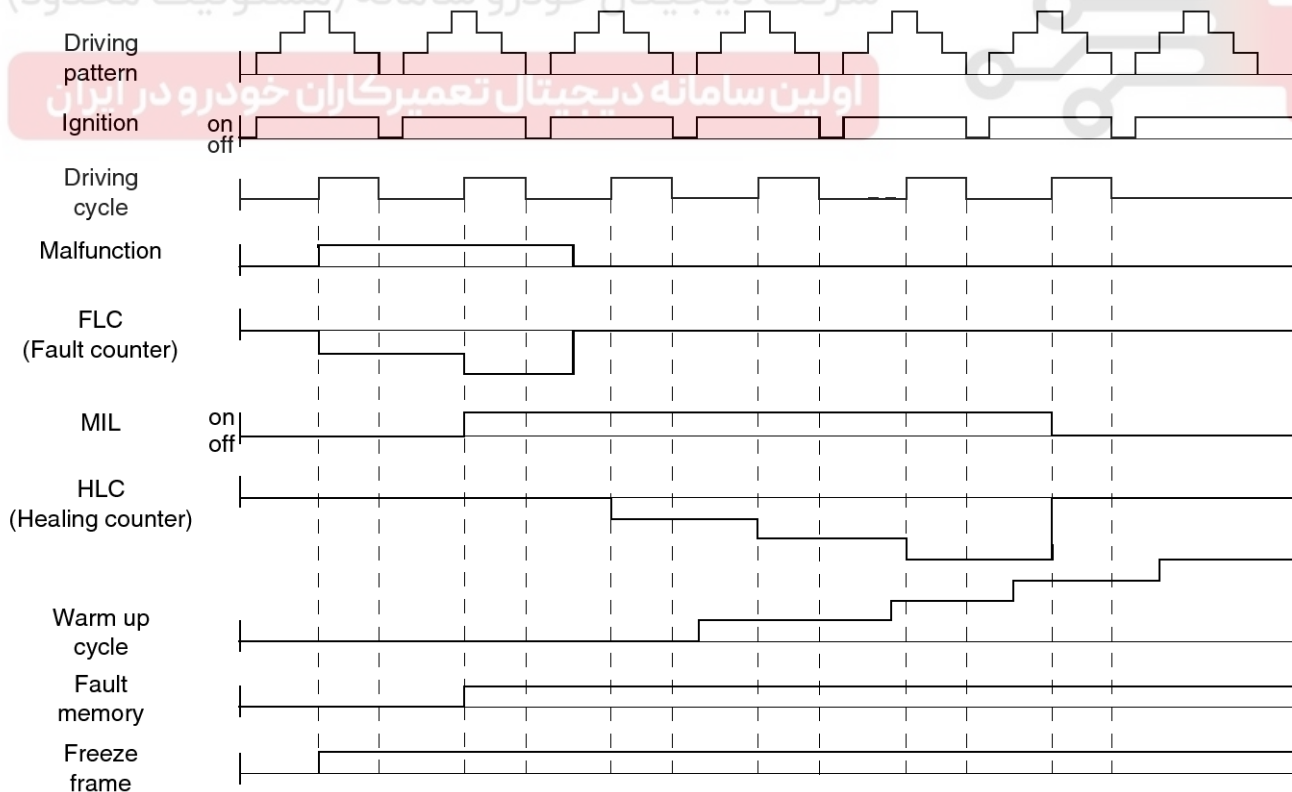
### Self-Diagnosis

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

### NOTICE

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

### The relation between DTC and driving pattern in EOBD system



LGIF601Q

## FLA-20

## Fuel System

1. When the same malfunction is detected and maintained during two sequential driving cycles, the MIL will automatically illuminate.
2. The MIL will go off automatically if no fault is detected after 3 sequential driving cycles.
3. A Diagnostic Trouble Code(DTC) is recorded in ECM memory when a malfunction is detected after two sequential driving cycles. The MIL will illuminate when the malfunction is detected on the second driving cycle.

If a misfire is detected, a DTC will be recorded, and the MIL will illuminate, immediately after a fault is first detected.

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

### NOTICE

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

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

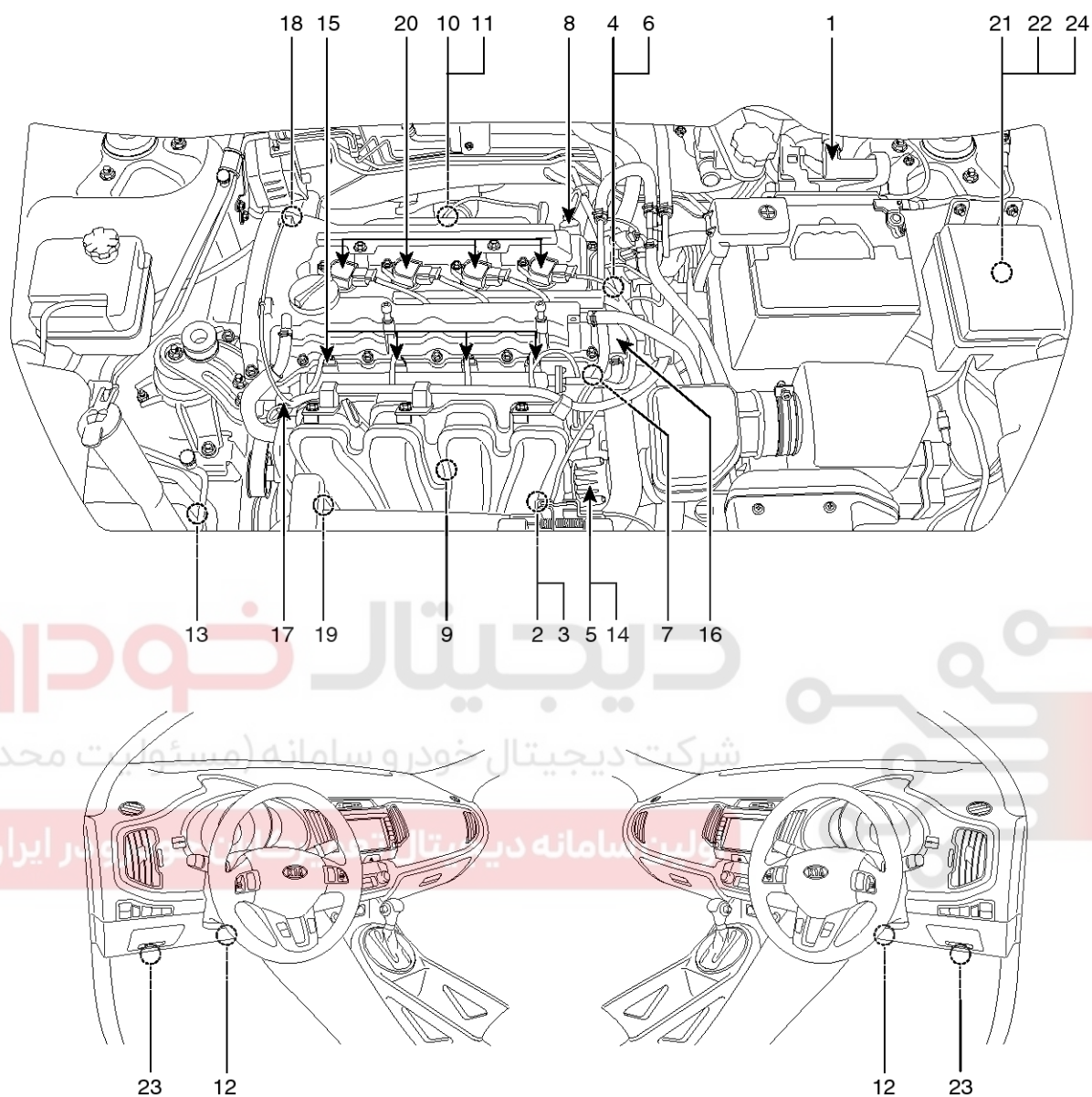
اولین سامانه دیجیتال تعمیرکاران خودرو در ایران



# Engine Control System

## FLA-21

### Components Location



[LHD]

[RHD]

SSLF11001L

## FLA-22

## Fuel System

1. ECM (Engine Control Module)
2. Manifold Absolute Pressure Sensor (MAPS)
3. Intake Air Temperature Sensor (IATS)
4. Engine Coolant Temperature Sensor (ECTS)
5. Throttle Position Sensor (TPS) [integrated into ETC Module]
6. Crankshaft Position Sensor (CKPS)
7. Camshaft Position Sensor (CMPS) [Bank 1 / Intake]
8. Camshaft Position Sensor (CMPS) [Bank 1 / Exhaust]
9. Knock Sensor (KS)
10. Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 1]
11. Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2]
12. Accelerator Position Sensor (APS)
13. A/C Pressure Transducer (APT)
14. ETC Motor [integrated into ETC Module]
15. Injector
16. Purge Control Solenoid Valve (PCSV)
17. CVVT Oil Control Valve (OCV) [Bank 1 / Intake]
18. CVVT Oil Control Valve (OCV) [Bank 1 / Exhaust]
19. Variable Intake Solenoid (VIS) Valve
20. Ignition Coil
21. Main Relay
22. Fuel Pump Relay
23. Data Link Connector (DLC) [16 Pin]
24. Multi-Purpose Check Connector [20 Pin]

# دیجیتال خودرو

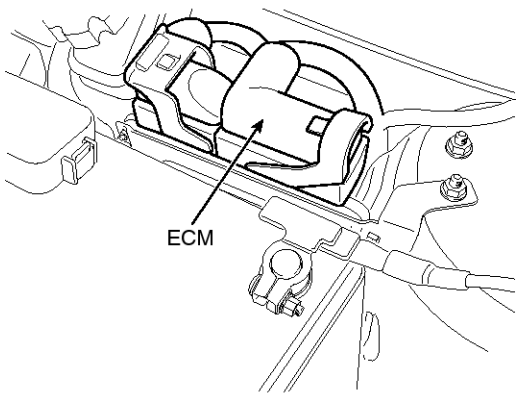
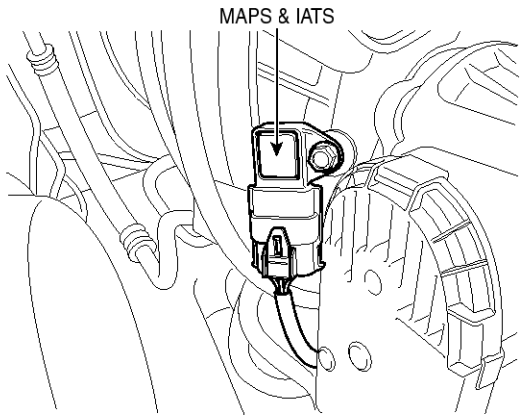
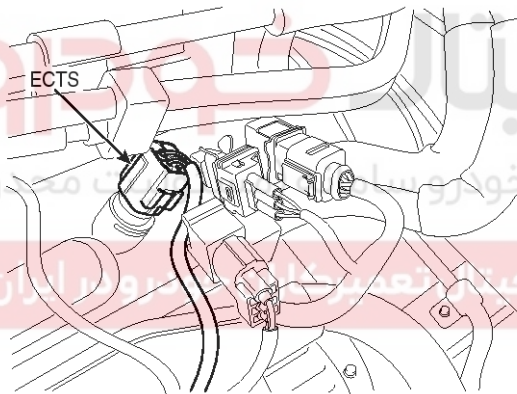
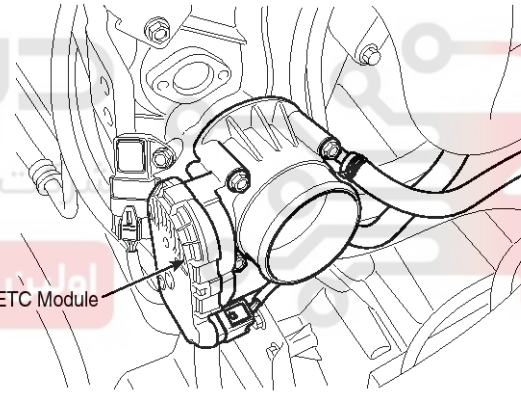
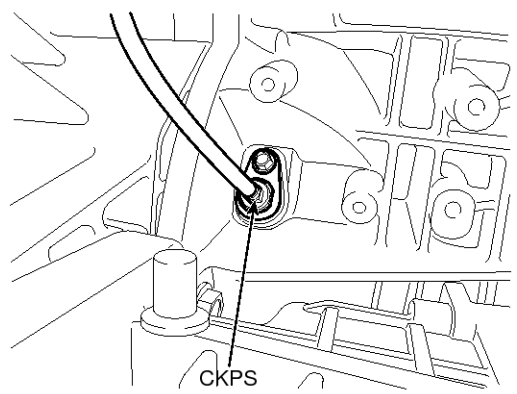
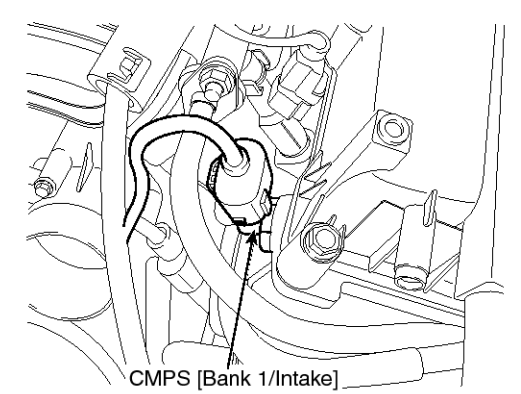
شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران



# Engine Control System

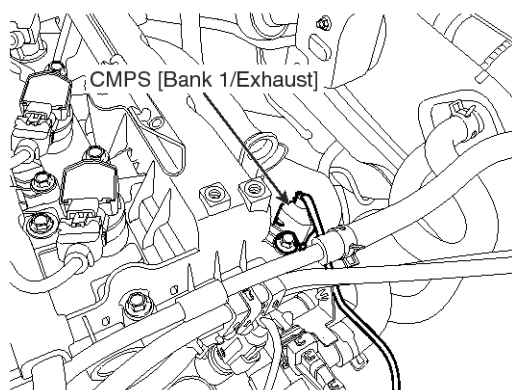
## FLA-23

1. ECM (Engine Control Module)	2. Manifold Absolute Pressure Sensor (MAPS) 3. Intake Air Temperature Sensor (IATS)
 <p>ECM</p> <p>SLMF10020D</p>	 <p>MAPS &amp; IATS</p> <p>SXMF19103D</p>
4. Engine Coolant Temperature Sensor (ECTS)	5. Throttle Position Sensor (TPS) 14. ETC Motor
 <p>ECTS</p> <p>SSLF11401D</p>	 <p>ETC Module</p> <p>SXMF10105L</p>
6. Crankshaft Position Sensor (CKPS)	7. Camshaft Position Sensor (CMPS) [Bank 1 / Intake]
 <p>CKPS</p> <p>SSLFL1002N</p>	 <p>CMPS [Bank 1/Intake]</p> <p>STDFL0106N</p>

## FLA-24

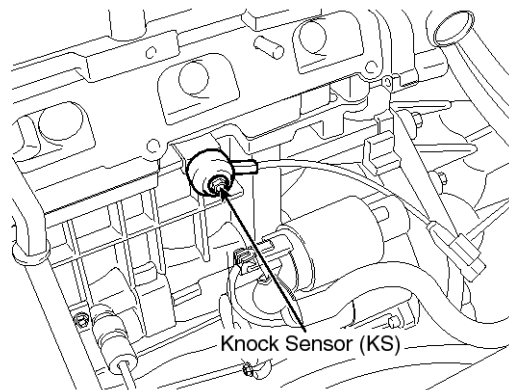
## Fuel System

8. Camshaft Position Sensor (CMPS) [Bank 1 / Exhaust]



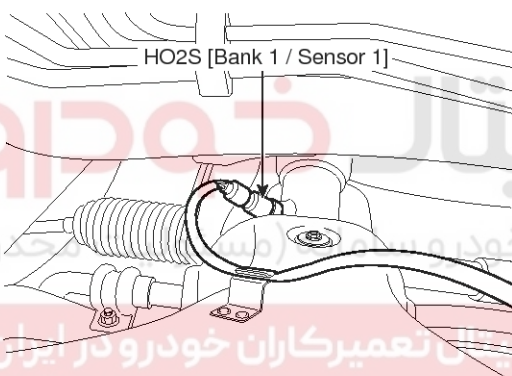
STDFL0107N

9. Knock Sensor (KS)



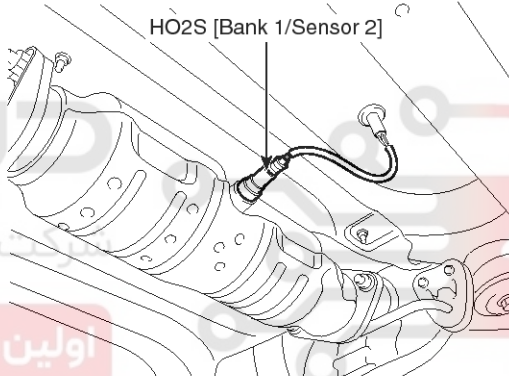
SNFFL9003N

10. Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 1]



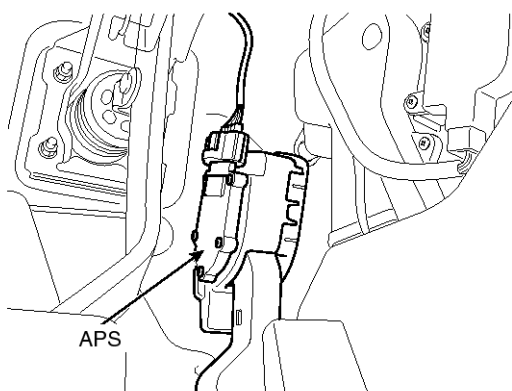
SSLF11002L

11. Heated Oxygen Sensor (HO2S) [Bank 1 / Sensor 2]



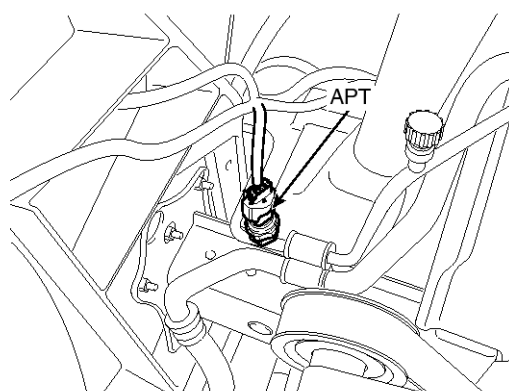
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12. Accelerator Position Sensor (APS)



SLMFL0160D

13. A/C Pressure Transducer (APT)

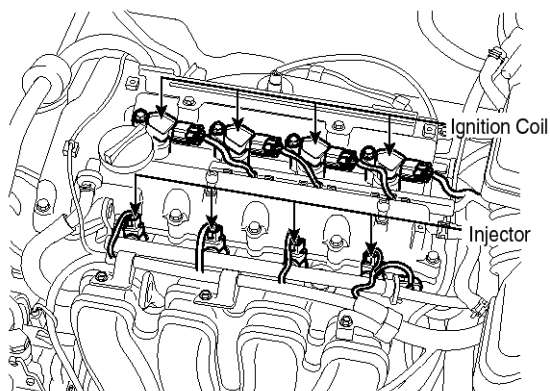


SLMFL0220D

# Engine Control System

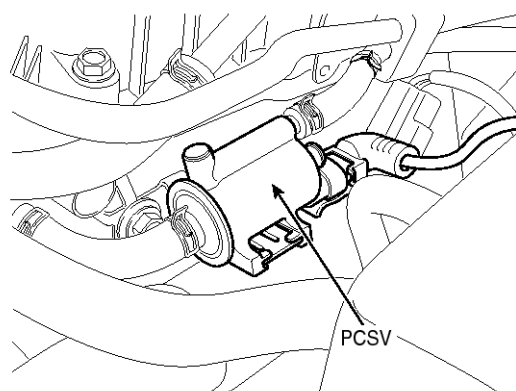
## FLA-25

15. Injector  
20. Ignition Coil



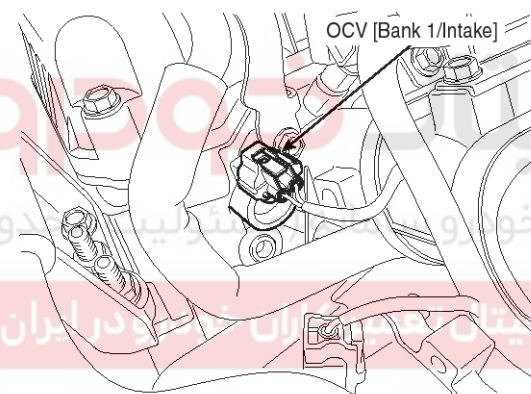
SXMF10114L

16. Purge Control Solenoid Valve (PCSV)



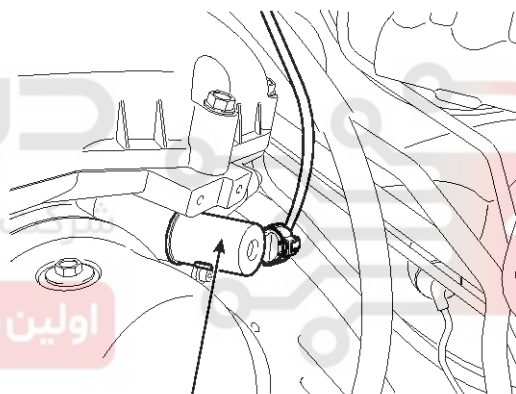
SXMF19115D

17. CVVT Oil Control Valve (OCV) [Bank 1 / Intake]



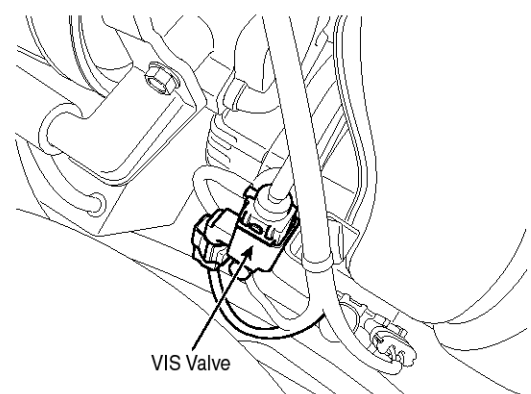
SXMF10117L

18. CVVT Oil Control Valve (OCV) [Bank 1 / Exhaust]



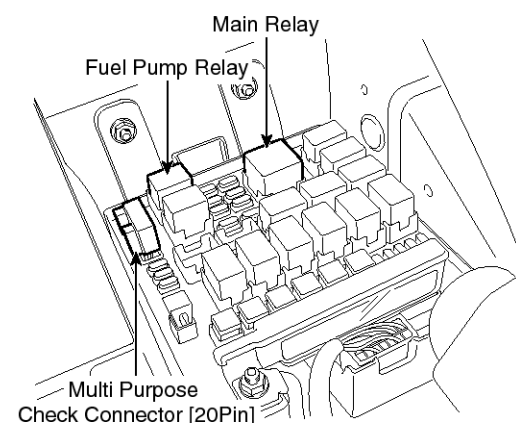
SXMF10118L

19. Variable Intake Solenoid (VIS) Valve



SXMF10119L

21. Main Relay  
22. Fuel Pump Relay  
24. Multi-Purpose Check Connector [20 Pin]



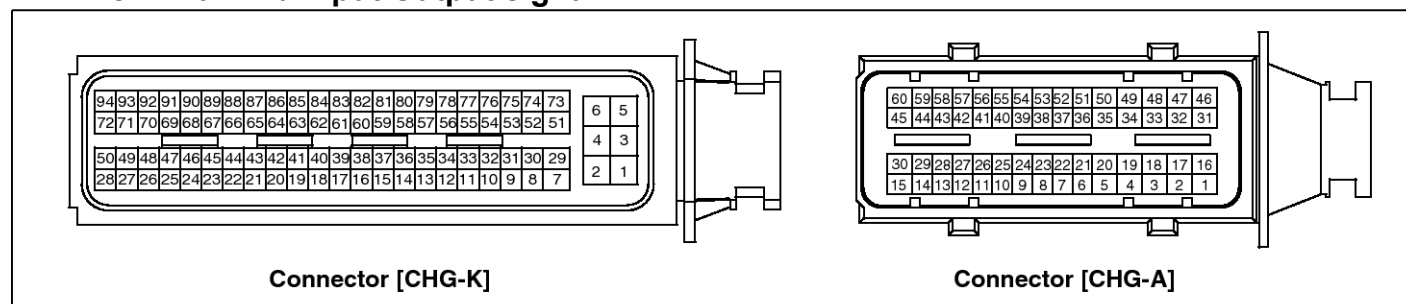
SLMF10404L

## FLA-26

## Fuel System

## Engine Control Module (ECM)

## ECM Terminal And Input/Output signal



SLMF10130L

## ECM Terminal Function

## Connector [CHG-K]

Pin No.	Description	Connected to
1	Power ground	Chassis Ground
2	Battery power (B+)	Ignition Switch
3	Power ground	Chassis Ground
4	Battery power (B+)	Main Relay
5	Power ground	Chassis Ground
6	Battery power (B+)	Battery
7	-	
8	-	
9	-	
10	-	
11	-	
12	Knock Sensor (KS) signal input	Knock Sensor (KS)
13	Sensor ground	Accelerator Position Sensor (APS) 2
14	Sensor ground	Engine Coolant Temperature Sensor (ECTS)
15	Camshaft Position Sensor (CMPS) [Bank 1/Exhaust] signal input	Camshaft Position Sensor (CMPS) [Bank 1/Exhaust]
16	Sensor ground	Heated Oxygen Sensor [Bank 1/Sensor 1] (with EURO 4)
17	Crankshaft Position Sensor (CKPS) signal input	Crankshaft Position Sensor (CKPS)
18	Rc/Rp (Pump Cell Voltage)	Heated Oxygen Sensor [Bank 1/Sensor 1] (with EURO 5)
19	VS+(NERNST Cell Voltage)	Heated Oxygen Sensor [Bank 1/Sensor 1] (with EURO 5)
20	VS-/IP- (Commom Ground for VS, IP)	Heated Oxygen Sensor [Bank 1/Sensor 1] (with EURO 5)

# Engine Control System

## FLA-27

Pin No.	Description	Connected to
21	-	
22	-	
23	-	
24	Start overrun (Ground)	Start Relay (Ground)
25	Injector (Cylinder #1) control output	Injector (Cylinder #1)
26	Injector (Cylinder #3) control output	Injector (Cylinder #3)
27	Injector (Cylinder #4) control output	Injector (Cylinder #4)
28	Injector (Cylinder #2) control output	Injector (Cylinder #2)
29	-	
30	Sensor power (+5V)	Manifold Absolute Pressure Sensor (MAPS)
31	Manifold Absolute Pressure Sensor (MAPS) signal input	Manifold Absolute Pressure Sensor (MAPS)
32	Throttle Position Sensor (TPS) 2 signal input	Throttle Position Sensor (TPS) 2
33	Engine Coolant Temperature Sensor (ECTS) signal input	Engine Coolant Temperature Sensor (ECTS)
34	Sensor ground	Knock Sensor (KS)
35	Accelerator Position Sensor (APS) 2 signal input	Accelerator Position Sensor (APS) 2
36	Sensor power (+5V)	Accelerator Position Sensor (APS) 2
37	Sensor ground	Camshaft Position Sensor (CMPS) [Bank 1/Exhaust]
38	Heated Oxygen Sensor [Bank 1/Sensor 1] signal input	Heated Oxygen Sensor [Bank 1/Sensor 1] (with EURO 4)
39	Sensor ground	Crankshaft Position Sensor (CKPS)
40	Vehicle speed signal input (Vehicle speed back up line)	ABS/ESP Control Unit
41	-	
42	Rc (Compensative Resistance)	Heated Oxygen Sensor [Bank 1/Sensor 1] (with EURO 5)
43	Sensor power (+5V)	A/C Pressure Transducer (APT)
44	-	
45	-	
46	-	
47	-	
48	-	
49	-	
50	Variable Intake Solenoid (VIS) Valve control output	Variable Intake Solenoid (VIS) Valve
51	Battery power (B+)	Main Relay
52	-	

## FLA-28

## Fuel System

Pin No.	Description	Connected to
53	Intake Air Temperature Sensor (IATS) signal input	Intake Air Temperature Sensor (IATS)
54	A/C Pressure Transducer (APT) signal input	A/C Pressure Transducer (APT)
55	-	
56	-	
57	Sensor ground	A/C Pressure Transducer (APT)
58	-	
59	Sensor ground	Throttle Position Sensor (TPS) 1,2
60	Sensor power (+5V)	Accelerator Position Sensor (APS) 1
61	Sensor ground	Accelerator Position Sensor (APS) 1
62	Camshaft Position Sensor (CMPS) [Bank 1/Intake] signal input	Camshaft Position Sensor (CMPS) [Bank 1/Intake]
63	Sensor power (+5V)	Throttle Position Sensor (TPS) 1,2
64	Main Relay control output	Main Relay
65	Cooling Fan Relay [Low] control output	Cooling Fan Relay [Low]
66	CVVT Oil Control (OCV) Valve [Bank 1/Intake] control output	CVVT Oil Control Valve (OCV) [Bank 1/Intake]
67	Purge Control Solenoid Valve (PCSV) control output	Purge Control Solenoid Valve (PCSV)
68	CVVT Oil Control (OCV) Valve [Bank 1/Exhaust] control output	CVVT Oil Control Valve (OCV) [Bank 1/Exhaust]
69	Immobilizer Lamp control output	Immobilizer Lamp [with Immobilizer]
70	Fuel Pump Relay control output	Fuel Pump Relay
71	ETC Motor [+] control output	ETC Motor
72	ETC Motor [-] control output	ETC Motor
73	-	
74	Sensor ground	Manifold Absolute Pressure Sensor (MAPS)
75	Immobilizer communication line	Smart key control module [with Smat key]
		Immobilizer module [with Immobilizer]
76	-	
77	CAN [High]	Other control module, Data Link Connector (DLC), Multi-purpose Check Connector
78	CAN [Low]	Other control module, Data Link Connector (DLC), Multi-purpose Check Connector
79	-	
80	Throttle Position Sensor (TPS) 1 signal input	Throttle Position Sensor (TPS) 1
81	-	
82	Accelerator Position Sensor (APS) 1 signal input	Accelerator Position Sensor (APS) 1

# Engine Control System

## FLA-29

Pin No.	Description	Connected to
83	Sensor ground	Camshaft Position Sensor (CMPS) [Bank 1/Intake]
84	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2] signal input	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2]
85	Sensor ground	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2]
86	Engine speed signal output	Smart key Control Module
87	A/C Compressor Relay control output	A/C Compressor Relay
88	Cooling Fan Relay [High] control output	Cooling Fan Relay [High]
89	-	
90	-	
91	-	
92	Malfunction Indicator Lamp (MIL) control output	Malfunction Indicator Lamp (MIL)
93	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1] Heater control output	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1] (with EURO 4 or EURO 5)
94	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2] Heater control output	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2]

### Connector [CHG-A]

Pin No.	Description	Connected to
1	Ignition Coil (Cylinder #4) control output	Ignition Coil (Cylinder #4) [with Immobilizer/with Smart key]
	Ignition Coil (Cylinder #1) control output	Ignition Coil (Cylinder #1) [without Immobilizer/without Smart key]
2	Shield	Ignition Coil (Cylinder #1,2,3,4)
3	-	
4	-	
5	-	
6	-	
7	-	
8	-	
9	-	
10	-	
11	-	
12	-	
13	-	
14	Electrical load signal input	Alternator
15	Ground	Cruise Control Switch

## FLA-30

## Fuel System

Pin No.	Description	Connected to
16	Ignition Coil (Cylinder #2) control output	Ignition Coil (Cylinder #2) [With Immobilizer/with Smart key]
	Ignition Coil (Cylinder #3) control output	Ignition Coil (Cylinder #3) [Without Immobilizer/without Smart key]
17	-	
18	-	
19	-	
20	-	
21	-	
22	-	
23	-	
24	-	
25	-	
26	-	
27	-	
28	Start overrun	ATM P/N Relay
29	Brake Switch 1 signal input	Brake Switch
30	Cruise Control Switch signal input	Cruise Control Switch
31	Ignition Coil (Cylinder #1) control output	Ignition Coil (Cylinder #1) [With Immobilizer/with Smart key]
	Ignition Coil (Cylinder #4) control output	Ignition Coil (Cylinder #4) [Without Immobilizer/without Smart key]
32	-	
33	-	
34	-	
35	-	
36	-	
37	-	
38	-	
39	-	
40	-	
41	-	
42	-	
43	Clutch Switch signal input	Clutch Switch
44	Brake Switch 2 signal input	Brake Switch
45	-	

# Engine Control System

## FLA-31

Pin No.	Description	Connected to
46	Ignition Coil (Cylinder #3) control output	Ignition Coil (Cylinder #3) [With Immobilizer/with Smart key]
	Ignition Coil (Cylinder #2) control output	Ignition Coil (Cylinder #2) [Without Immobilizer/without Smart key]
47	-	
48	-	
49	-	
50	-	
51	-	
52	-	
53	-	
54	-	
55	-	
56	-	
57	-	
58	Power Steering Pressure Switch signal input	Power Steering Pressure Switch [Without MDPS]
59	-	
60	-	

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## FLA-32

## Fuel System

ECM Terminal Input/ Output signal  
Connector [CHG-K]

Pin No.	Description	Condition	Type	Level	Test Result
1	Power ground	Idle	DC	Max. 50mV	
2	Battery power (B+)	IG OFF	DC	Max. 0.5V	10.2mV
		IG ON		Battery Voltage	12.02V
3	Power ground	Idle	DC	Max. 50mV	2.8mV
4	Battery power (B+)	IG OFF	DC	Max. 1.0V	3.1mV
		IG ON		Battery Voltage	12.1V
5	Power ground	Idle	DC	Max. 50mV	1.8mV
6	Battery power (B+)	Always (Without Ignition key)	Current	Below 2.0 mA	0.4 mA
			DC	Battery Voltage	12.88V
7	-				
8	-				
9	-				
10	-				
11	-				
12	Knock Sensor (KS) signal input	Knocking	Variable Frequency	-0.3 ~ 0.3V	
		Normal		0 V	
13	Sensor ground	Idle	DC	Max. 50mV	30mV
14	Sensor ground	Idle	DC	Max. 50mV	12.4mV
15	Camshaft Position Sensor (CMPS) [Bank 1/Exhaust] signal input	Idle	Pulse	HI: Vcc or Battery Voltage	5.0V
				LO: Max. 0.5V	0.2V
				FREQ: 5.36Hz	
16	Sensor ground	Idle	DC	Max. 50mV	29.0mV
17	Crankshaft Position Sensor (CKPS) signal input	Idle	Pulse	HI: Vcc or Battery Voltage	5.00V
				LO: Max. 0.5V	40mV
				FREQ: 600Hz	
18	Rc/Rp (Pump Cell Voltage)	Idle	Analog	Normal: $450 \pm 50$ mV Rich: Max. Normal+150 mV Lean: Min. Normal-150 mV	
19	VS+ (NERNST Cell Voltage)	Idle	Analog	Normal: $450 \pm 50$ mV Rich: Max. Normal+150 mV Lean: Min. Normal-150 mV	
20	VS-/IP- (Common Ground for VS, I-P)	Idle	Analog	Reference for V_IP, V_N	

## Engine Control System

## FLA-33

Pin No.	Description	Condition	Type	Level	Test Result
21	-				
22	-				
23	Fuel consumption signal output	Idle	Pulse	HI: Battery Voltage	13.7V
				LO: Max. 0.5V	0V
				Frequency	3.33Hz
				Pulse Width	500μs
24	Start overrun (Ground)				
25	Injector (Cylinder #1) control output	Idle	Pulse	HI: Battery Voltage	13.8V
				LO: Max. 1.0V	200mV
				Vpeak: Max. 80V	54.1V
				Frequency	5.21Hz
				Dwell Time	2.74ms
26	Injector (Cylinder #3) control output	Idle	Pulse	HI: Battery Voltage	13.9V
				LO: Max. 1.0V	170mV
				Vpeak: Max. 80V	53.9V
				Frequency	5.18Hz
				Dwell Time	2.73ms
27	Injector (Cylinder #4) control output	Idle	Pulse	HI: Battery Voltage	14V
				LO: Max. 1.0V	160mV
				Vpeak: Max. 80V	54.3V
				Frequency	5.24Hz
				Dwell Time	2.70ms
28	Injector (Cylinder #2) control output	Idle	Pulse	HI: Battery Voltage	14.1V
				LO: Max. 1.0V	160mV
				Vpeak: Max. 80V	53.9V
				Frequency: 5.21Hz	5.21Hz
				Dwell Time: 2.73ms	2.74ms
29	-				
30	Sensor power (+5V)	IG OFF	DC	Max. 0.5V	0mV
		IG ON		4.9 ~ 5.1V	4.98V
31	Manifold Absolute Pressure Sensor (MAPS) signal input	Idle	Analog	0.8 ~ 1.6V	1.37V
32	Throttle Position Sensor (TPS) 2 signal input	C.T	Analog	4.2 ~ 5.0V	4.52V
		W.O.T		3.3 ~ 3.8V	3.68V

## FLA-34

## Fuel System

Pin No.	Description	Condition	Type	Level	Test Result
33	Engine Coolant Temperature Sensor (ECTS) signal input	Idle	Analog	0.5 ~ 4.5V	1.02V
34	Sensor ground	Idle	DC	Max. 50mV	8mV
35	Accelerator Position Sensor (APS) 2 signal input	C.T	Analog	Max. 1.0V	0.4V
		W.O.T		1.5 ~ 3.0V	1.9V
36	Sensor power (+5V)	IG OFF	DC	Max. 0.5V	5mV
		IG ON		4.9 ~ 5.1V	5.02V
37	Sensor ground	Idle	DC	Max. 50mV	11mV
38	Heated Oxygen Sensor [Bank 1/Sensor 1] signal input	Idle	DC	Rich: 0.6 ~ 1.0V	926mV
				Lean: Max. 0.4V	20mV
39	Sensor ground	Idle	DC	Max. 50mV	11mV
40	Vehicle speed signal input (Vehicle speed back up line)	Vehicle Run	Pulse	HI: Min. 4.5V	5.0V
				LO: Max. 0.5V	0V
				Frequency	46.9Hz at Idle
				Duty(-)	50.4% at Idle
41	-				
42	Rc (Compensative Resistance)	Idle	Analog	$ R_c - R_c/R_p  < \pm 0.1V$	
43	Sensor power (+5V)	IG OFF	DC	Max. 0.5V	
		IG ON		4.9 ~ 5.1V	
44	-				
45	-				
46	Alternator (COM)				
47	-				
48	-				
49	-				
50	Variable Intake Solenoid (VIS) Valve control output	Active	DC	Max. 1.0V	316mV
		Inactive		Battery Voltage	14.0V
51	Battery power (B+)	IG OFF	DC	Max. 1.0V	3.1mV
		IG ON		Battery Voltage	12.3V
52	-				
53	Intake Air Temperature Sensor (IATS) signal input	Idle	Analog	0 ~ 5.0V	2.55V
54	A/C Pressure Transducer (APT) signal input	Idle	DC	0.4 ~ 4.6V	A/C OFF: 1.29 V A/C ON: 2.01V
55	-				

# Engine Control System

## FLA-35

Pin No.	Description	Condition	Type	Level	Test Result
56	Blower Motor "MAX" Switch signal input				
57	Sensor ground	Idle	DC	Max. 50mV	11mV
58	-				
59	Sensor ground	Idle	DC	Max. 50mV	6mV
60	Sensor power (+5V)	IG OFF	DC	Max. 0.5V	10mV
		IG ON		4.9 ~ 5.1V	5.02V
61	Sensor ground	Idle	DC	Max. 50mV	30mV
62	Camshaft Position Sensor (CMPS) [Bank 1/Intake] signal input	Idle	Pulse	HI: Vcc or Battery Voltage	5.0V
				LO: Max. 0.5V	0.2V
				Frequency	5.2Hz
63	Sensor power (+5V)	IG OFF	DC	Max. 0.5V	0V
		IG ON		4.9 ~ 5.1V	5.03V
64	Main Relay control output	Relay OFF	DC	Battery Voltage	12.3V
		Relay ON		Max. 1.0V	730mV
65	Cooling Fan Relay [Low] control output	A/C ON	Pulse	HI: Battery Voltage	10.4V
				LO: 0 ~ 0.5V	60mV
66	CVVT Oil control (OCV) Valve [Bank 1/Intake] control output	Idle	Pulse	HI: Battery Voltage	15.0V
				LO: Max. 1.0V	120mV
				Frequency	300Hz
				Duty(+)	84.70%
67	Purge control Solenoid Valve (PCSV) control output	Inactive Active	Pulse	HI: Battery Voltage	14.3V
				LO: Max. 1.0V	80mV
				Vpeak: Max. 70V	57.0V
				Frequency	16Hz
68	CVVT Oil control (OCV) Valve [Bank 1/Exhaust] control output	Idle	Pulse	HI: Battery Voltage	13.5V
				LO: Max. 1.0V	100mV
				Vpeak: Max.70V	13.5V
				Frequency	300Hz
69	Immobilizer Lamp control output	Lamp OFF	DC	HI: Battery Voltage	13.2V
		Lamp ON		LO: Max . 2.0V	40mV
70	Fuel Pump Relay control output	Relay OFF	DC	Battery Voltage	12.8V
		Relay ON		Max. 1.0V	40mV
71	ETC Motor [+] control output	Idle	Pulse	HI: Battery Voltage	13.4V
				LO: Max . 1.0V	0V

## FLA-36

## Fuel System

Pin No.	Description	Condition	Type	Level	Test Result
72	ETC Motor [-] control output	Idle	Pulse	HI: Battery Voltage	13.3V
				LO: Max . 1.0V	0V
73	-				
74	Sensor ground	Idle	DC	Max. 50 mV	7mV
75	Immobilizer communication line	During communicating	Pulse	HI: Min. 8.5V	11.8V
				LO: Max. 3.5V	1.0V
76	LIN communication signal input				
77	CAN [High]	Recessive	Pulse	2.0 ~ 3.0V	2.58V
		Dominant		2.75 ~ 4.5V	3.54V
78	CAN [Low]	Recessive	Pulse	2.0 ~ 3.0V	2.64V
		Dominant		0.5 ~ 2.25V	1.52V
79	-				
80	Throttle Position Sensor (TPS) 1 signal input	C.T	Analog	0.3 ~ 0.9 V	0.65V
		W.O.T		1.5 ~ 3.0 V	1.63V
81	-				
82	Accelerator Position Sensor (APS) 1 signal input	C.T	Analog	Max. 1.0V	0.8V
		W.O.T		Min. 4.0V	4.0V
83	Sensor ground	Idle	DC	Max. 50 mV	12mV
84	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2] signal input	Idle	DC	Rich: 0.6 ~ 1.0V	74 mV
				Lean: Max. 0.4V	70mV
85	Sensor ground	Idle	DC	Max. 50 mV	10 mV
86	Engine speed signal output	Idle	Pulse	HI: Battery Voltage	14.0V
				LO: Max. 0.5V	60mV
				Frequency: 20~26Hz	21Hz
				Duty(+)	50%
87	A/C Compressor Relay control output	A/C OFF	DC	Battery Voltage	14.3 V
		A/C ON		Max. 1.0V	102mV
88	Cooling Fan Relay [High] control output	Relay OFF	DC	Battery Voltage	
		Relay ON		Max. 1.0V	
89	-				
90	-				
91	-				
92	Malfunction Indicator Lamp (MIL) control output	Lamp OFF	DC	Battery Voltage	13.8V
		Lamp ON		Max. 1.0V	54mV

# Engine Control System

## FLA-37

Pin No.	Description	Condition	Type	Level	Test Result
93	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1] Heater control output (with EURO 4 or EURO 5)	Engine Run	Pulse	HI: Battery Voltage	14.4V
				LO: Max. 1.0V	0.36V
				Frequency	10.0Hz
				Duty(+)	58.30%
94	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2] Heater control output	Engine Run	Pulse	HI: Battery Voltage	14.0V
				LO: Max. 1.0V	0.31V
				Frequency	7.68Hz
				Duty(+)	53.9%

### Connector [CHG-A]

Pin No.	Description	Condition	Type	Level	Test Result
1	Ignition Coil (Cylinder #4) control output [with Immobilizer/with Smart key]	Idle	Pulse	1st Voltage: 300~400V	416V
				ON Voltage: Max. 2.0V	1.4V
	Ignition Coil (Cylinder #1) control output [without Immobilizer/without Smart key]			Frequency	5.2Hz
				Dwell Time	2.78ms
2	Shield	Idle	DC	Max. 50mV	16.8mV
3	-				
4	-				
5	-				
6	-				
7	-				
8	-				
9	-				
10	-				
11	-				
12	-				
13	Electrical load [Wiper] signal input				
14	Alternator (FR)	Idle	Pulse	HI: Battery Voltage	13.4V
				LO: Max 1.5V	40 mV
15	Ground	Idle	DC	Max. 50 mV	

## FLA-38

## Fuel System

Pin No.	Description	Condition	Type	Level	Test Result
16	Ignition Coil (Cylinder #2) control output [with Immobilizer/with Smart key]	Idle	Pulse	1st Voltage: 300~400V	416V
				ON Voltage: Max. 2.0V	1.3V
	Ignition Coil (Cylinder #3) control output [without Immobilizer/without Smart key]			Frequency	5.2Hz
				Dwell Time	2.73ms
17	-				
18	-				
19	-				
20	-				
21	-				
22	-				
23	-				
24	-				
25	-				
26	-				
27	-				
28	Start overrun				
29	Brake Switch 1 signal input	Brake ON	DC	Battery Voltage	
		Brake OFF		Max. 0.5 V	
30	Cruise control Switch signal input	Cruise ON	DC	Battery Voltage	
		Cruise OFF		4.3 ~ 4.7V	
31	Ignition Coil (Cylinder #1) control output [with Immobilizer/with Smart key]	Idle	Pulse	1st Voltage: 300~400V	408V
				ON Voltage: Max. 2.0V	1.6V
	Ignition Coil (Cylinder #4) control output [without Immobilizer/without Smart key]			Frequency	5.2Hz
				Dwell Time	2.74ms
32	-				
33	-				
34	-				
35	-				
36	-				
37	-				
38	-				
39	-				

## Engine Control System

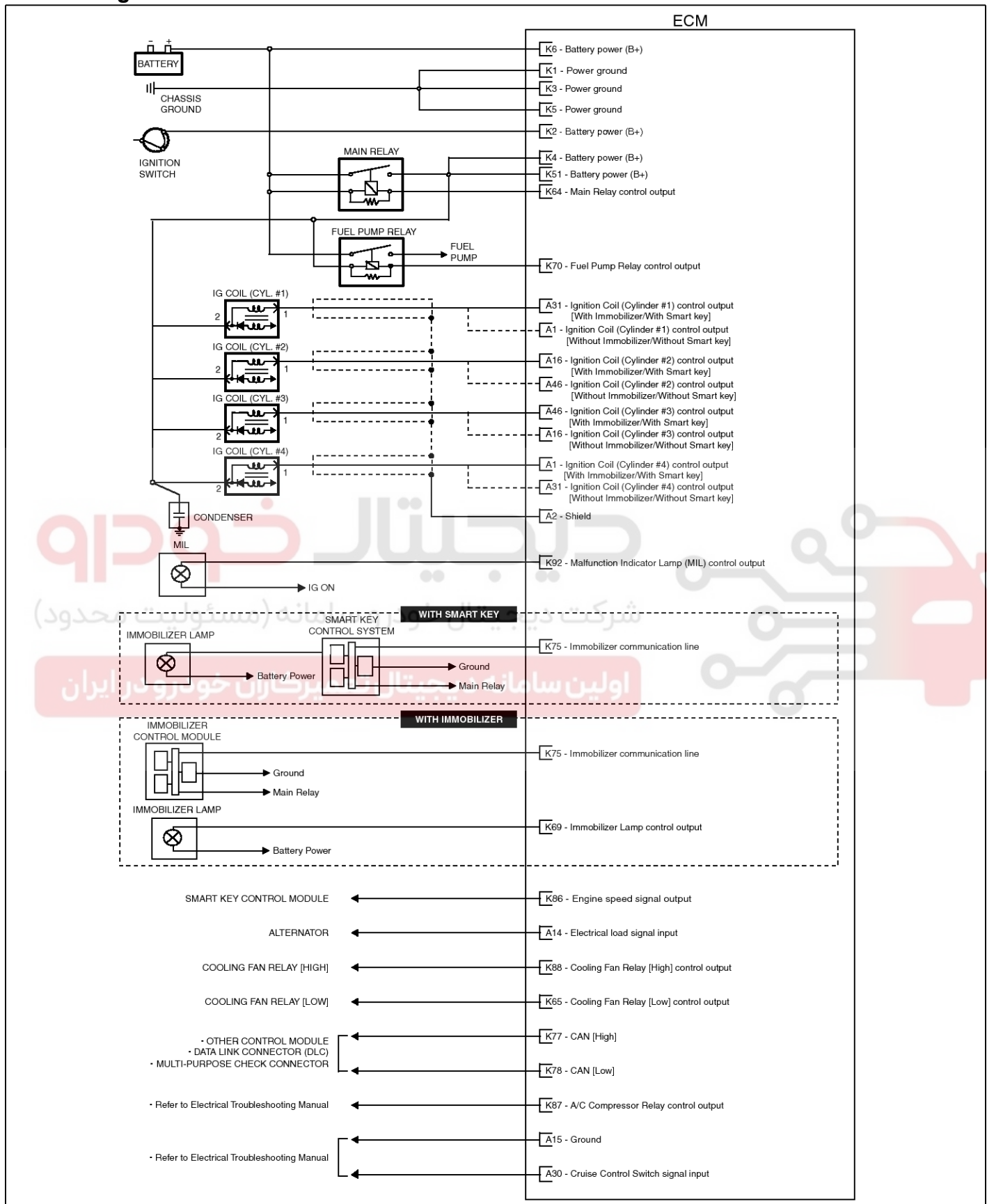
## FLA-39

Pin No.	Description	Condition	Type	Level	Test Result
40	-				
41	-				
42	A/C Blower Switch signal input	A/C S/W OFF	DC	Max. 0.5V	20mV
		A/C S/W ON		Battery Voltage	11.8V
43	Clutch Switch signal input	Release	DC	Max. 0.5V	
		Push		Battery Voltage	
44	Brake Switch 2 signal input	Push	DC	Max. 0.5V	
		Normal		Battery Voltage	
45	-				
46	Ignition Coil (Cylinder #3) control output [with Immobilizer/with Smart key]	Idle	Pulse	1st Voltage: 300~400V	410V
				ON Voltage: Max. 2.0V	1.5V
	Ignition Coil (Cylinder #2) control output [without Immobilizer/without Smart key]			Frequency	5.2Hz
				Dwell Time	2.78ms
47	-				
48	-				
49	-				
50	-				
51	-				
52	-				
53	-				
54	-				
55	-				
56	-				
57	A/C Switch “ON” signal input	A/C OFF	DC	Max. 0.5V	0V
		A/C ON		Battery Voltage	14.0V
58	Power Steering Pressure Switch signal input	S/W ON	DC	Max. 0.5V	
		S/W OFF		Battery Voltage	
59	-				
60	-				

## FLA-40

## Fuel System

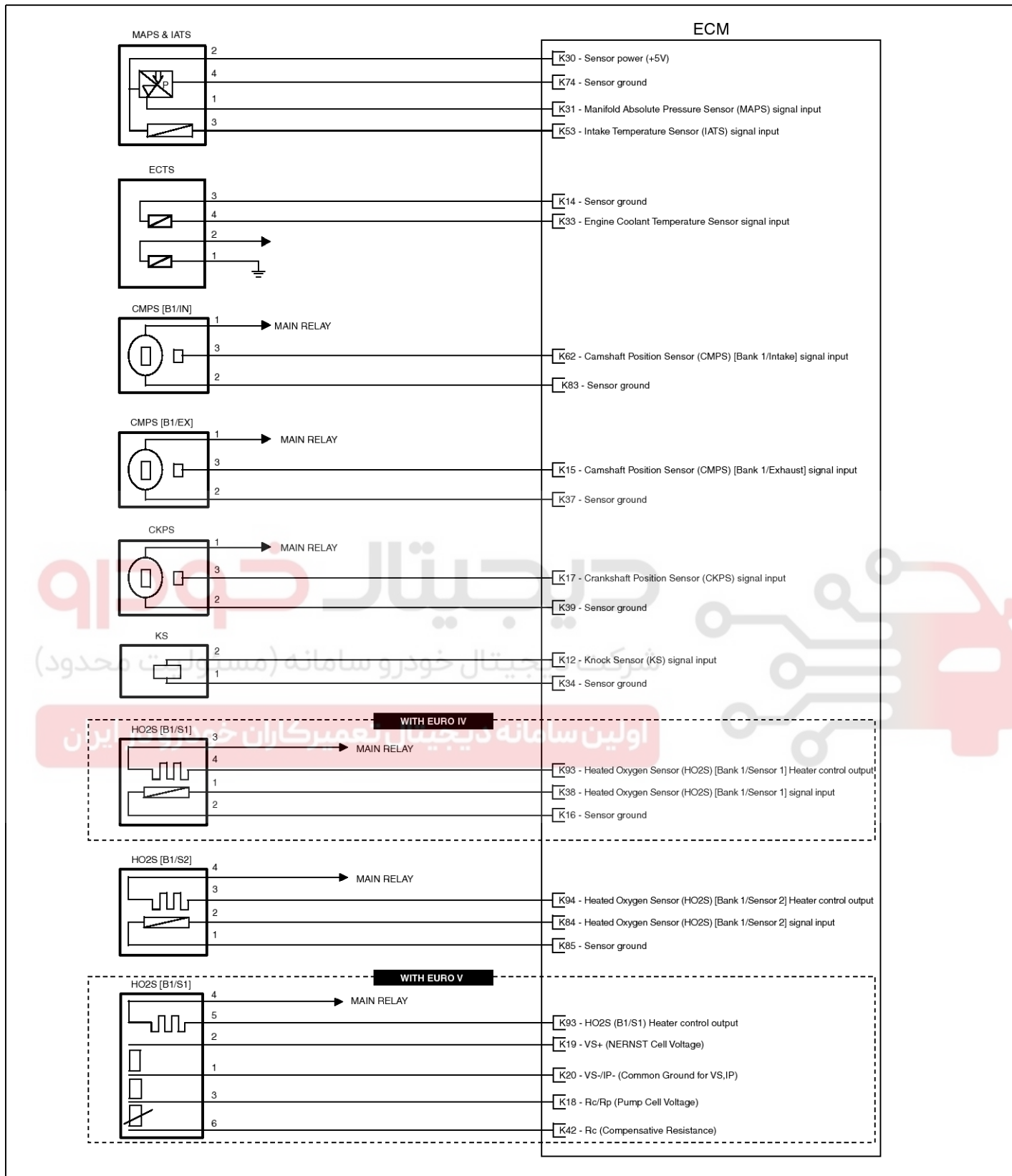
## Circuit Diagram



SSLF11003L

# Engine Control System

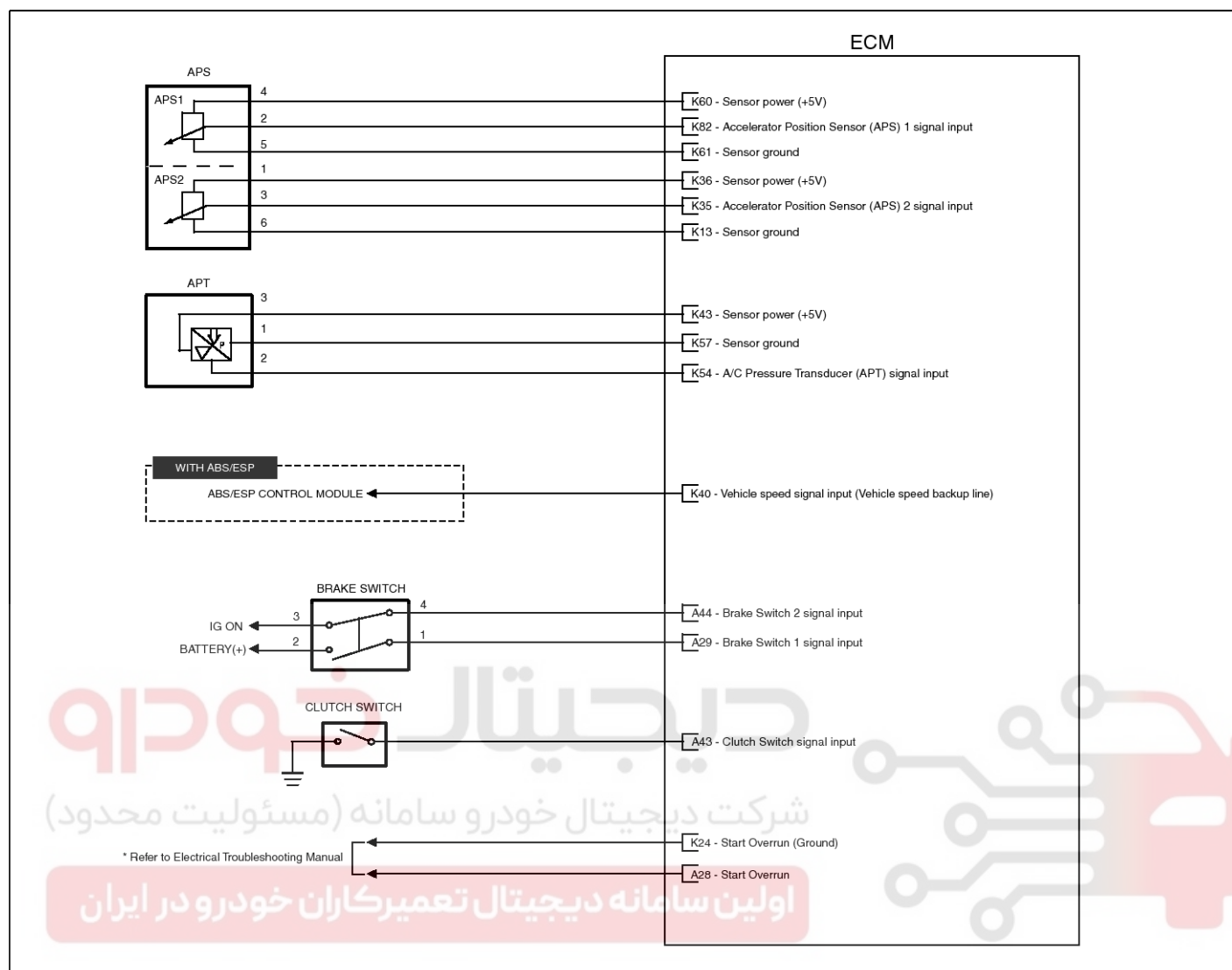
## FLA-41



SSLF11004L

## FLA-42

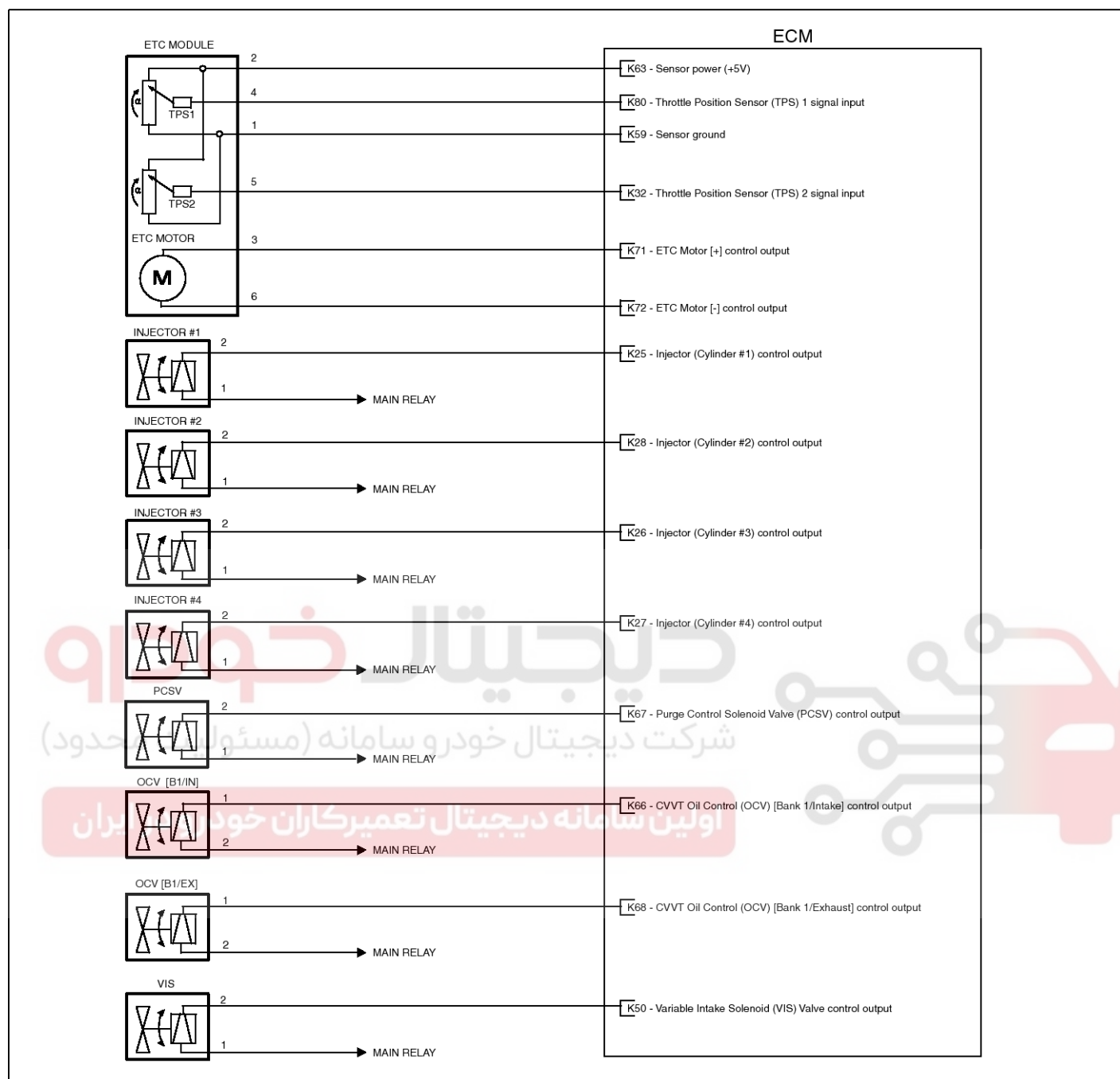
## Fuel System



SSLF11005L

## Engine Control System

## FLA-43



SXMFI0134L

## FLA-44

## Fuel System

## Removal

**NOTICE**

When replacing the ECM, the vehicle equipped with immobilizer must be performed the procedure as below.

[In the case of installing used ECM]

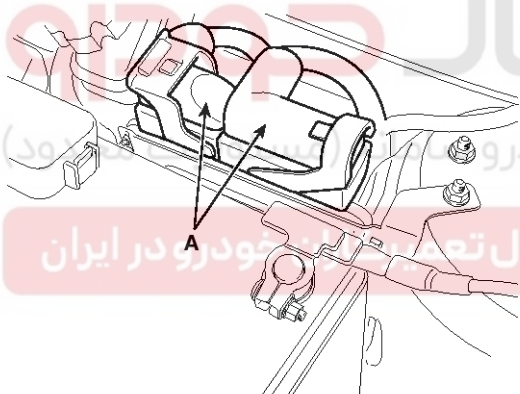
1. Perform "ECM neutralization mode" procedure with GDS. (Refer to "Immobilizer" in BE group)
2. Insert the key and turn it to the IGN ON and OFF position. Then the ECM key register process is completed automatically.

[In the case of installing new ECM]

Insert the key and turn it to the IGN ON and OFF position.

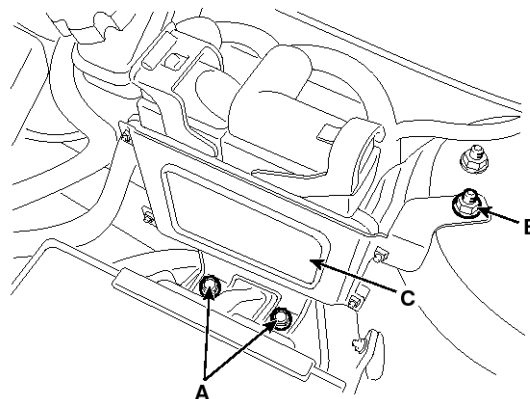
Then the ECM key register process is completed automatically.

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Disconnect the ECM Connector (A).



SLMF10021D

3. Remove the battery (Refer to "Chargin System" in EE group).
4. Remove the mounting bolts (A) and nut (B), and then remove the ECM (C).



SLMF10030D

## Installation

**NOTICE**

When replacing the ECM, the vehicle equipped with immobilizer must be performed the procedure as below.

[In the case of installing used ECM]

1. Perform "ECM neutralization mode" procedure with GDS. (Refer to "Immobilizer" in BE group)
2. Insert the key and turn it to the IGN ON and OFF position. Then the ECM key register process is completed automatically.

[In the case of installing new ECM]

Insert the key and turn it to the IGN ON and OFF position.

Then the ECM key register process is completed automatically.

1. Installation is reverse of removal.

**ECM installation bolt:**

3.9 ~ 5.9 N.m (0.4 ~ 0.6 kgf.m, 2.9 ~ 4.3 lb-ft)

**ECM bracket installation bolt:**

21.6 ~ 32.4 N.m (2.2 ~ 3.3 kgf.m, 15.9 ~ 23.9 lb-ft)

**ECM bracket installation nut:**

9.8 ~ 14.7 N.m (1.0 ~ 1.5 kgf.m, 7.2 ~ 10.9 lb-ft)

# Engine Control System

## FLA-45

### ECM Problem Inspection Procedure

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

**Specification:** Below  $1\Omega$

2. TEST ECM CONNECTOR: Disconnect the ECM connector and visually check the ground terminals on ECM side and harness side for bent pins or poor contact pressure. If the problem is found, repair it.
3. If problem is not found in Step 1 and 2, the ECM could be faulty. If so, make sure there were no DTC's before swapping the ECM with a new one, and then check the vehicle again. If DTC's were found, examine this first before swapping 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 Inspection Procedure" in Basic Inspection Procedure).



دیجیتال خودرو  
شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

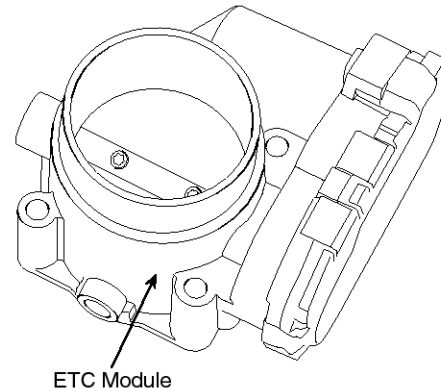
## FLA-46

## Fuel System

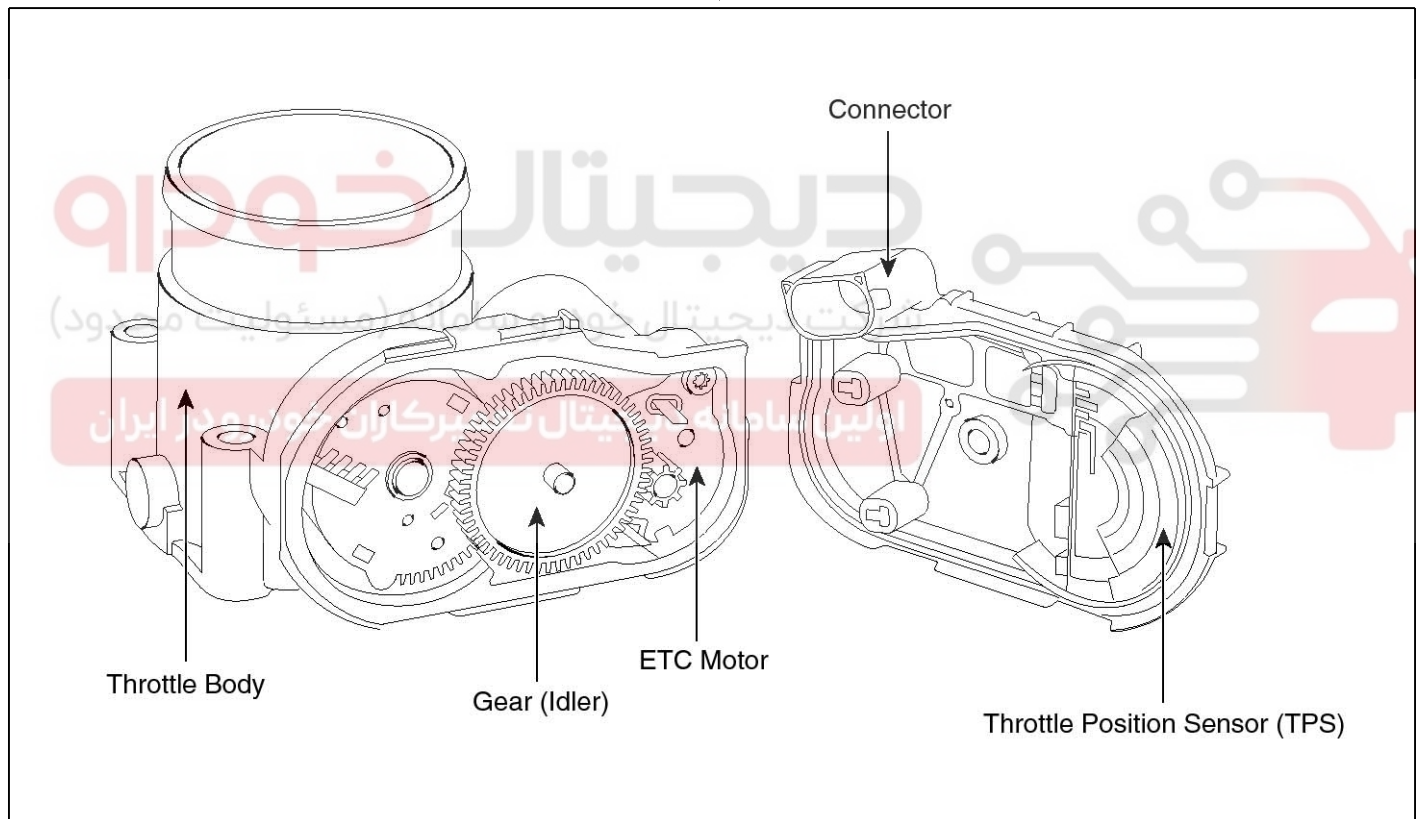
### ETC (Electronic Throttle Control) System

#### Description

The Electronic Throttle Control (ETC) System consists of a throttle body with an integrated control motor and throttle position sensor (TPS). Instead of the traditional throttle cable, an Accelerator Position Sensor (APS) is used to receive driver input. The ECM uses the APS signal to calculate the target throttle angle; the position of the throttle is then adjusted via ECM control of the ETC motor. The TPS signal is used to provide feedback regarding throttle position to the ECM. Using ETC, precise control over throttle position is possible; the need for external cruise control modules/cables is eliminated.



SBKFL9129L

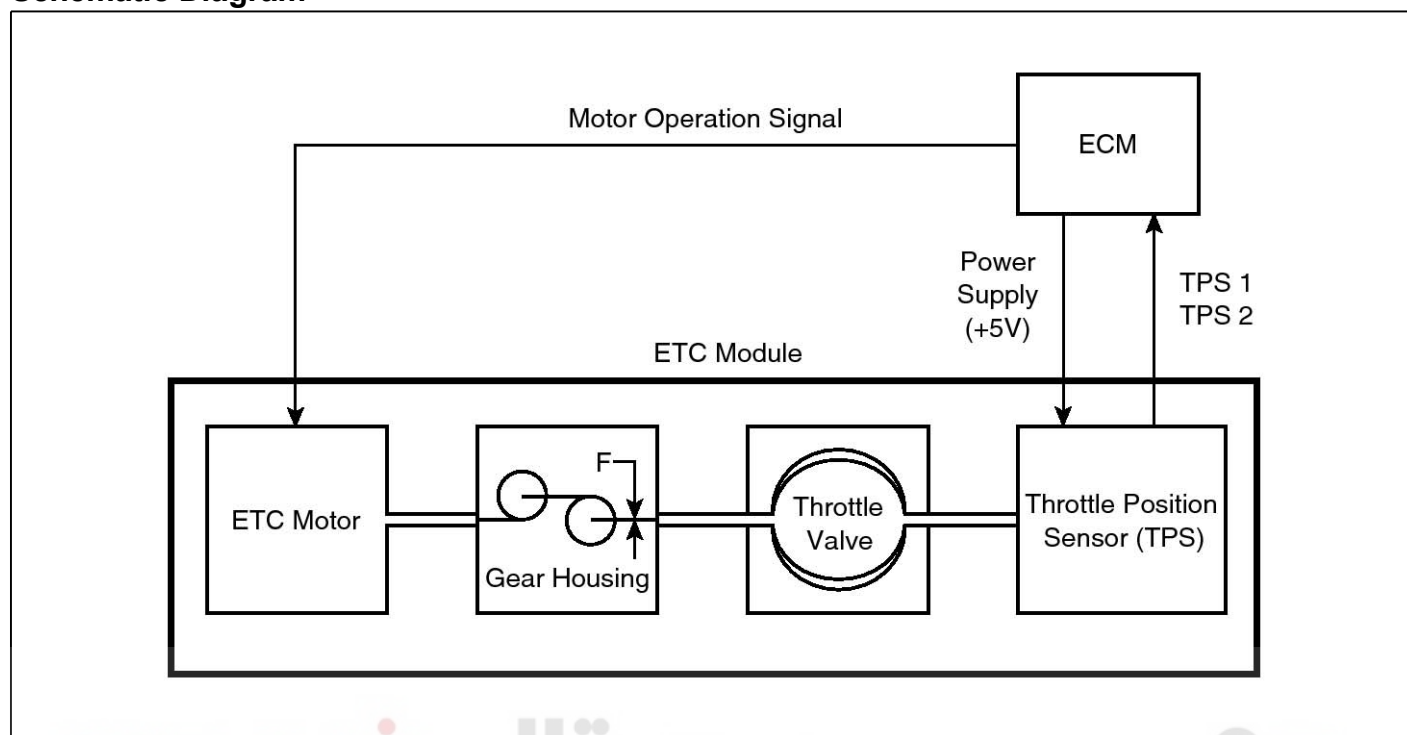


SBKFL9130L

# Engine Control System

FLA-47

## Schematic Diagram



SBKFL9134N

## Fail-Safe Mode

Item	Fail-Safe	
ETC Motor	Throttle valve stuck at 5°	
TPS	TPS 1 fault	Replace it with TPS2
	TPS 2 fault	Replace it with TPS1
	TPS 1,2 fault	Throttle valve stuck at 5°
APS	TPS 1 fault	Replace it with TPS2
	TPS 2 fault	Replace it with TPS1
	TPS 1,2 fault	Throttle valve stuck at 5°

## NOTICE

When throttle value is stuck at 5°, engine speed is limited at below 1,500rpm and vehicle speed at maximum 40 ~ 50 km/h (25 ~ 31 mph)

## FLA-48

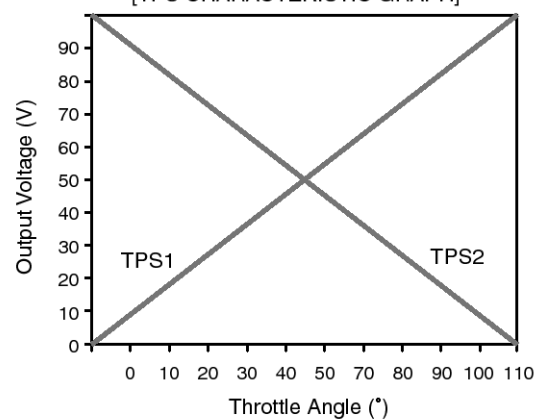
## Fuel System

## Specification

## [Throttle Position Sensor (TPS)]

Throttle Angle(°)	Output Voltage(V)	
	TPS1	TPS2
0	0.0	5.0
10	0.48	4.52
20	0.95	4.05
30	1.43	3.57
40	1.90	3.10
50	2.38	2.62
60	2.86	2.14
70	3.33	1.67
80	3.81	1.19
90	4.29	0.71
100	4.76	0.24
105	5.0	0
C.T (6 ~ 15°)	0.29 ~ 0.71	4.29 ~ 4.71
W.O.T (93 ~ 102°)	4.43 ~ 4.86	0.14 ~ 0.57

[TPS CHARACTERISTIC GRAPH]



EGRF235A

Item	Sensor Resistance( $k\Omega$ )
TPS1	0.875 ~ 1.625 [20°C (68°F)]
TPS2	0.875 ~ 1.625 [20°C (68°F)]

## [ETC Motor]

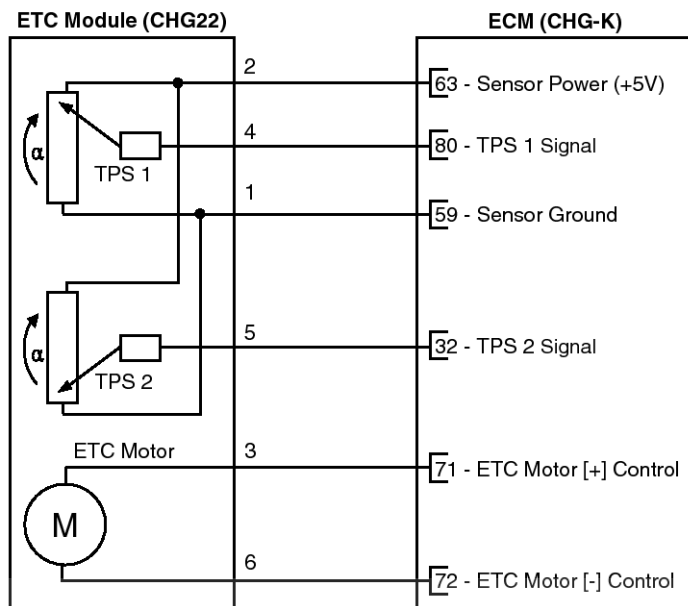
Item	Specification
Coil Resistance ( $\Omega$ )	1.2 ~ 1.8 [20°C (68°F)]

# Engine Control System

FLA-49

## Circuit Diagram

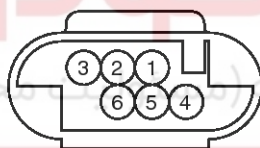
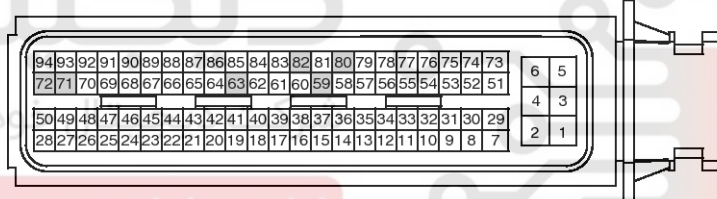
[Circuit Diagram]



[Connection Information]

Terminal	Connected to	Function
1	ECM CHG-K (59)	Sensor Ground
2	ECM CHG-K (63)	Sensor Power (+5V)
3	ECM CHG-K (71)	ETC Motor [+] Control
4	ECM CHG-K (80)	TPS 1 Signal
5	ECM CHG-K (32)	TPS 2 Signal
6	ECM CHG-K (72)	ETC Motor [-] Control

[Harness Connector]

CHG22  
ETC ModuleCHG-K  
ECM

SLMF10135L

## Inspection

### Throttle Position Sensor (TPS)

1. Connect the GDS on the Data Link Connector (DLC).
2. Start the engine and measure the output voltage of TPS 1 and 2 at C.T. and W.O.T.

Throttle Angle	Output Voltage (V)	
	TPS 1	TPS 2
C.T	0.3 ~ 0.9	4.2 ~ 5.0
W.O.T	1.5 ~ 3.0	3.3 ~ 3.8

3. Turn the ignition switch OFF and disconnect the scantool from the DLC.

4. Disconnect the ETC module connector and measure the resistance between the ETC module terminals 1 and 2.

**Specification:** Refer to "Specification"

### ETC Motor

1. Turn the ignition switch OFF.
2. Disconnect the ETC module connector.
3. Measure resistance between the ETC module terminals 3 and 6.
4. Check that the resistance is within the specification.

**Specification:** Refer to "Specification"

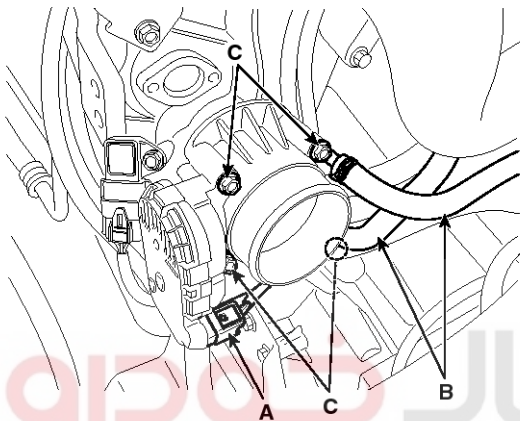
## FLA-50

## Fuel System

## Removal

## [With Coolant Hose]

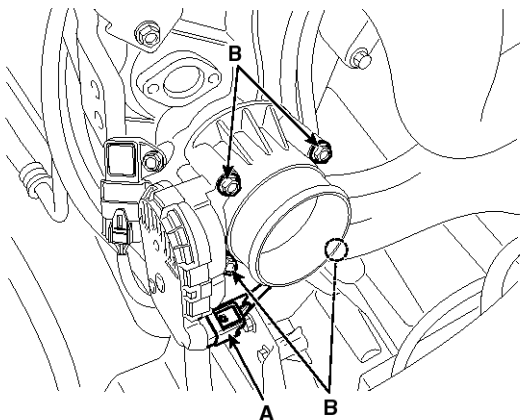
1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Remove the resonator and the air intake hose (Refer to "Intake And Exhaust System" in EM group).
3. Disconnect the ETC module connector (A).
4. Disconnect the coolant hoses (B).
5. Remove the installation bolts (C), and then remove the ETC module from the engine.



SXMf19131D

## [Without Coolant Hose]

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Remove the resonator and the air intake hose (Refer to "Intake And Exhaust System" in EM group).
3. Disconnect the ETC module connector (A).
4. Remove the installation bolts (B), and then remove the ETC module from the engine.



SLMF10400D

## Installation

## ⚠ CAUTION

- Install the component with the specified torques.
- Note that internal damage may occur when the component is dropped. In this case, use it after inspecting.

1. Installation is reverse of removal.

**Electronic throttle body Installation bolt:**

9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)

# Engine Control System

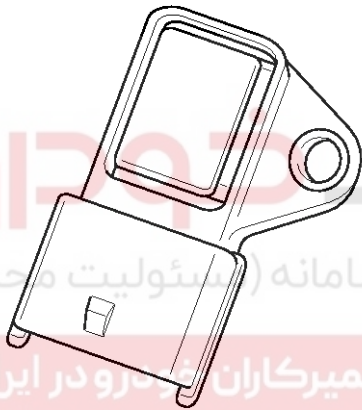
## FLA-51

### Manifold Absolute Pressure Sensor (MAPS)

#### Description

Manifold Absolute Pressure Sensor (MAPS) is a speed-density type sensor and is installed on the surge tank. It senses absolute pressure of the surge tank and transfers the analog signal proportional to the pressure to the ECM. By using this signal, the ECM calculates the intake air quantity and engine speed.

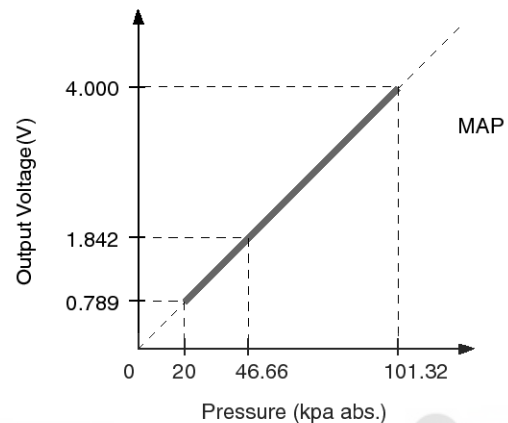
The MAPS consists of a piezo-electric element and a hybrid IC amplifying the element output signal. The element is silicon diaphragm type and adapts pressure sensitive variable resistor effect of semi-conductor. Because 100% vacuum and the manifold pressure apply to both sides of the sensor respectively, this sensor can output analog signal by using the silicon variation proportional to pressure change.



SMGF19111L

#### Specification

Pressure (kPa)	Output Voltage (V)
20.0	0.79
46.7	1.84
101.3	4.0

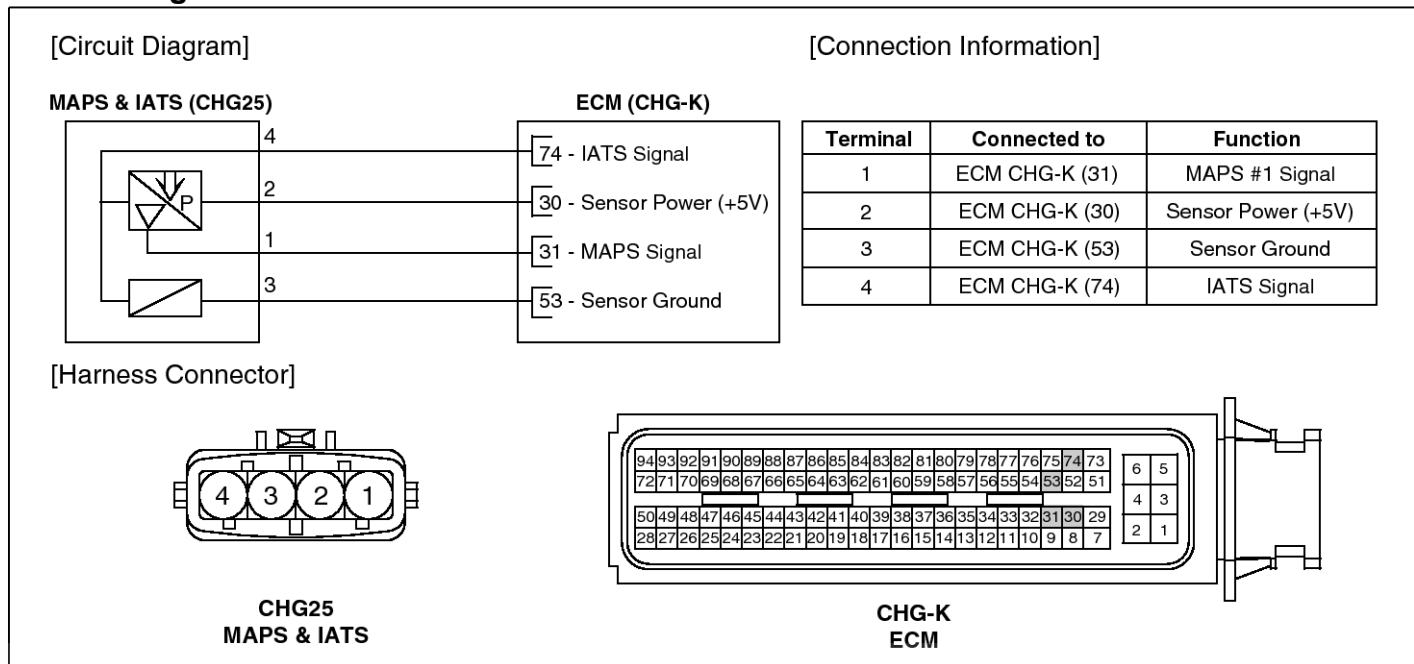


SHDFL8129C

## FLA-52

## Fuel System

## Circuit Diagram



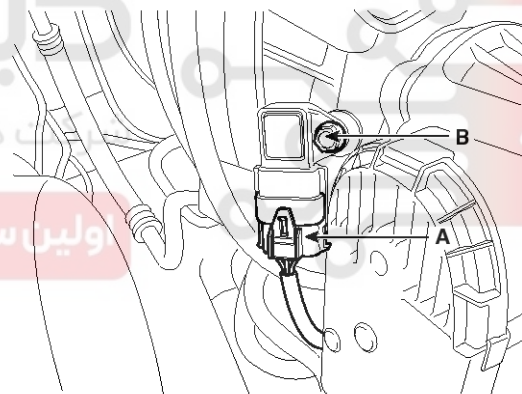
## Inspection

1. Connect the GDS on the Data Link Connector (DLC).
2. Measure the output voltage of the MAPS at idle and IG ON.

Condition	Output Voltage (V)
IG ON	3.9 ~ 4.1
Idle	0.8 ~ 1.6

## Removal

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Disconnect the manifold absolute pressure sensor connector (A).
3. Remove the installation bolt (B), and then remove the sensor from the surge tank.



SSLF11006L

SXMf19133D

## Installation

## ⚠ CAUTION

- Install the component with the specified torques.
- Note that internal damage may occur when the component is dropped. In this case, use it after inspecting.

## ⚠ CAUTION

- Insert the sensor in the installation hole and be careful not to damage when installation.

1. Installation is reverse of removal.

**Manifold absolute pressure sensor installation bolt:**  
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)

# Engine Control System

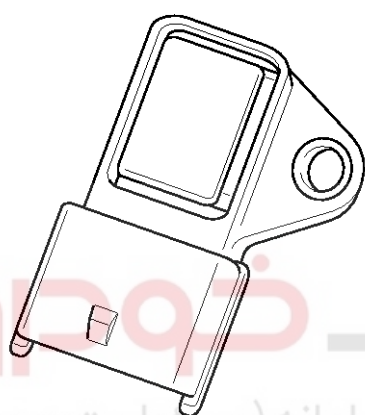
## FLA-53

### Intake Air Temperature Sensor (IATS)

#### Description

Intake Air Temperature Sensor (IATS) is included inside Manifold Absolute Pressure Sensor and detects the intake air temperature.

To calculate precise air quantity, correction of the air temperature is needed because air density varies according to the temperature. So the ECM uses not only MAPS signal but also IATS signal. This sensor has a Negative Temperature Coefficient (NTC) Thermister and it's resistance changes in reverse proportion to the temperature.



SAMF19005N

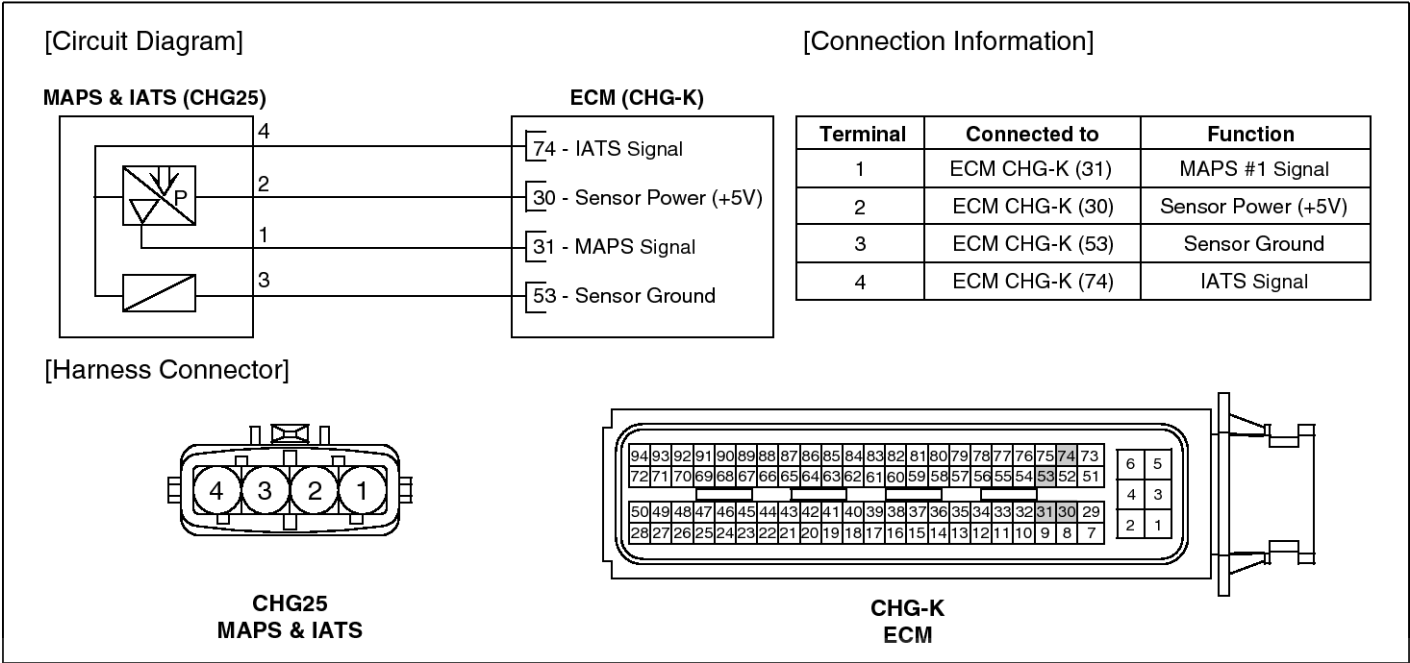
#### Specification

Temperature [ $^{\circ}\text{C}$ ( $^{\circ}\text{F}$ )]	Resistance ( $\text{k}\Omega$ )
-40(-40)	40.93 ~ 48.35
-20(-4)	13.89 ~ 16.03
0(32)	5.38 ~ 6.09
10(50)	3.48 ~ 3.90
20(68)	2.31 ~ 2.57
40(104)	1.08 ~ 1.21
50(122)	0.76 ~ 0.85
60(140)	0.54 ~ 0.62
80(176)	0.29 ~ 0.34

FLA-54

Fuel System

Circuit Diagram



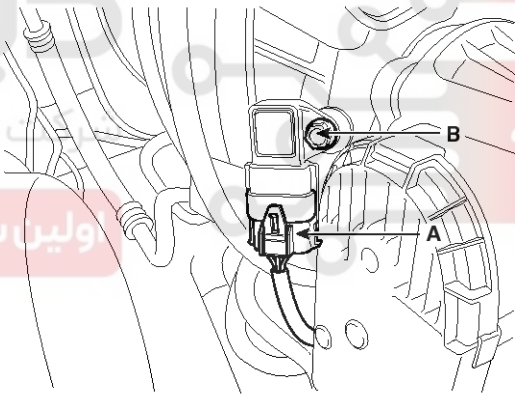
Inspection

1. Turn the ignition switch OFF.
2. Disconnect the IATS connector.
3. Measure resistance between the IATS terminals 3 and 4.
4. Check that the resistance is within the specification.

**Specification:** Refer to "Specification"

Removal

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Disconnect the manifold absolute pressure sensor connector (A).
3. Remove the installation bolt (B), and then remove the sensor from the surge tank.



SXMF19133D

Installation

**CAUTION**

- Install the component with the specified torques.
- Note that internal damage may occur when the component is dropped. In this case, use it after inspecting.

**CAUTION**

- Insert the sensor in the installation hole and be careful not to damage when installation.

1. Installation is reverse of removal.

**Manifold absolute pressure sensor installation bolt:**  
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)

# Engine Control System

## FLA-55

### Engine Coolant Temperature Sensor (ECTS)

#### Description

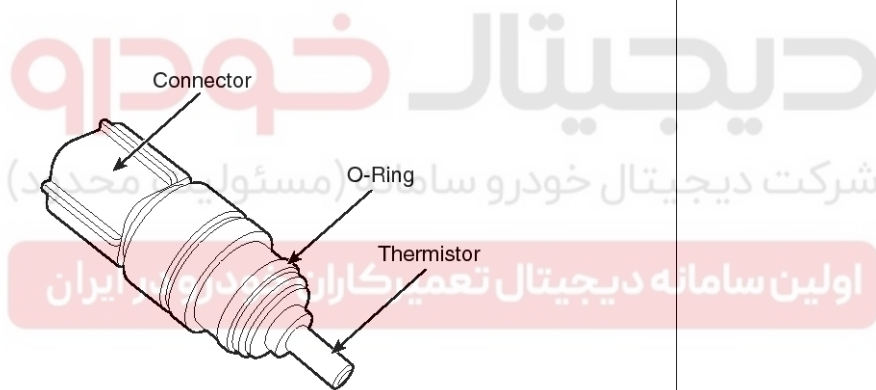
Engine Coolant Temperature Sensor (ECTS) is located in the engine coolant passage of the cylinder head for detecting the engine coolant temperature. The ECTS uses a thermistor whose resistance changes with the temperature.

The electrical resistance of the ECTS decreases as the temperature increases, and increases as the temperature decreases. The reference +5V 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.

#### Specification

Temperature		Resistance (k $\Omega$ )
$^{\circ}\text{C}$	$^{\circ}\text{F}$	
-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

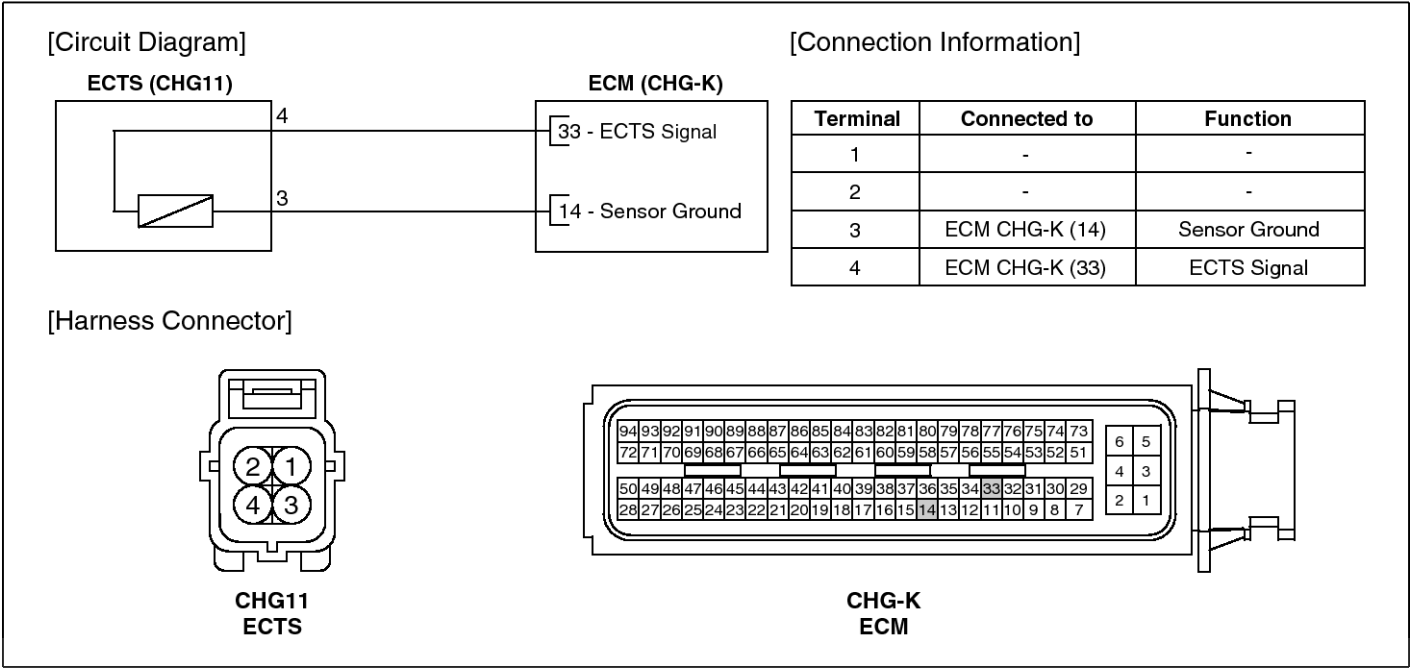


STDFL0127N

FLA-56

Fuel System

Circuit Diagram



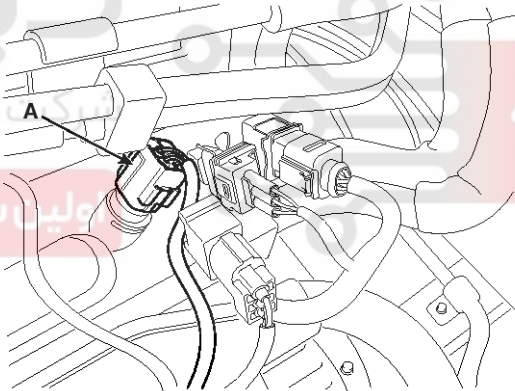
Inspection

1. Turn the ignition switch OFF.
2. Disconnect the ECTS connector.
3. Remove the ECTS.
4. After immersing the thermistor of the sensor into engine coolant, measure resistance between the ECTS terminals 3 and 4.
5. Check that the resistance is within the specification.

**Specification:** Refer to "Specification"

Removal

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Disconnect the engine coolant temperature sensor connector (A).



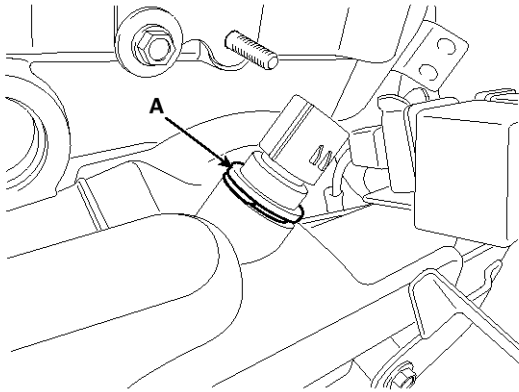
SSLF11007L

SLMF10401D

# Engine Control System

## FLA-57

3. Remove the fixing clip (A), and then pull the sensor from the water temperature control assembly.



SXMf19135D

### ⚠ CAUTION

Note that engine coolant may be flowed out from the water temperature control assembly when removing the sensor.

4. Supplement the engine coolant (Refer to "Cooling System" in EM group).

### Installation

#### ⚠ CAUTION

- Install the component with the specified torques.
- Note that internal damage may occur when the component is dropped. In this case, use it after inspecting.

#### ⚠ CAUTION

- Apply the engine coolant to the O-ring.

#### ⚠ CAUTION

- Insert the sensor in the installation hole and be careful not to damage when installation.

1. Installation is reverse of removal.



## FLA-58

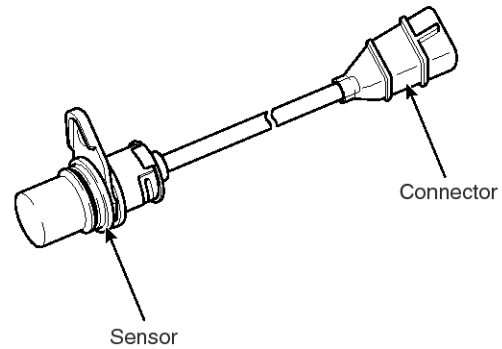
## Fuel System

### Crankshaft Position Sensor (CKPS)

#### Description

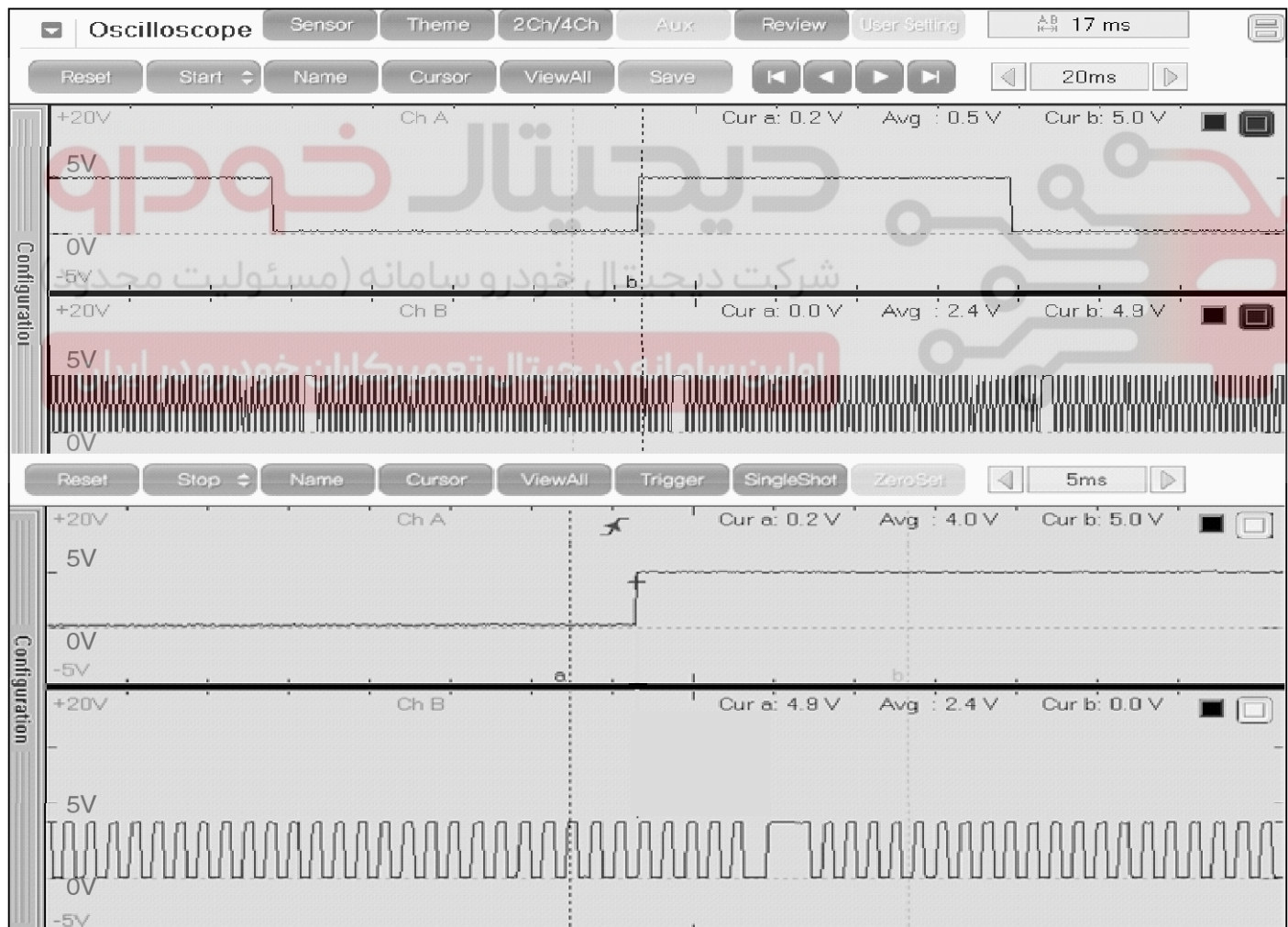
Crankshaft Position Sensor (CKPS) detects the crankshaft position and is one of the most important sensors of the engine control system. If there is no CKPS signal input, the engine may stop because of CKPS signal missing. This sensor is installed on the cylinder block or the transaxle housing and generates alternating current by magnetic flux field which is made by the sensor and the target wheel when engine runs.

The target wheel consists of 58 slots and 2 missing slots on 360 degrees CA (Crank Angle).



EGRF245A

#### Wave Form



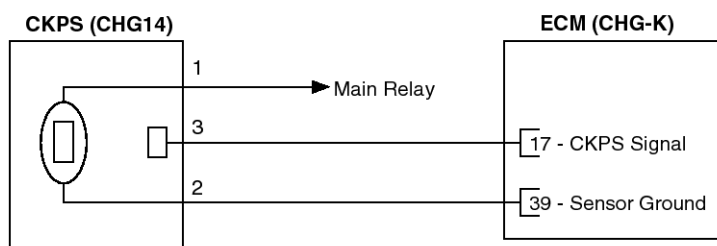
SBKFL9136L

# Engine Control System

FLA-59

## Circuit Diagram

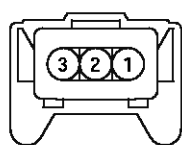
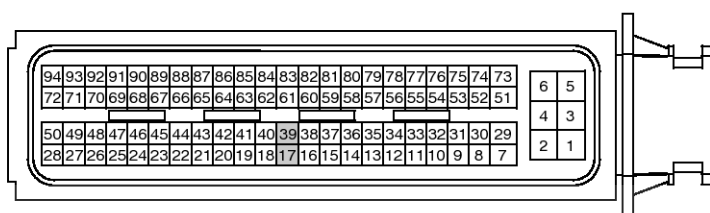
[Circuit Diagram]



[Connection Information]

Terminal	Connected to	Function
1	Main Relay	Battery Power (B+)
2	ECM CHG-K (39)	Sensor Ground
3	ECM CHG-K (17)	CKPS Signal

[Harness Connector]

CHG14  
CKPSCHG-K  
ECM

SLMF10139L

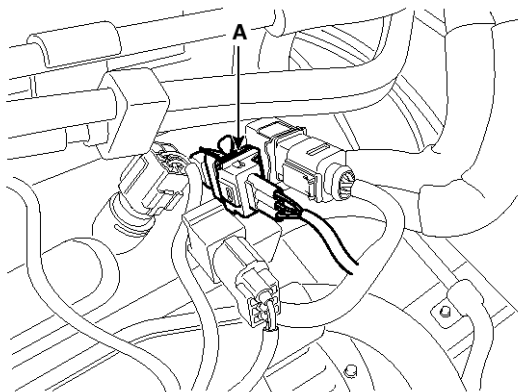
## Inspection

1. Check the signal waveform of the CMPS and CKPS using the GDS.

**Specification:** Refer to "Wave Form"

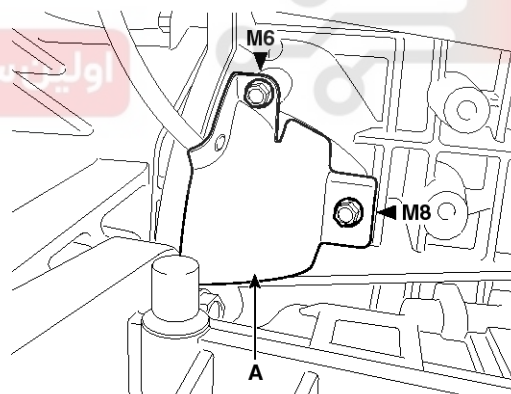
## Removal

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Disconnect the crankshaft position sensor connector (A).



SLMF10402D

3. Remove the protector (A).

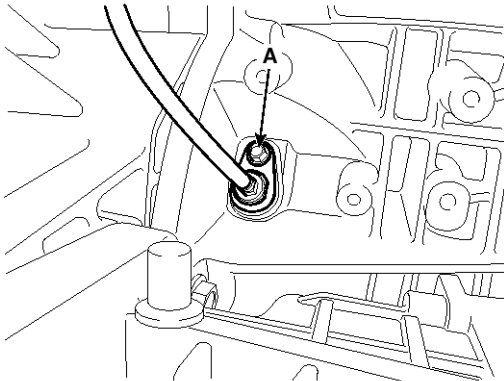


SLMFL0323N

## FLA-60

## Fuel System

4. Remove the installation bolt (A), and then remove the crankshaft position sensor.



SSLFL1008N

## Installation

## ⚠ CAUTION

- Install the component with the specified torques.
- Note that internal damage may occur when the component is dropped. In this case, use it after inspecting.

## ⚠ CAUTION

- Apply the engine oil to the O-ring.

## ⚠ CAUTION

- Insert the sensor in the installation hole and be careful not to damage when installation.

1. Installation is reverse of removal.

**Crankshaft position sensor installation bolt:** 9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)

**Crankshaft position sensor protector installation bolt (M8):** 18.6 ~ 23.5 N.m (1.9 ~ 2.4 kgf.m, 13.7 ~ 17.4 lb-ft)

**Crankshaft position sensor protector installation bolt (M6):** 9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)

دیجیتال خودرو  
شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

# Engine Control System

## FLA-61

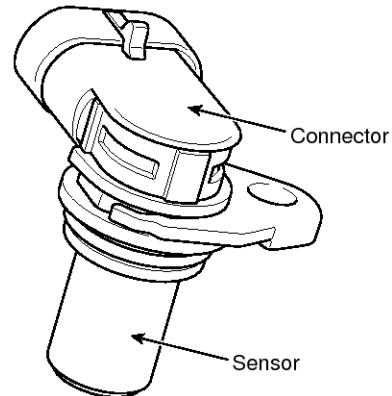
### Camshaft Position Sensor (CMPS)

#### Description

Camshaft Position Sensor (CMPS) is a hall sensor and detects the camshaft position by using a hall element.

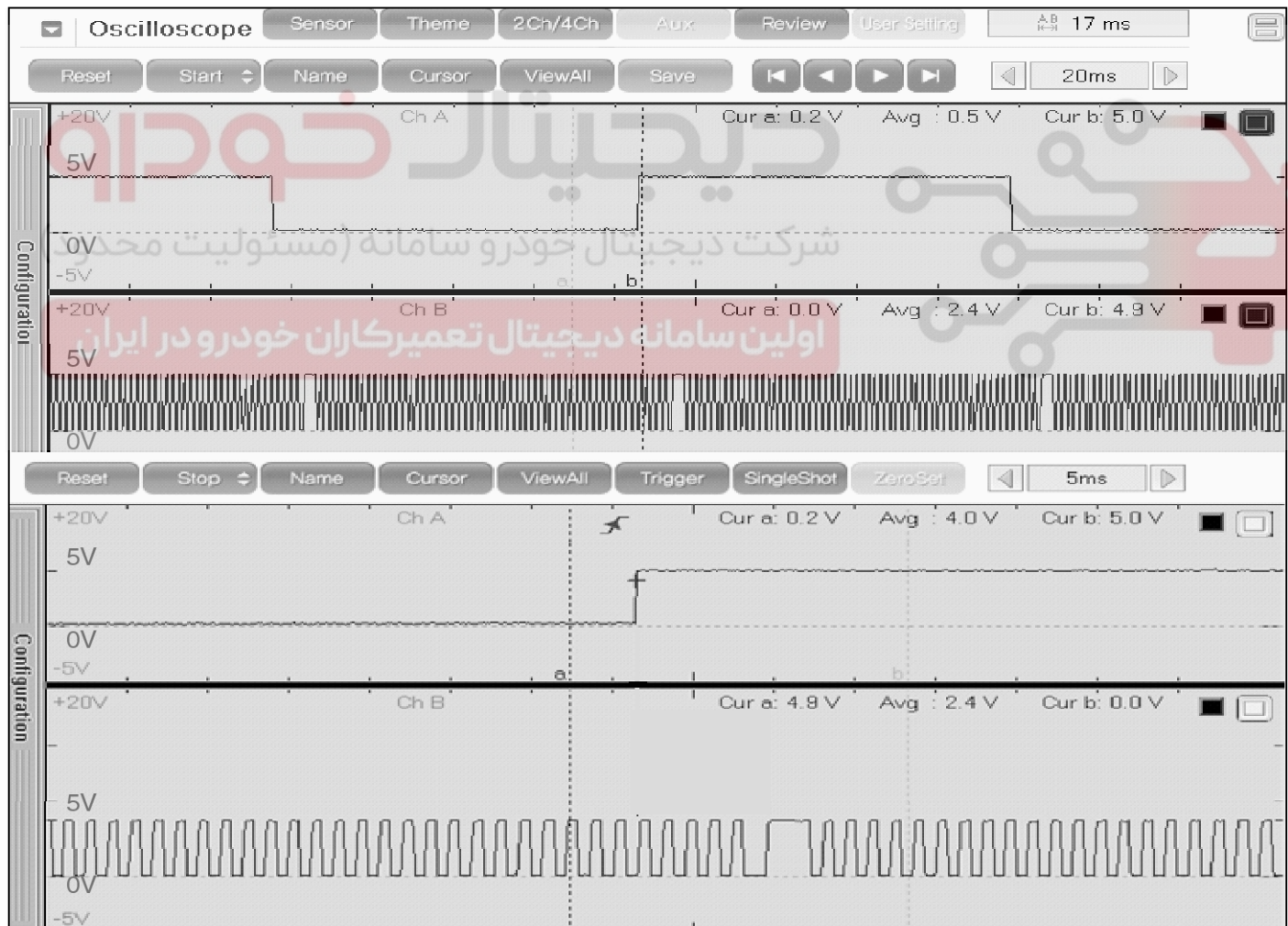
It is related with Crankshaft Position Sensor (CKPS) and detects the piston position of each cylinder which the CKPS can't detect.

The CMPS is installed on engine head cover and uses a target wheel installed on the camshaft. The Cam Position sensor is a hall-effect type sensor. As the target wheel passes the Hall sensor, the magnetic field changes in the sensor. The sensor then switches a signal which creates a square wave.



SBHFL9138L

#### Wave Form



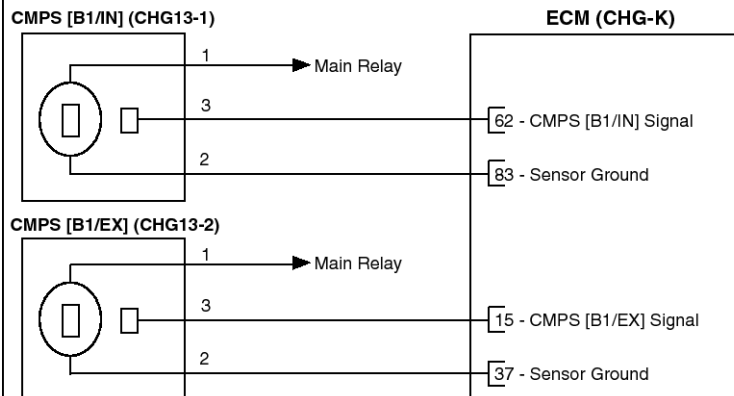
SBKFL9136L

## FLA-62

## Fuel System

## Circuit Diagram

## [Circuit Diagram]



## [Connection Information]

## CMPS [B1/IN] (CHG13-1)

Terminal	Connected to	Function
1	Main Relay	Battery Power (B+)
2	ECM CHG-K (83)	Sensor Ground
3	ECM CHG-K (62)	CMPS [B1/IN] Signal

## CMPS [B1/EX] (CHG13-2)

Terminal	Connected to	Function
1	Main Relay	Battery Power (B+)
2	ECM CHG-K (37)	Sensor Ground
3	ECM CHG-K (15)	CMPS [B1/EX] Signal

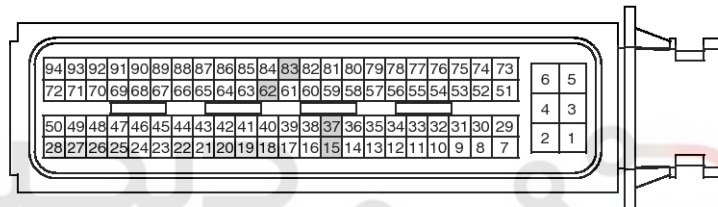
## [Harness Connector]



CHG13-1  
CMPS [B1/IN]



CHG13-2  
CMPS [B1/EX]



CHG-K  
ECM

SLMF10140L

## Inspection

1. Check the signal waveform of the CMPS and CKPS using the GDS.

**Specification:** Refer to "Wave Form"

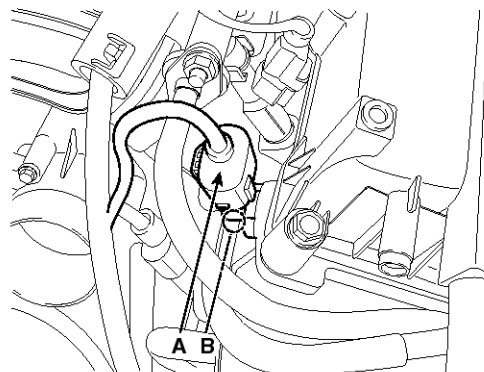
## Removal

## ⚠ WARNING

- DON'T remove the camshaft position sensor during engine running or right after engine stops, or a scald by the flowed out engine oil may occur.

## [Bank 1 / Intake]

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Disconnect the camshaft position sensor connector (A).
3. Remove the installation bolt (B), and then remove the sensor.



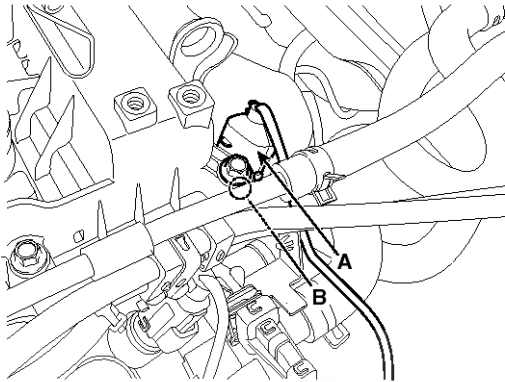
SXMf19142D

# Engine Control System

## FLA-63

### [Bank 1 / Exhaust]

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Disconnect the camshaft position sensor connector (A).
3. Remove the hanger and the protector.
4. Remove the installation bolt (B), and then remove the sensor.



SXMF19143D

### Installation

#### ⚠ CAUTION

- Install the component with the specified torques.
- Note that internal damage may occur when the component is dropped. In this case, use it after inspecting.

#### ⚠ CAUTION

- Apply the engine oil to the O-ring.

#### ⚠ CAUTION

- Insert the sensor in the installation hole and be careful not to damage when installation.

#### ⚠ CAUTION

- Be careful not to damage the sensor housing and the connector.
- Be careful not to damage the O-ring.

1. Installation is reverse of removal.

#### Camshaft position sensor installation bolt:

9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)



FLA-64

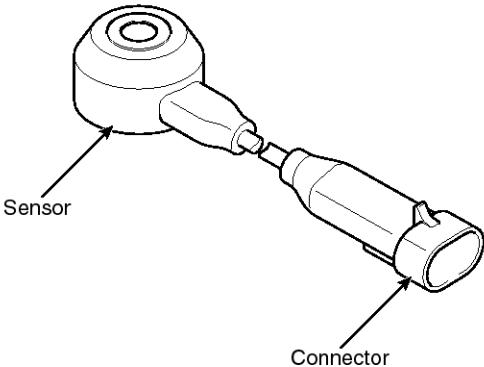
Fuel System

Knock Sensor (KS)

Description

Knocking is a phenomenon characterized by undesirable vibration and noise and can cause engine damage. Knock Sensor (KS) is installed on the cylinder block and senses engine knocking.

When knocking occurs, the vibration from the cylinder block is applied as pressure to the piezoelectric element. When a knock occurs, the sensor produces voltage signal. The ECM retards the ignition timing when knocking occurs. If the knocking disappears after retarding the ignition timing, the ECM will advance the ignition timing. This sequential control can improve engine power, torque and fuel economy.

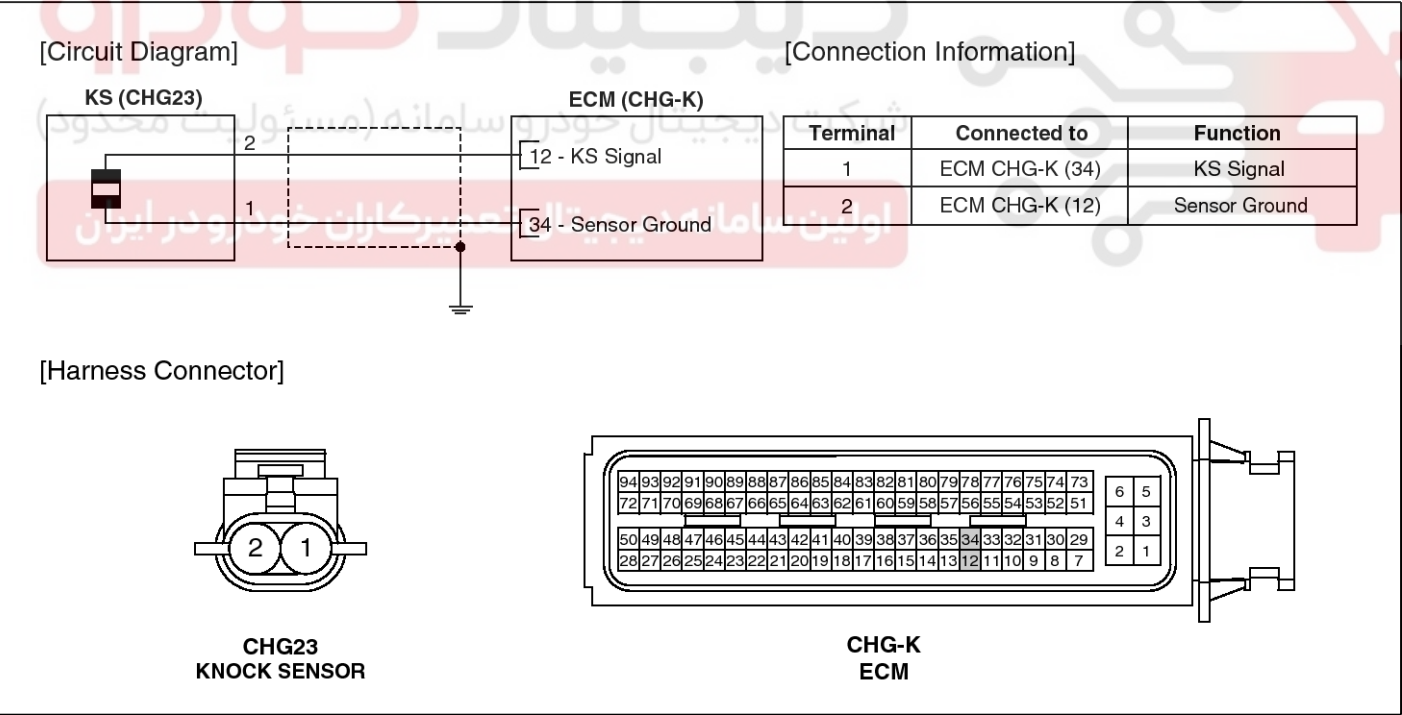


EGRF251A

Specification

Item	Specification
Capacitance (pF)	850 ~ 1,150

Circuit Diagram



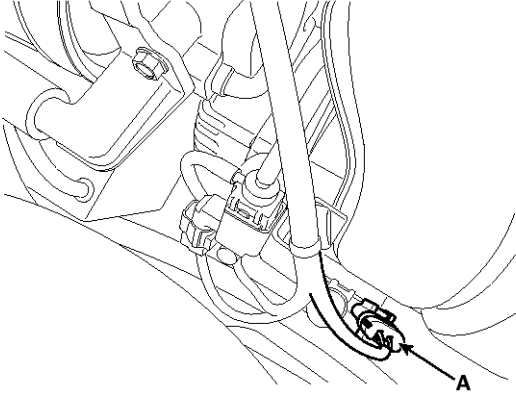
SLMF10141L

# Engine Control System

## FLA-65

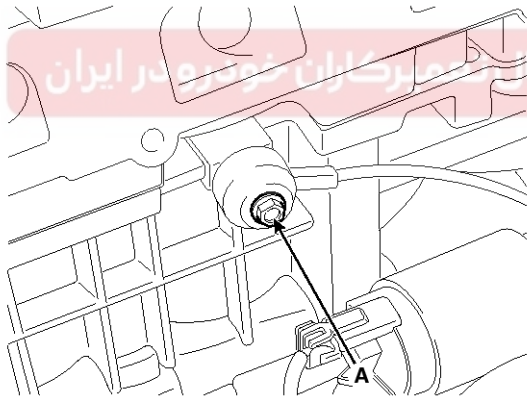
### Removal

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Disconnect the knock sensor connector (A).



SXMf19144D

3. Remove the under cover (Refer to "Engine and Transaxle System" in EM group).
4. Remove the intake manifold stay (Refer to "Intake And Exhaust System" in EM group).
5. Remove the installation bolt (A), and then remove the sensor from the cylinder block.



SXMf19145D

### Installation

#### ⚠ CAUTION

- Install the component with the specified torques.
- Note that internal damage may occur when the component is dropped. In this case, use it after inspecting.

1. Installation is reverse of removal.

#### Knock sensor installation bolt:

18.6 ~ 23.5 N.m (1.9 ~ 2.4 kgf.m, 13.7 ~ 17.4 lb-ft)

## FLA-66

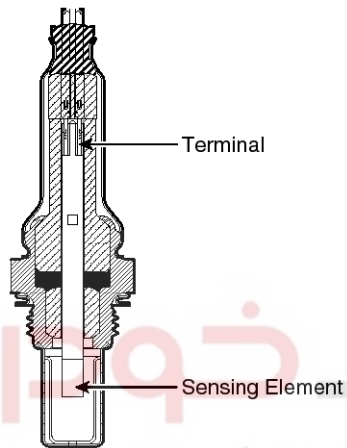
## Fuel System

## Heated Oxygen Sensor (HO2S)

## Description

Heated Oxygen Sensor (HO2S) consists of zirconium and alumina and is installed both upstream and downstream of the Closed Coupled Catalytic Converter. It varies in accordance with the air/fuel ratio.

The sensor must be hot in order to operate normally. To keep it hot, the sensor has a heater which is controlled by the ECM via a duty cycle signal. When the exhaust gas temperature is lower than the specified value, the heater warms the sensor tip.



SHDFL8147C

## Specification

## [EURO 4]

## HO2S [Bank 1/Sensor 1] (Binary type)

A/F Ratio ( $\lambda$ )	Output Voltage(V)
RICH	Approx. 0.9
LEAN	Approx. 0.04

Item	Specification
Heater Resistance ( $\Omega$ )	3.3 ~ 4.1 $\Omega$ [21°C(69.8°F)]

## HO2S [Bank 1/Sensor 2] (Binary type)

A/F Ratio ( $\lambda$ )	Output Voltage(V)
RICH	Approx. 0.9
LEAN	Approx. 0.04

Item	Specification
Heater Resistance ( $\Omega$ )	3.3 ~ 4.1 $\Omega$ [21°C(69.8°F)]

## [EURO 5]

## HO2S [Bank 1/Sensor 1] (Linear type)

Item	Specification
Heater Resistance ( $\Omega$ )	2.5 ~ 4.0 [20°C(68°F)]

## HO2S [Bank 1/Sensor 2] (Binary type)

A/F Ratio ( $\lambda$ )	Output Voltage(V)
RICH	Approx. 0.9
LEAN	Approx. 0.04

Item	Specification
Heater Resistance ( $\Omega$ )	3.3 ~ 4.1 $\Omega$ [21°C(69.8°F)]

# Engine Control System

## FLA-67

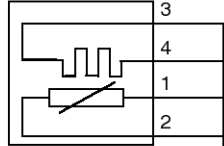
### Circuit Diagram

[Circuit Diagram]

[EURO 4]

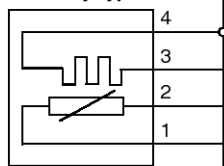
HO2S [B1/S1] (CHG16)

: Binary type



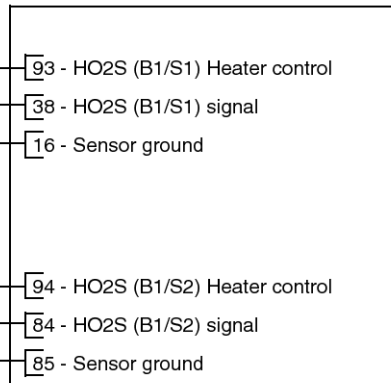
HO2S [B1/S2] (CHG17)

: Binary type



Main Relay

ECM(CHG-K)



[Connection Information]

HO2S [B1/S1] (CHG16)

Terminal	Connected to	Function
1	ECM CHG-K (38)	HO2S (B1/S1) Signal
2	ECM CHG-K (16)	Sensor Ground
3	Main Relay	Power Supply (B+)
4	ECM CHG-K (93)	Heater control

HO2S [B1/S2] (CHG17)

Terminal	Connected to	Function
1	ECM CHG-K (85)	Sensor Ground
2	ECM CHG-K (84)	HO2S (B1/S2) Signal
3	ECM CHG-K (94)	Heater control
4	Main Relay	Power Supply (B+)

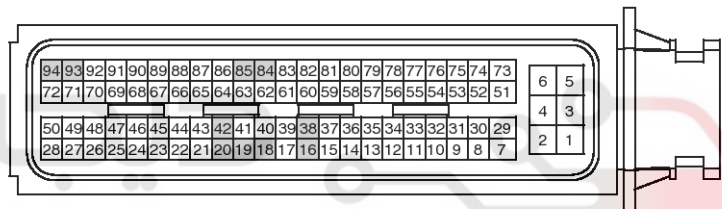
[Harness Connector]



CHG16  
HO2S [B1/S1]



CHG17  
HO2S [B1/S2]



CHG-K  
ECM

SSLF11008L

## FLA-68

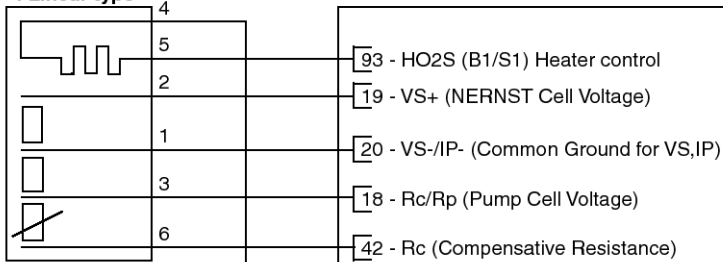
## Fuel System

## [Circuit Diagram]

## [EURO 5]

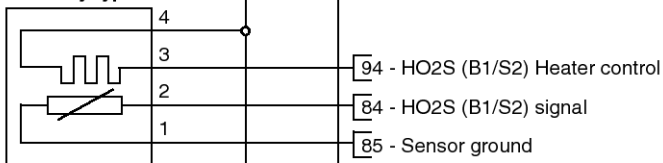
## HO2S [B1/S1] (CHG20)

: Linear type



## HO2S [B1/S2] (CHG17)

: Binary type



Main Relay

## [Connection Information]

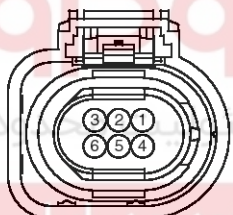
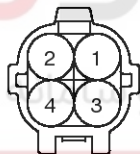
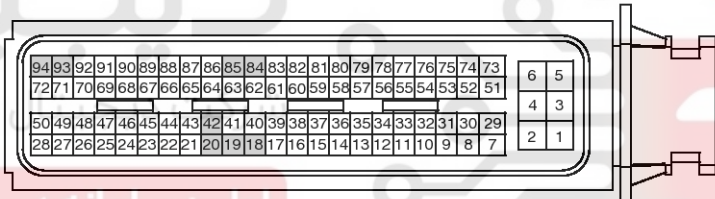
## HO2S [B1/S1] (CHG20)

Terminal	Connected to	Function
1	ECM CHG-K (20)	VS-/IP- (Common Ground for VS,IP)
2	ECM CHG-K (19)	VS+ (NERNST Cell Voltage)
3	ECM CHG-K (18)	Rc/Rp (Pump Cell Voltage)
4	Main Relay	Power Supply (B+)
5	ECM CHG-K (93)	Heater control
6	ECM CHG-K (42)	Rc (Compensative Resistance)

## HO2S [B1/S2] (CHG17)

Terminal	Connected to	Function
1	ECM CHG-K (85)	Sensor Ground
2	ECM CHG-K (84)	HO2S (B1/S2) Signal
3	ECM CHG-K (94)	Heater control
4	Main Relay	Power Supply (B+)

## [Harness Connector]

CHG20  
HO2S [B1/S1]CHG17  
HO2S [B1/S2]CHG-K  
ECM

## Inspection

1. Turn the ignition switch OFF.
2. Disconnect the HO2S connector.
3. Measure resistance between the HO2S terminals 4 and 5 (EURO5)/ 3 and 4 (EURO4) [B1/S1].
4. Measure resistance between the HO2S terminals 3 and 4 [B1/S2].
5. Check that the resistance is within the specification.

**Specification:** Refer to "Specification"

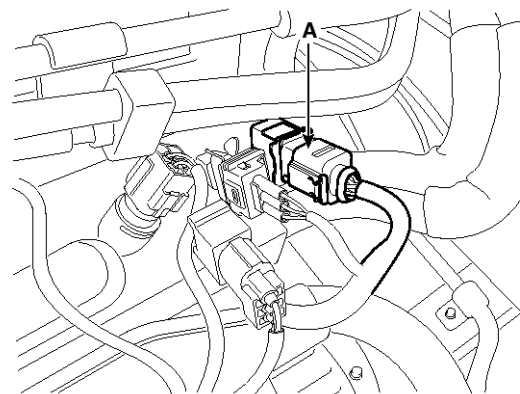
## Removal

## [Bank 1 / Sensor 1]

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Disconnect the connector (A), and then remove the sensor (B).

## NOTICE

Note that the SST (Part No.: 09392-2H100) is useful when removing the heated oxygen sensor.

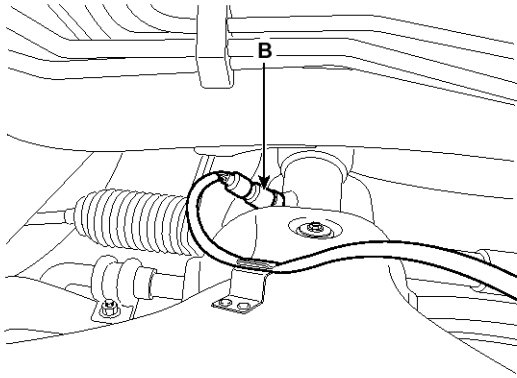


SLMF10403D

SSLF11009L

# Engine Control System

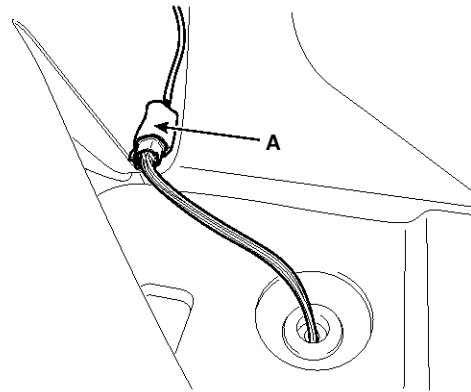
## FLA-69



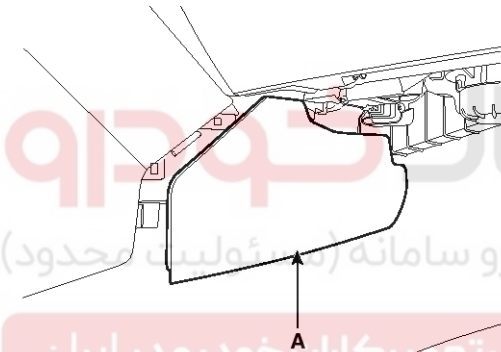
SSLF10041D

### [Bank 1 / Sensor 2]

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Remove the console side cover.



SLMF10060D

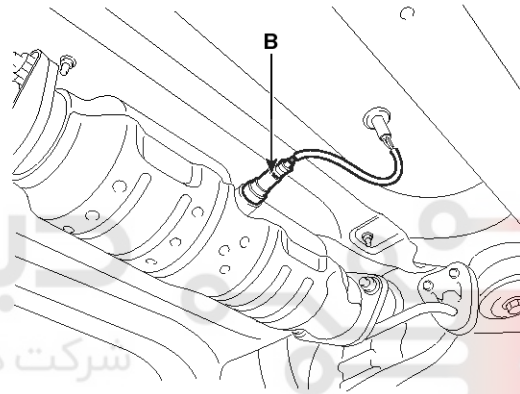


SSLF10050D

3. Disconnect the connector (A), and then remove the sensor (B).

### NOTICE

Note that the SST (Part No.: 09392-2H100) is useful when removing the heated oxygen sensor.



SLMF10051D

### Installation

#### CAUTION

- Install the component with the specified torques.
- Note that internal damage may occur when the component is dropped. In this case, use it after inspecting.

#### CAUTION

- DON'T use a cleaner, spray, or grease to sensing element and connector of the sensor because oil component in them may malfunction the sensor performance.
- Sensor and its wiring may be damaged in case of contacting with the exhaust system (Exhaust Manifold, Catalytic Converter, and so on).

1. Installation is reverse of removal.

### Heated oxygen sensor installation:

44.1 ~ 49.1 N.m (4.5 ~ 5.0 kgf.m, 32.6 ~ 36.2 lb-ft)

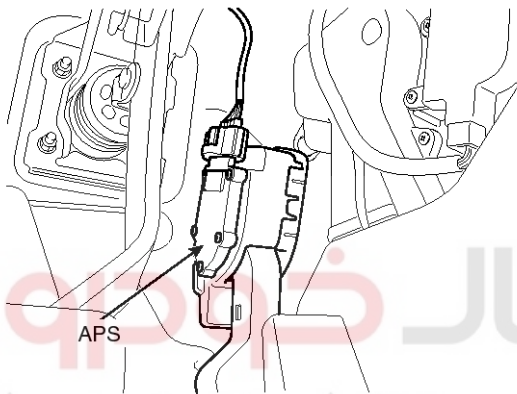
## FLA-70

## Fuel System

## Accelerator Position Sensor (APS)

## Description

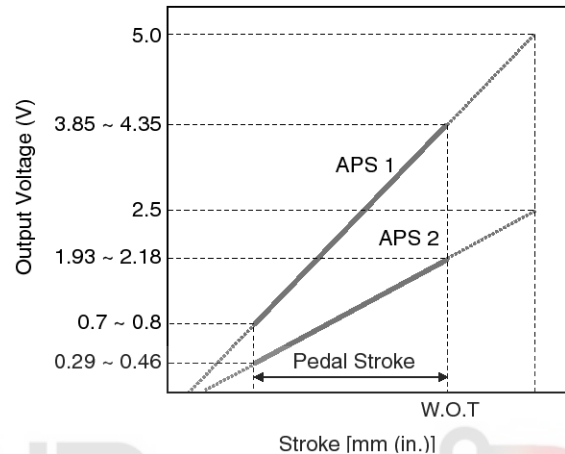
Accelerator Position Sensor (APS) is installed on the accelerator pedal module and detects the rotation angle of the accelerator pedal. The APS is one of the most important sensors in engine control system, so it consists of the two sensors which adapt individual sensor power and ground line. The second sensor monitors the first sensor and its output voltage is half of the first one. If the ratio of the sensor 1 and 2 is out of the range (approximately 1/2), the diagnostic system judges that it is abnormal.



SLMFL0160D

## Specification

Accelerator Position	Output Voltage (V)	
	APS1	APS2
C.T	0.7 ~ 0.8	0.29 ~ 0.46
W.O.T	3.85 ~ 4.35	1.93 ~ 2.18



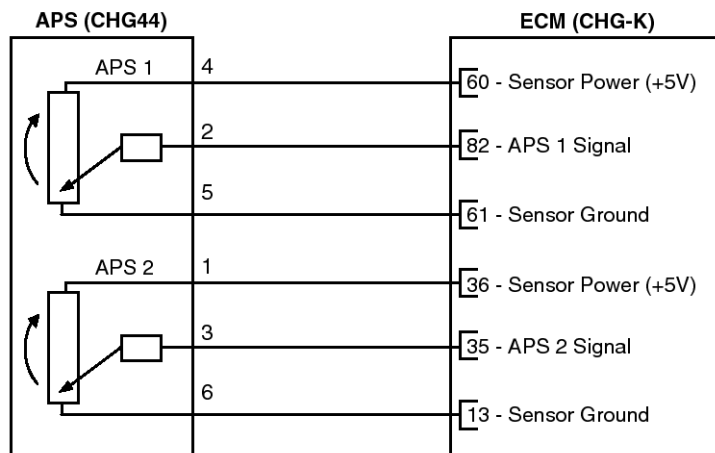
SXMFL0143L

# Engine Control System

## FLA-71

### Circuit Diagram

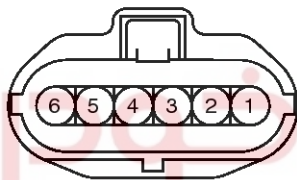
[Circuit Diagram]



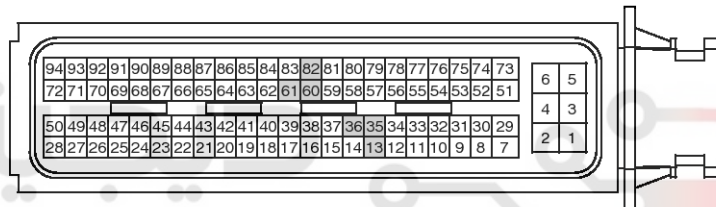
[Connection Information]

Terminal	Connected to	Function
1	ECM CHG-K (36)	APS 2 Sensor Power (+5V)
2	ECM CHG-K (82)	APS 1 Signal
3	ECM CHG-K (35)	APS 2 Signal
4	ECM CHG-K (60)	APS 1 Sensor Power (+5V)
5	ECM CHG-K (61)	APS 1 Sensor Ground
6	ECM CHG-K (13)	APS 2 Sensor Ground

[Harness Connector]



CHG44  
APS



CHG-K  
ECM

SLMF10144L

### Inspection

1. Connect the GDS on the Data Link Connector (DLC).
2. Turn the ignition switch ON.
3. Measure the output voltage of the APS 1 and 2 at C.T and W.O.T.

**Specification:** Refer to "Specification"

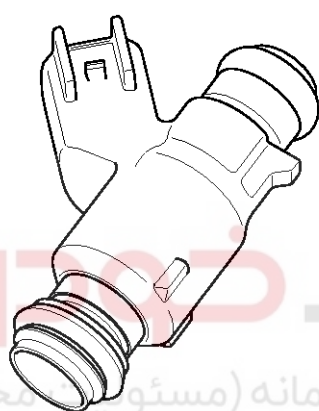
## FLA-72

## Fuel System

## Injector

## Description

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



## Specification

Item	Specification
Coil Resistance ( $\Omega$ )	13.8 ~ 15.2 [20°C (68°F)]

دیجیتال خودرو ۹۱۷۰  
شرکت دیجیتال خودرو سامانه (مسئول محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

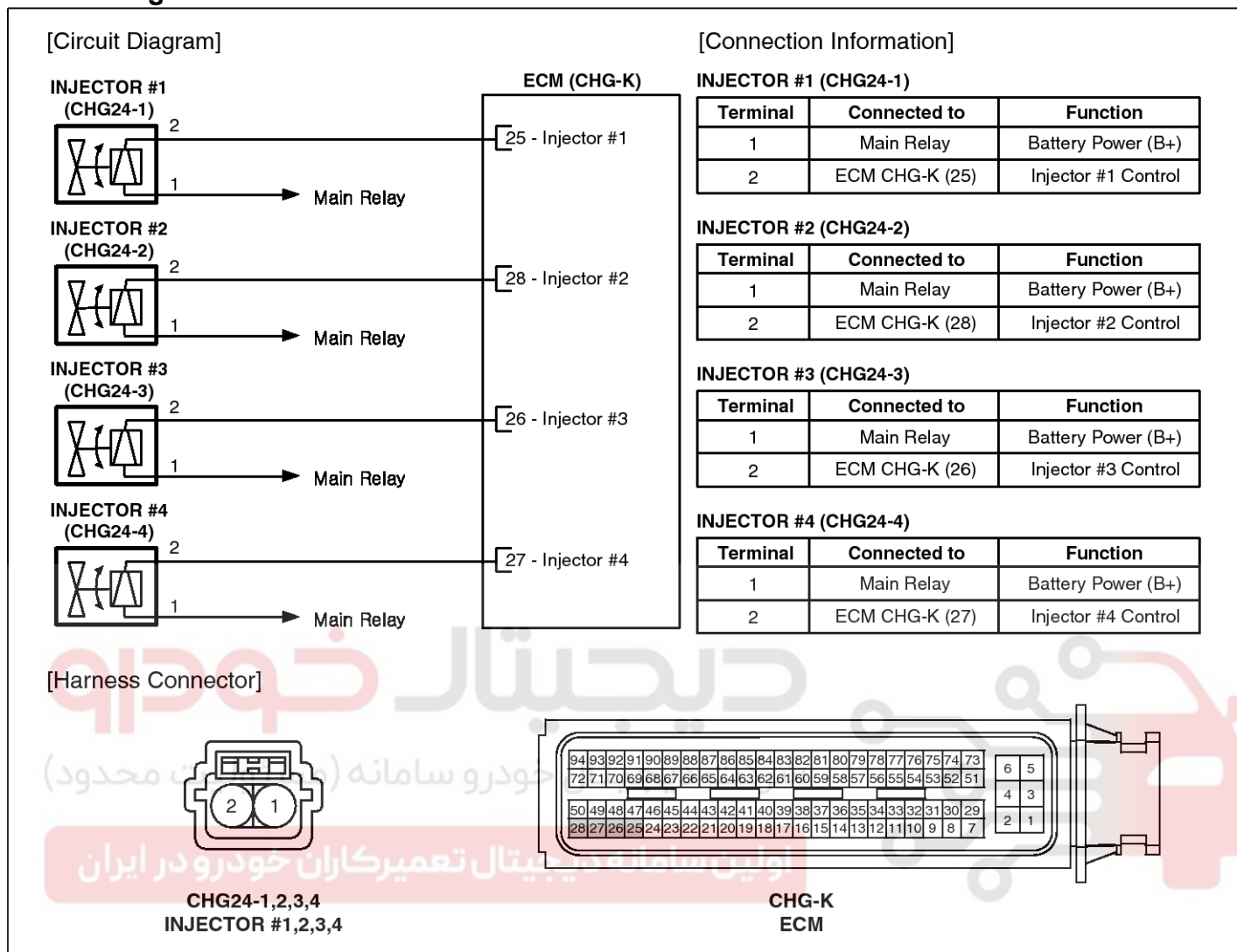
KFCF1026



# Engine Control System

## FLA-73

### Circuit Diagram



SLMF10146L

### Inspection

1. Turn the ignition switch OFF.
2. Disconnect the injector connector.
3. Measure resistance between the injector terminals 1 and 2.
4. Check that the resistance is within the specification.

**Specification:** Refer to "Specification"

### Removal

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Release the residual pressure in fuel line (Refer to "Release Residual Pressure in Fuel Line" in this group).

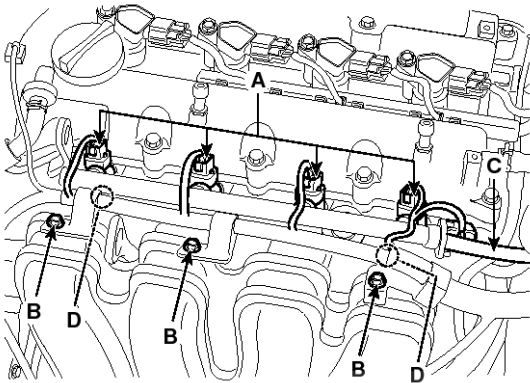
#### ⚠ CAUTION

When removing the fuel pump relay, a Diagnostic Trouble Code (DTC) may occur. Delete the code with the GDS after completion of "Release Residual Pressure in Fuel Line" work.

## FLA-74

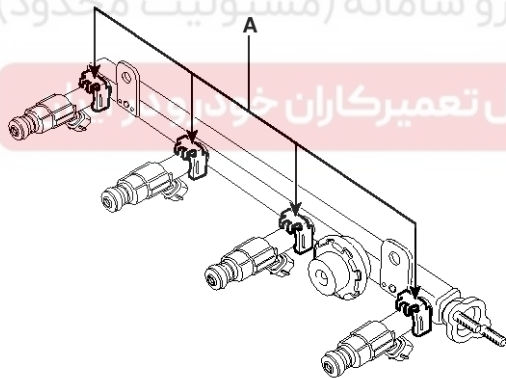
## Fuel System

3. Disconnect the injector connector (A).
4. Remove the wiring harness bracket installation bolt (B).
5. Remove the installation nut, and then disconnect the fuel feed tube (C).
6. Remove the installation bolt (D), and then remove the delivery pipe & injector assembly from the engine.



SXMf19157D

7. Remove the fixing clip (A), and then separate the injector from the delivery pipe.



SXMf19158D

## Installation

## ⚠ CAUTION

- Install the component with the specified torques.
- Note that internal damage may occur when the component is dropped. In this case, use it after inspecting.

## ⚠ CAUTION

- Apply the engine oil to the injector O-ring.

## ⚠ CAUTION

- Inspect the injector O-ring when installing.

1. Installation is reverse of removal.

**Delivery pipe installation bolt:**

18.6 ~ 23.5 N.m (1.9 ~ 2.4 kgf.m, 13.7 ~ 17.4 lb-ft)

**Delivery pipe installation nut (↔ Fuel feed tube):**

7.8 ~ 9.8 N.m (0.8 ~ 1.0 kgf.m, 5.8 ~ 7.2 lb-ft)

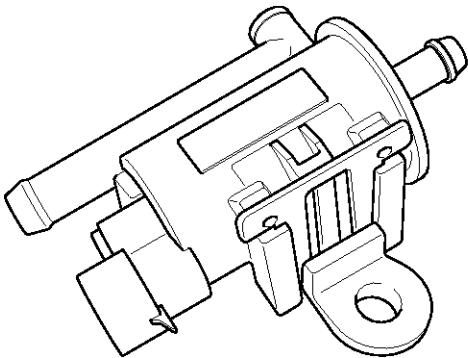
Engine Control System

FLA-75

Purge Control Solenoid Valve (PCSV)

Description

Purge Control Solenoid Valve (PCSV) is installed on the surge tank and controls the passage between the canister and the intake manifold. It is a solenoid valve and is open when the ECM grounds the valve control line. When the passage is open (PCSV ON), fuel vapor stored in the canister is transferred to the intake manifold.

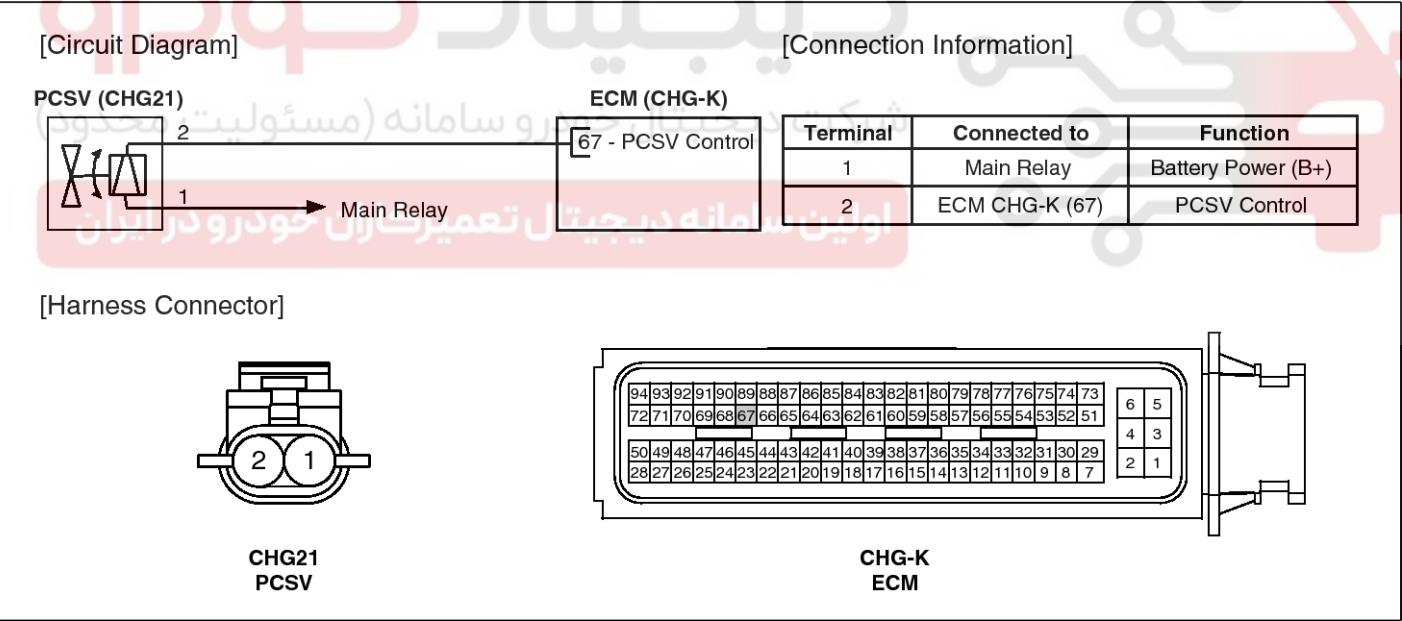


KFCF1028

Specification

Item	Specification
Coil Resistance (Ω)	19.0 ~ 22.0 [20℃ (68°F)]

Circuit Diagram



SLMF10147L

Inspection

1. Turn the ignition switch OFF.

2. Disconnect the PCSV connector.
3. Measure resistance between the PCSV terminals 1 and 2.

4. Check that the resistance is within the specification.

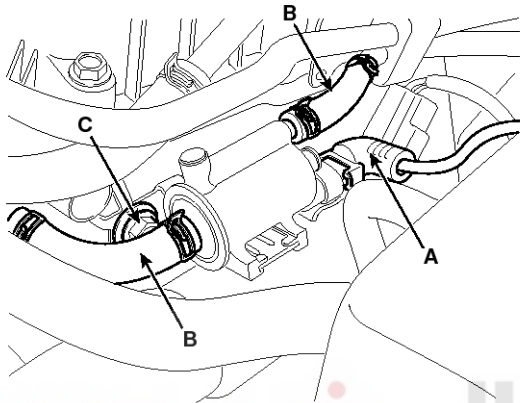
Specification: Refer to "Specification"

## FLA-76

## Fuel System

## Removal

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Disconnect the purge control solenoid valve connector (A).
3. Disconnect the vapor hoses (B) from the purge control solenoid valve.
4. Remove the bracket installation bolt (C), and then remove the valve from the surge tank.



SXMFI9159D

## Installation

## ⚠ CAUTION

- Install the component with the specified torques.
- Note that internal damage may occur when the component is dropped. In this case, use it after inspecting.

## ⚠ CAUTION

- Be careful of foreign material not to flow into the valve.

1. Installation is reverse of removal.

**Purge control solenoid valve bracket installation bolt: 9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)**



# Engine Control System

FLA-77

## CVVT Oil Control Valve (OCV)

### Description

Continuous Variable Valve Timing (CVVT) system advances or retards the valve timing of the intake and exhaust valve in accordance with the ECM control signal which is calculated by the engine speed and load.

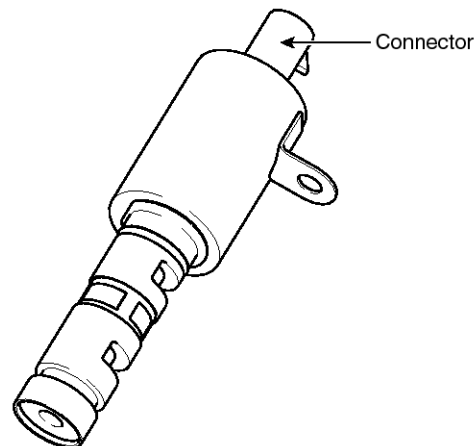
By controlling CVVT, the valve over-lap or under-lap occurs, which makes better fuel economy and reduces exhaust gases (NOx, HC) and improves engine performance through reduction of pumping loss, internal EGR effect, improvement of combustion stability, improvement of volumetric efficiency, and increase of expansion work.

This system consist of

-the CVVT Oil Control Valve (OCV) which supplies the engine oil to the cam phaser or runs out the engine oil from the cam phaser in accordance with the ECM PWM (Pulse With Modulation) control signal,

-and the Cam Phaser which varies the cam phase by using the hydraulic force of the engine oil.

The engine oil getting out of the CVVT oil control valve varies the cam phase in the direction (Intake Advance/Exhaust Retard) or opposite direction (Intake Retard/Exhaust Advance) of the engine rotation by rotating the rotor connected with the camshaft inside the cam phaser.



SBKFL9183L

### Specification

Item	Specification
Coil Resistance ( $\Omega$ )	6.9 ~ 7.9 [20°C (68°F)]

FLA-78

Fuel System

Circuit Diagram

[Circuit Diagram]

OCV [B1/IN] (CHG05-1)

ECM (CHG-K)

66 - OCV [B1/IN] Control

Main Relay

OCV [B1/EX] (CHG05-2)

ECM (CHG-K)

68 - OCV [B1/EX] Control

Main Relay

[Connection Information]

OCV [B1/IN] (CHG05-1)

Terminal	Connected to	Function
1	ECM CHG-K (66)	OCV [B1/IN] Control
2	Main Relay	Battery Power (B+)

OCV [B1/EX] (CHG05-2)

Terminal	Connected to	Function
1	ECM CHG-K (68)	OCV [B1/EX] Control
2	Main Relay	Battery Power (B+)

[Harness Connector]

CHG05-1  
OCV [B1/IN]

CHG05-2  
OCV [B1/EX]

CHG-K  
ECM

SLMF10148L

Inspection

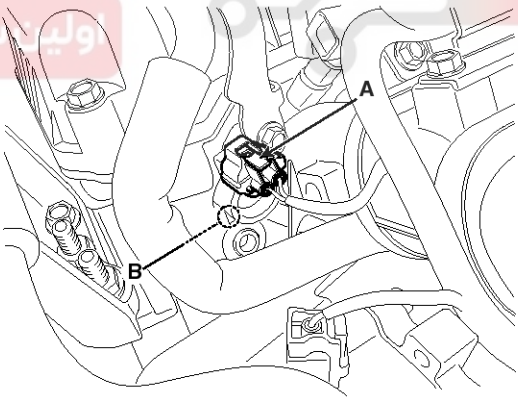
1. Turn the ignition switch OFF.
2. Disconnect the OCV connector.
3. Measure resistance between the OCV terminals 1 and 2.
4. Check that the resistance is within the specification.

Specification: Refer to "Specification"

Removal

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Disconnect the CVVT oil control valve connector (A).
3. Remove the installation bolt (B), and then remove the valve from the engine.

[Bank 1 / Intake]

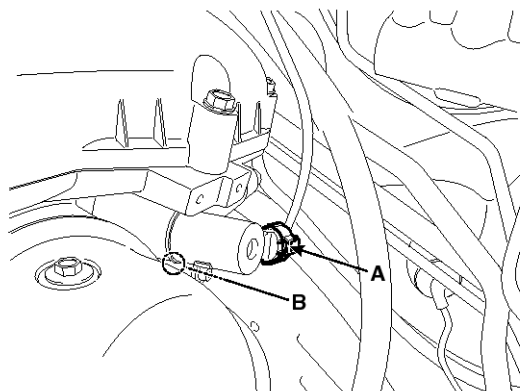


SXMF19161D

# Engine Control System

## FLA-79

[Bank 1 / Exhaust]



SXMF19162D

### Installation

#### ⚠ CAUTION

- Install the component with the specified torques.
- Note that internal damage may occur when the component is dropped. In this case, use it after inspecting.

#### ⚠ CAUTION

- Apply the engine oil to the valve O-ring.

1. Installation is reverse of removal.

#### CVT oil control valve installation bolt:

9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)

دیجیتال خودرو

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران



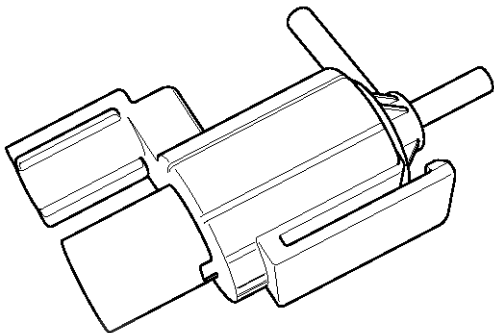
FLA-80

Fuel System

Variable Intake Solenoid (VIS) Valve

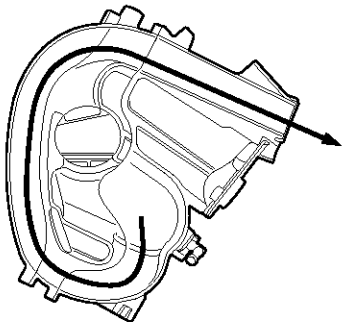
Description

Variable Intake manifold Solenoid (VIS) valve is installed on the intake manifold. The VIS valve controls the vacuum modulator which activates a valve in the intake manifold. The ECM opens or closes this valve according to engine condition (Refer to below table).

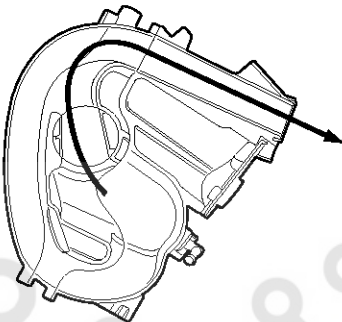


KFCF1029

Engine condition	VIS valve	Operation
Medium speed	Closed	Increasing engine performance in low engine speed by reducing intake interference among cylinders
Low / High speed	Open	Minimizing intake resistance by shortening intake manifold length and increasing area of air entrance



Medium speed



Low / High speed

SNFFL9036N

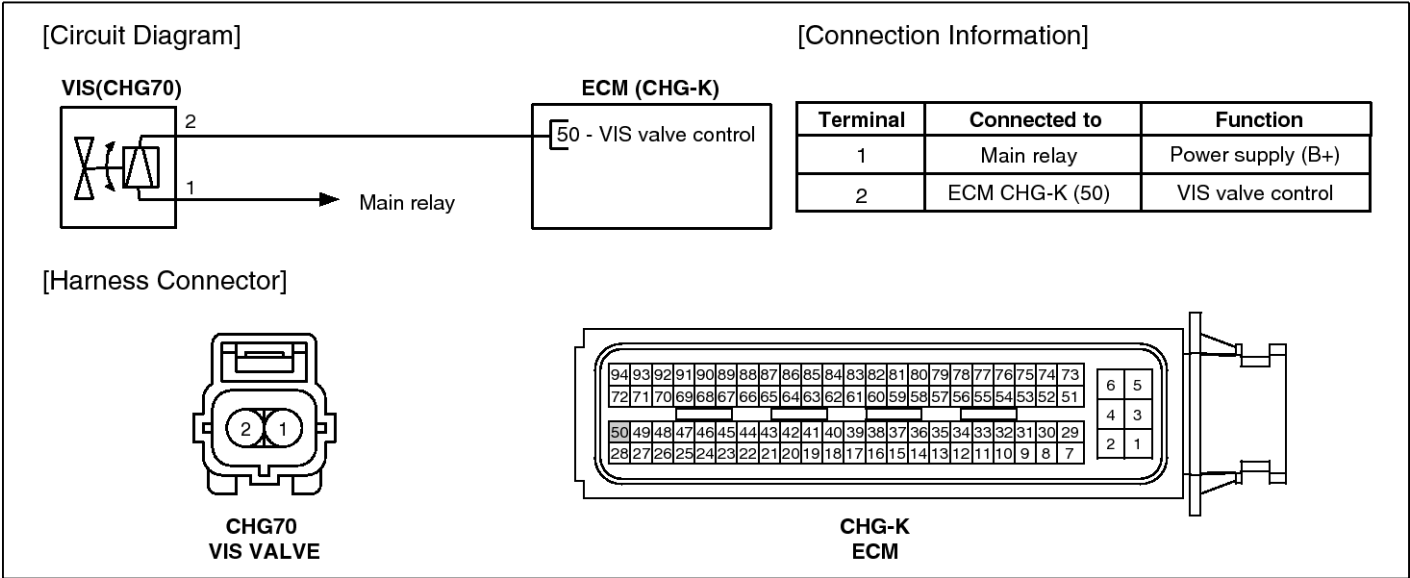
Specification

Item	Specification
Coil resistance (Ω)	30.0 ~ 35.0 [20℃ (68°F)]

Engine Control System

FLA-81

Circuit Diagram



SLMF10149L

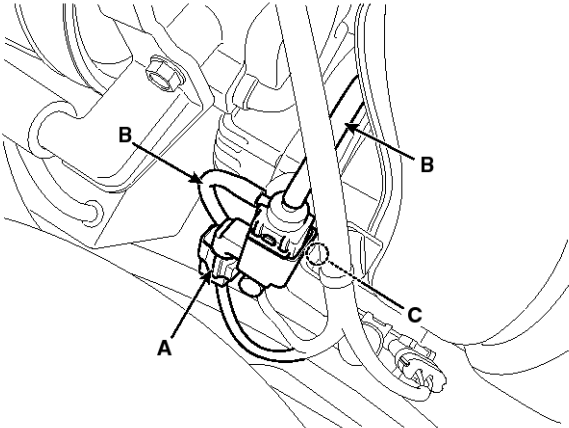
Inspection

1. Turn the ignition switch OFF.
2. Disconnect the VIS valve connector.
3. Measure resistance between VIS valve terminals 1 and 2.

Specification: Refer to "Specification"

Removal

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Disconnect the variable intake solenoid valve connector (A).
3. Disconnect the vacuum hoses (B) from the valve.
4. Remove the installation nut (C), and then remove the valve from the surge tank.



SXMF19165D

Installation

CAUTION

- Install the component with the specified torques.
- Note that internal damage may occur when the component is dropped. In this case, use it after inspecting.

CAUTION

- Be careful of foreign material not to flow into the valve.

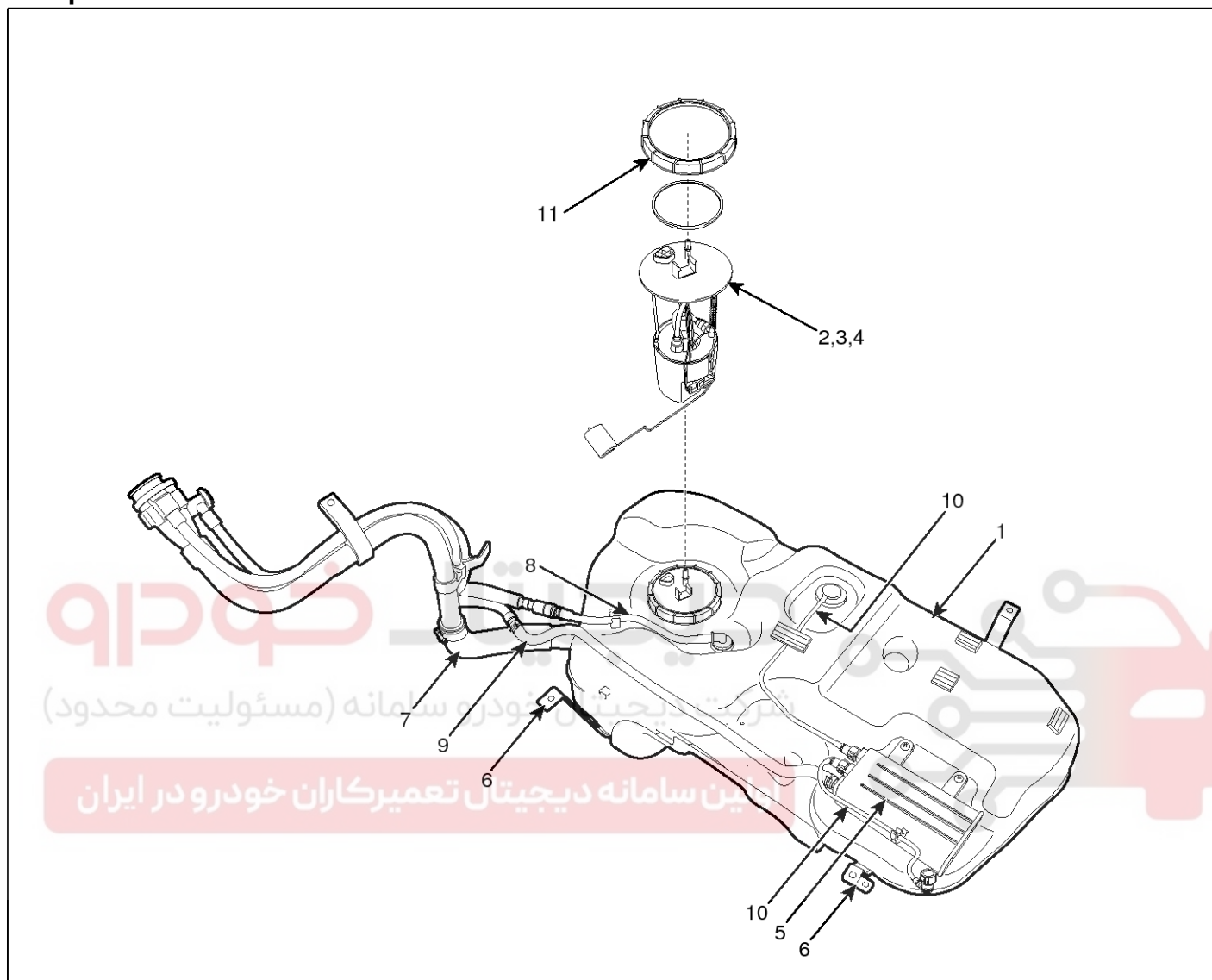
1. Installation is reverse of removal.

## FLA-82

## Fuel System

## Fuel Delivery System

## Components Location



SSLF11010L

- |                            |                           |
|----------------------------|---------------------------|
| 1. Fuel Tank               | 7. Fuel Filler Hose       |
| 2. Fuel Pump               | 8. Leveling Tube          |
| 3. Fuel Filter             | 9. Ventilation Hose       |
| 4. Fuel Pressure Regulator | 10. Vapor Tube            |
| 5. Canister                | 11. Fuel Pump Plate Cover |
| 6. Fuel Tank Band          |                           |

# Fuel Delivery System

## FLA-83

### Fuel Pressure Test

1. Release the residual pressure in fuel line (Refer to "Release Residual Pressure in Fuel Line" in this group).

#### CAUTION

When removing the fuel pump relay, a Diagnostic Trouble Code (DTC) may occur. Delete the code with the GDS after completion of "Release Residual Pressure in Fuel Line" work.

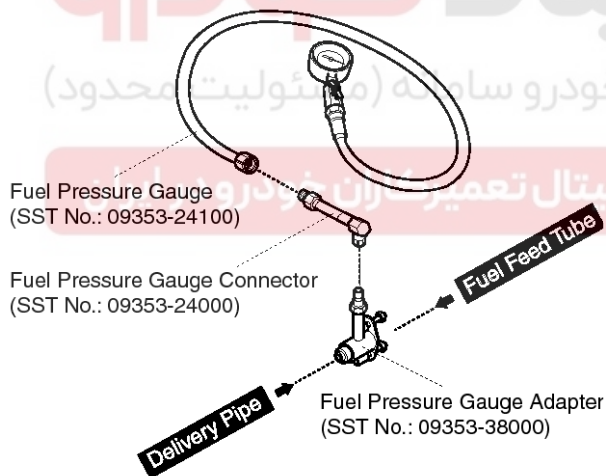
2. Install the Special Service Tool (SST).

- 1) Disconnect the fuel feed tube from the delivery pipe.

#### CAUTION

There may be some residual pressure even after "Release Residual Pressure in Fuel Line" work, so cover the hose connection with a shop towel to prevent residual fuel from spilling out before disconnecting any fuel connection.

- 2) Install the special service tool for measuring the fuel pressure in between the fuel feed tube and the fuel delivery pipe (Refer to the figure below).



STDFL0144N

3. Inspect fuel leakage on connections among the fuel feed tube, the delivery pipe, and the SST components with IG ON.

4. Measure Fuel Pressure.

- 1) Start the engine and measure the fuel pressure at idle.

**Fuel Pressure:** 324 ~ 363 kPa (3.3 ~ 3.7 kgf/cm<sup>2</sup>, 46.9 ~ 52.6 psi)

#### NOTICE

If the fuel pressure differs from the standard value, repair or replace the related part (Refer to the table below).

Fuel Pressure	Cause	Related Part
Too Low	Fuel filter clogged	Fuel Filter
	Fuel leakage	Fuel Pressure Regulator
Too High	Fuel pressure regulator valve stuck	Fuel Pressure Regulator

- 2) Stop the engine, and then check for the change in the fuel pressure gauge reading.

**Standard Value:** The gauge reading should hold for about 5 minutes after the engine stops

#### NOTICE

If the gauge reading should not be held, repair or replace the related part (Refer to the table below).

Fuel Pressure (After Engine Stops)	Cause	Related Part
Fuel Pressure Drops Slowly	Leakage on injector	Injector
Fuel Pressure Drops Immediately	Check valve of fuel pump stuck open	Fuel Pump

- 3) Turn the ignition switch OFF.

5. Release the residual pressure in fuel line (Refer to "Release Residual Pressure in Fuel Line").

#### CAUTION

When removing the fuel pump relay, a Diagnostic Trouble Code (DTC) may occur. Delete the code with the GDS after completion of "Release Residual Pressure in Fuel Line" work.

6. Test End

- 1) Remove the Special Service Tool (SST) from the fuel feed tube and the delivery pipe.
- 2) Connect the fuel feed tube and the delivery pipe.

## FLA-84

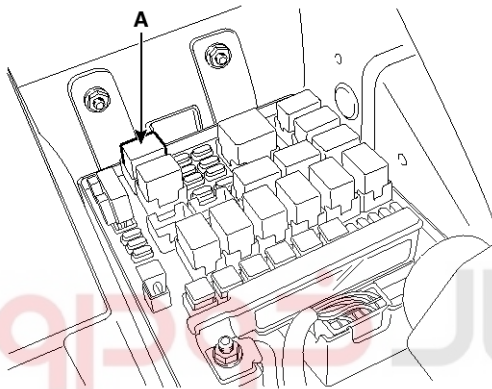
## Fuel System

### Release Residual Pressure in Fuel Line

#### ⚠ CAUTION

There may be some residual pressure even after “Release Residual Pressure in Fuel Line” work, so cover the hose connection with a shop towel to prevent residual fuel from spilling out before disconnecting any fuel connection.

1. Turn the ignition switch OFF and disconnect the battery (-) cable.
2. Remove the fuel pump relay (A).



SLMF10241D



#### ⚠ CAUTION

When removing the fuel pump relay, a Diagnostic Trouble Code (DTC) may occur. Delete the code with the GDS after completion of “Release Residual Pressure in Fuel Line” work.

3. Connect the battery (-) cable.
4. Start the engine and let idle, and then turn the ignition switch OFF after the engine has stopped on its own.
5. Disconnect the battery (-) cable, and then install the fuel pump relay (A).
6. Connect the battery (-) cable.
7. Delete the Diagnostic Trouble Code (DTC) related the fuel pump relay with the GDS.

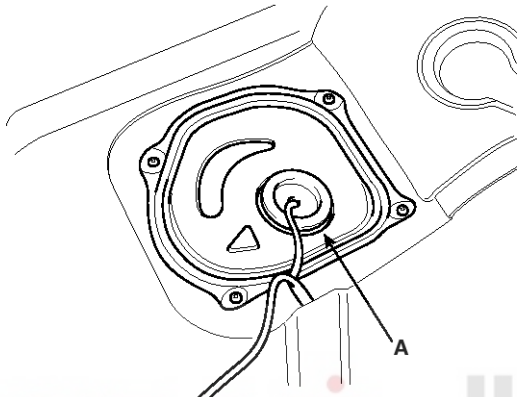
# Fuel Delivery System

FLA-85

## Fuel Tank

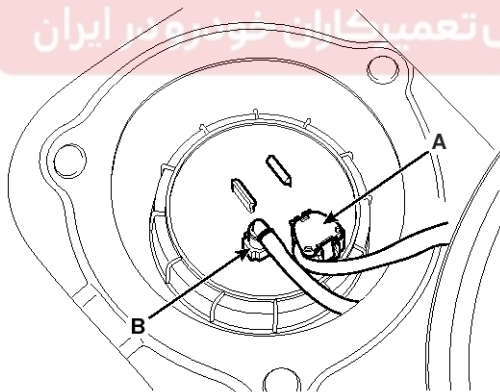
### Removal

1. Release the residual pressure in fuel line (Refer to "Release Residual Pressure in Fuel Line" in this group).
2. Remove the rear seat [LH] (Refer to "Seat" in BD group).
3. Remove the fuel pump service cover (A).



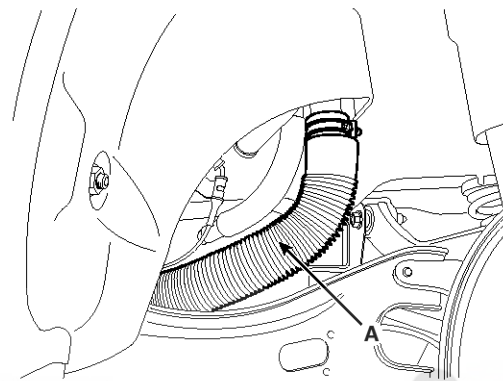
SLMFL0270D

4. Disconnect the fuel pump connector (A).
5. Disconnect the fuel feed tube quick connector (B).



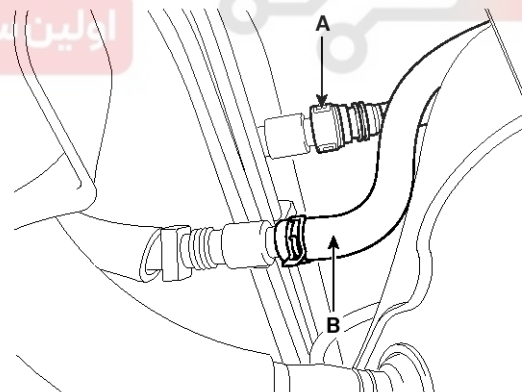
SSLF11011L

6. Remove the rear-LH wheel & tire.
7. Lift the vehicle and support the fuel tank with a jack.
8. Remove the center muffler assembly (Refer to "Intake And Exhaust System" in EM group).
9. Remove the propeller shaft (Refer to "Propeller Shaft Assembly" in DS group) [4WD].
10. Disconnect the fuel filler hose (A).



SLMFL0330D

11. Disconnect the leveling tube quick-connector (A) and the ventilation hose quick-connector (B).

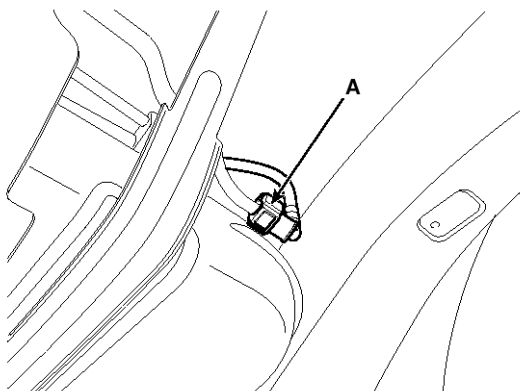


SLMF10120D

## FLA-86

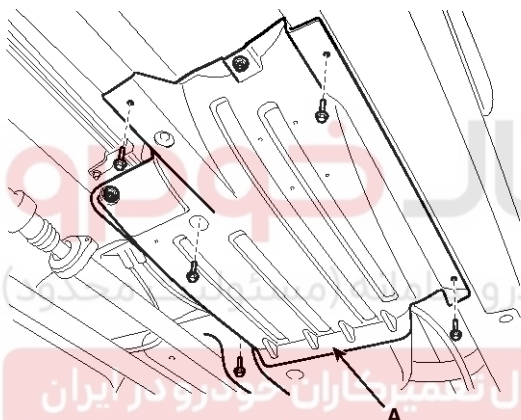
## Fuel System

12. Disconnect the vapor hose quick-connector (A).



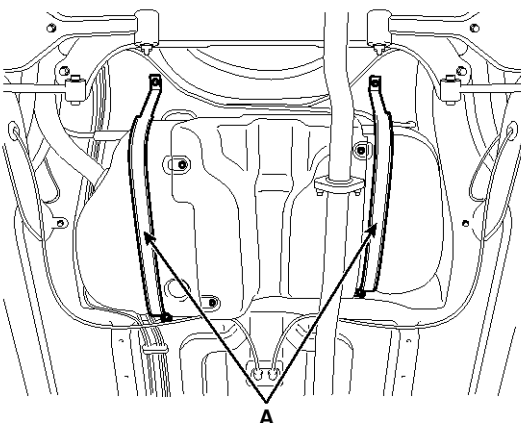
SLMF10130D

13. Remove the under cover (A).



SSLF10110D

14. Remove the fuel tank from the vehicle after removing the fuel tank band (A).



SLMF10141D

## Installation

1. Installation is reverse of removal.

## Fuel tank band installation nut:

39.2 ~ 54.0 N.m (4.0 ~ 5.5 kgf.m, 28.9 ~ 39.8 lb-ft)

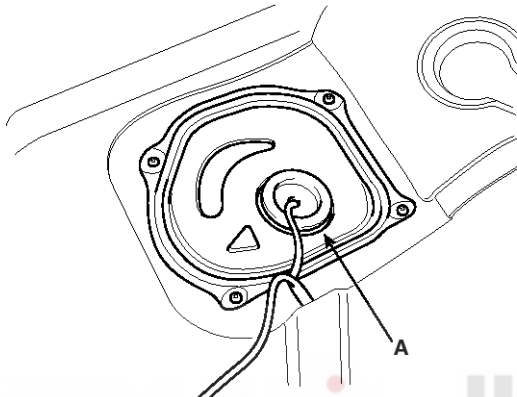
# Fuel Delivery System

FLA-87

## Fuel Pump

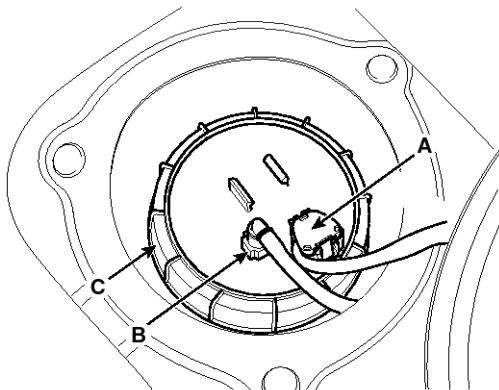
### Removal

1. Release the residual pressure in fuel line (Refer to "Release Residual Pressure in Fuel Line" in this group).
2. Remove the rear seat [LH] (Refer to "Seat" in BD group).
3. Remove the fuel pump service cover (A).

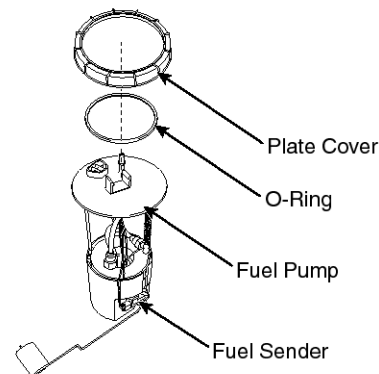


SLMFL0270D

4. Disconnect the fuel pump connector (A).
5. Disconnect the fuel feed tube quick connector (B).
6. Remove the plate cover (C) by using the special service tool [SST No.: 09310-2S100], and then remove the fuel pump from the fuel tank.



SSLF11012L



SSLF11013L

### Installation

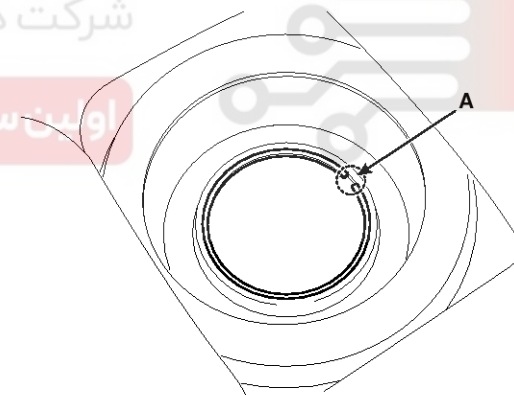
1. Installation is reverse of removal.

#### Fuel pump plate cover tightening:

58.9 ~ 68.7 N.m (6.0 ~ 7.0 kgf.m, 43.4 ~ 50.6 lb-ft)

#### CAUTION

Be careful of fuel pump direction when installing (Refer to the groove (A) in the fuel tank).



SXMFL9241D

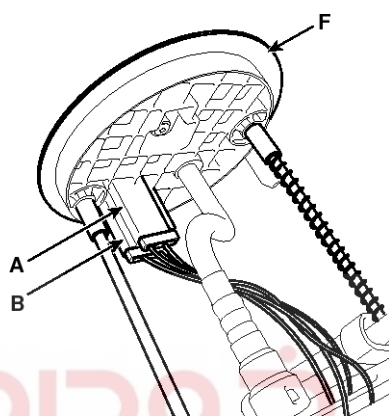
## FLA-88

## Fuel System

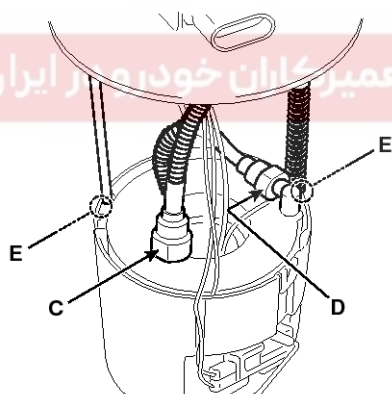
## Fuel Filter

## Replacement

1. Remove the fuel pump (Refer to "Fuel Pump" in this group).
2. Disconnect the electric pump wiring connector (A) and the fuel sender connector (B).
3. Disconnect the fuel tube quick-connectors (C, D).
4. Remove the head assembly (F) after releasing the fixing hooks (E).

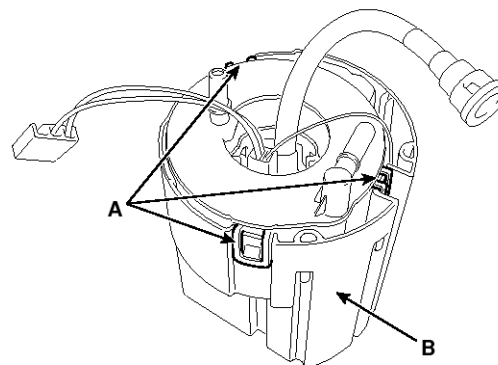


SLMF10180D



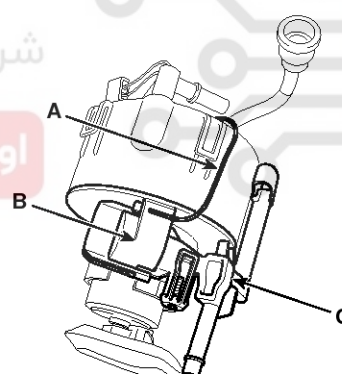
SLMF10190D

5. Remove the reservoir-cup (B) after releasing the fixing hooks (A).



SLMF10200D

6. Disconnect the ground cable (A).
7. Release the fixing hooks, and then remove the assist pump (C) after separating the fuel pressure regulator (B).



SLMF10210D

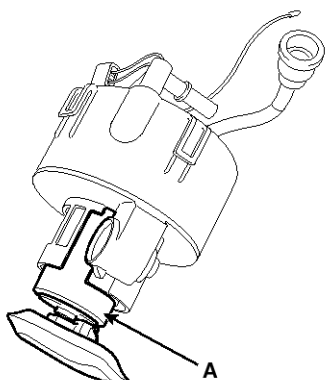
**CAUTION**

Be careful of O-ring.

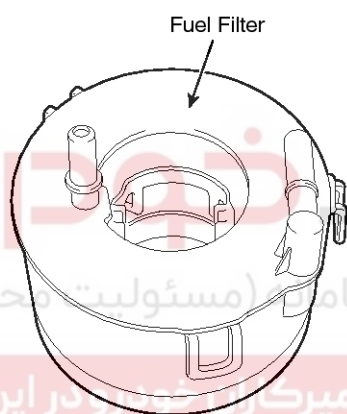
# Fuel Delivery System

## FLA-89

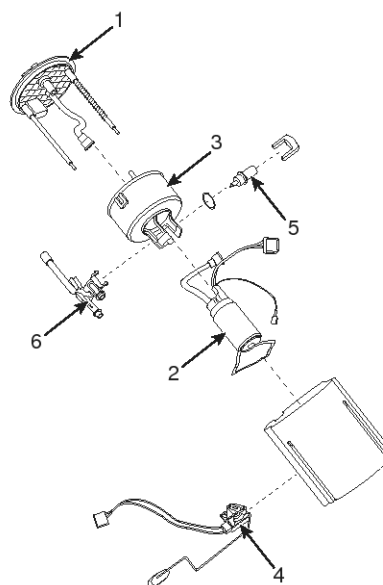
8. Separate the electric pump motor (A) from the fuel filter.



SLMF10220D



SLMF10170L



SLMF10230D

1. Head Assembly
2. Electric Pump Motor
3. Fuel Filter
4. Fuel Sender
5. Fuel Pressure Regulator
6. Assist Pump

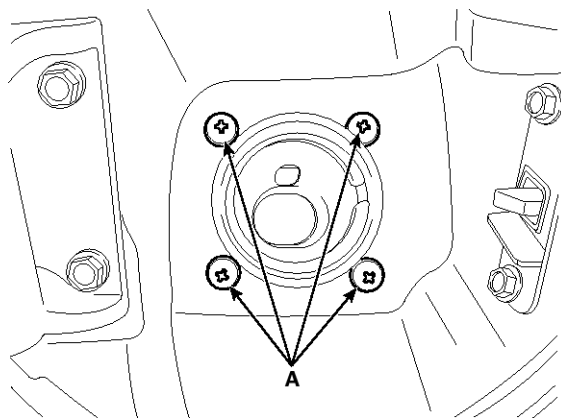
## FLA-90

## Fuel System

## Filler-Neck Assembly

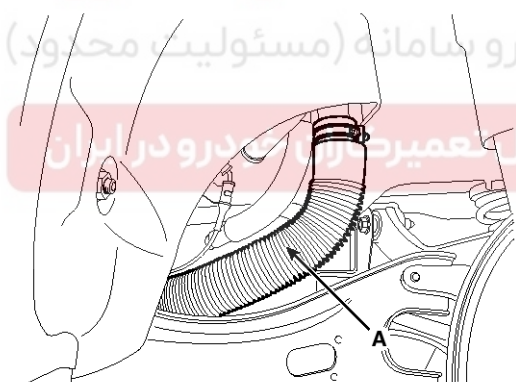
## Removal

1. Open the fuel filler door, and then remove the filler-neck assembly mounting screws (A).



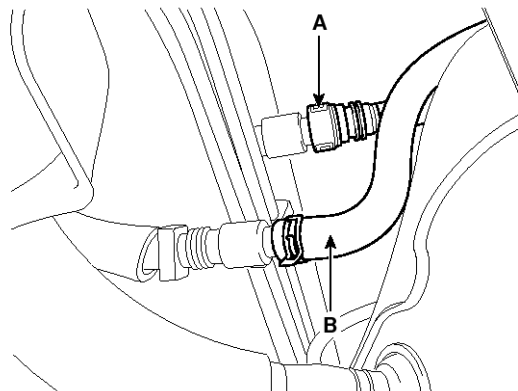
SCMFL6655D

2. Remove the rear-LH wheel & tire and the wheel guard.
3. Disconnect the fuel filler hose (A).



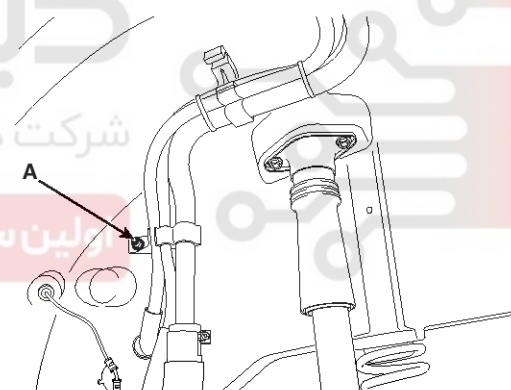
SLMFL0330D

4. Disconnect the leveling tube quick-connector (A) and the ventilation hose (B).



SLMF10120D

5. Remove the filler-neck assembly from the vehicle after removing the bracket mounting nut (A).



SLMFL0300D

## Installation

1. Installation is reverse of removal.

## Filler-neck assembly bracket installation nut :

3.9 ~ 5.9 N.m (0.4 ~ 0.6 kgf.m, 2.9 ~ 4.3 lb-ft)

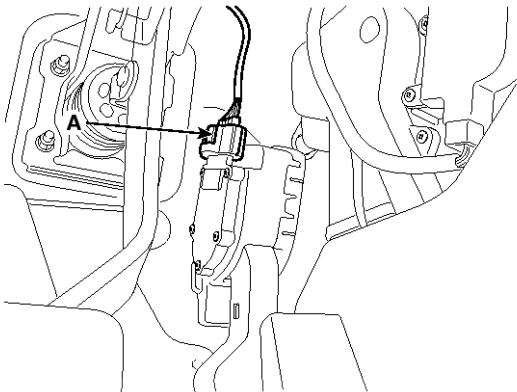
# Fuel Delivery System

## FLA-91

### Accelerator Pedal

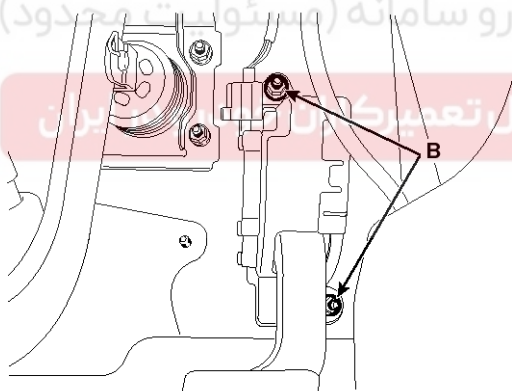
#### Removal

1. Turn the ignition switch OFF and disconnect the negative (-) battery cable.
2. Disconnect the accelerator position sensor connector (A).

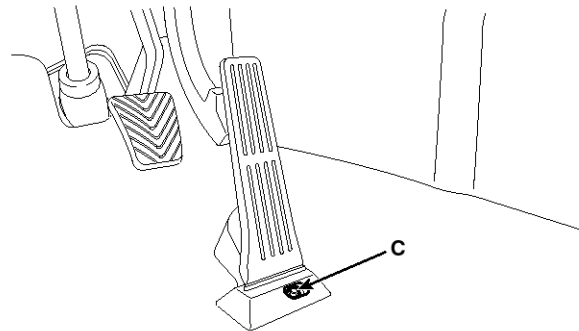


SLMF10409D

3. Remove the installation bolt (B) and nuts (C), and then remove the accelerator pedal module.



SCMFL0121N



SLMFL0010N

#### Installation

1. Installation is reverse of removal.

#### Accelerator pedal module installation bolt:

7.8 ~ 11.8 N.m (0.8 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)

#### Accelerator pedal module installation nut:

16.7 ~ 25.5 N.m (1.7 ~ 2.6 kgf.m, 12.3 ~ 18.8 lb-ft)

## FLA-92

## Fuel System

## Delivery Pipe

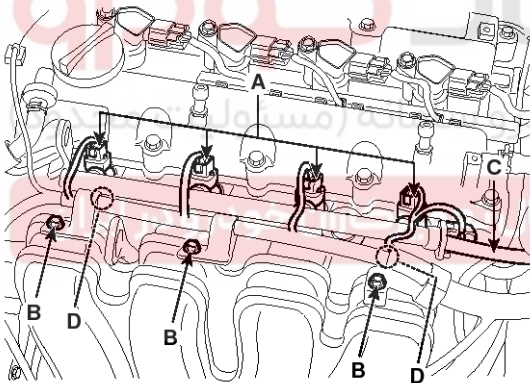
## Removal

1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Release the residual pressure in fuel line (Refer to "Release Residual Pressure in Fuel Line" in this group).

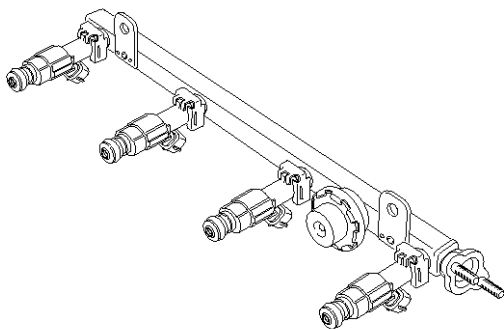
**CAUTION**

When removing the fuel pump relay, a Diagnostic Trouble Code (DTC) may occur. Delete the code with the GDS after completion of "Release Residual Pressure in Fuel Line" work.

3. Disconnect the injector connector (A).
4. Remove the wiring harness bracket installation bolt (B).
5. Remove the installation nut, and then disconnect the fuel feed tube (C).
6. Remove the installation bolt (D), and then remove the delivery pipe & injector assembly from the engine.



SXMf19157D



SXMf10158L

## Installation

1. Installation is reverse of removal.

**Delivery pipe installation bolt:**

18.6 ~ 23.5 N.m (1.9 ~ 2.4 kgf.m, 13.7 ~ 17.4 lb-ft)

**Delivery pipe installation nut (↔ Fuel feed tube):**

7.8 ~ 9.8 N.m (0.8 ~ 1.0 kgf.m, 5.8 ~ 7.2 lb-ft)