General Information

Specifications

Fuel Delivery System

Items	Specification	
Fuel Tank	Capacity	58lit. (61.3 U.S.qt., 51.0 Imp.qt.)
Fuel Filter	Type	Paper type
Fuel Pressure Regulator	Regulated Fuel Pressure	338 ~ 348kpa (3.45 ~ 3.55kgf/㎠, 49.0 ~ 50.5psi)
Fuel Pump	Type	Electrical, in-tank type
	Driven by	Electric motor
Fuel Return System	Type	Returnless

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
101.32	4.0

Intake Air Temperature Sensor (IATS)

▷ Type: Thermistor type

▷ Specification

Temperature [℃(°F)]	Resistance (kΩ)
-40(-40)	40.93 ~ 48.35
-30(-22)	23.43 ~ 27.34
-20(-4)	13.89 ~ 16.03
-10(14)	8.50 ~ 9.71
0(32)	5.38 ~ 6.09
10(50)	3.48 ~ 3.90
20(68)	2.31 ~ 2.57
25(77)	1.90 ~ 2.10
30(86)	1.56 ~ 1.74
40(104)	1.08 ~ 1.21
60(140)	0.54 ~ 0.62
80(176)	0.29 ~ 0.34

Engine Coolant Temperature Sensor (ECTS)

▷ Type: Thermistor type

▷ Specification

Temperature [℃(°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)

▷ Type: Variable resistor type

▷ Specification

Throttle Angle	Output Voltage (V)
C.T	0.25 ~ 0.9
W.O.T	Min. 4.0V

Items	Specification
Sensor Resistance (kΩ)	1.6 ~ 2.4 [20°C(68°F)]

Heated Oxygen Sensor (HO2S)

▷ Type: Zirconia (ZrO2) type

▷ Specification

A/F Ratio (λ)	Output Voltage (V)
Rich	0.6 ~ 1.0
Lean	0 ~ 0.4

Item	Specification
Heater Resistance (Ω)	Approx. 9.0 [20°C(68°F)]

Camshaft Position Sensor (CMPS)

▷ Type: Hall effect type

Crankshaft Position Sensor (CKPS)

▷ Type: Hall effect type

Knock Sensor (KS)

▷ Type: Piezo-electricity type

▷ Specification

Item	Specification
Capacitance (pF)	950 ~ 1,350
Resistance(MΩ)	4.87

CVVT Oil Temperature Sensor (OTS)

▷ Type: Thermistor type

▷ Specification

Temperature		Resistance (kΩ)
°C	°F	
-40	-40	52.15
-20	-4	16.52
0	32	6.0
20	68	2.45
40	104	1.11
60	140	0.54
80	176	0.29

Actuators

Injector

▷ Number: 4

▷ Specification

Item	Specification
Coil Resistance (Ω)	13.8 ~ 15.2 [20℃ (68˚F)]

Idle Speed Control Actuator (ISCA)

▷ Type: Double coil type

▷ Specification

Item	Specification
Closing Coil Resistance (Ω)	14.6 ~ 16.2 [20℃ (68˚F)]
Opening Coil Resistance (Ω)	11.1 ~ 12.7 [20℃ (68˚F)]

Duty (%)	Air Flow Rate (m³/h)
15	1.0 ~ 2.3
35	7.5 ~ 12.7
70	43.0 ~ 55.0
96	63.0 ~ 71.0

Purge Control Solenoid Valve (PCSV)

▷ Specification

Item	Specification
Coil Resistance (Ω)	26Ω [20℃ (68˚F)]

CVVT Oil Control Valve (OCV)

▷ Specification

Item	Specification
Coil Resistance (Ω)	6.7 ~ 7.7 [20℃ (68˚F)]

Ignition Coil

▷ Type: Double ended type

▷ Specification

Item	Specification
Primary Coil Resistance (Ω)	0.58Ω±10% [20℃ (68˚F)]
Secondary Coil Resistance (kΩ)	8.8kΩ±15% [20℃ (68˚F)]

Service Standard

Items	Specification		
Ignition Timing	BTDC 8° ± 5°		
Idle Speed	A/CON OFF	Neutral,N,P-range	700 ± 100 rpm
		D-range	
	A/CON ON	Neutral,N,P-range	850 ± 100 rpm
		D-range	

Tightening Torques

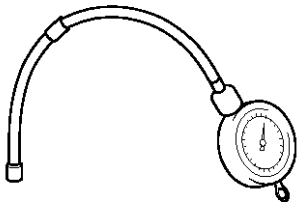
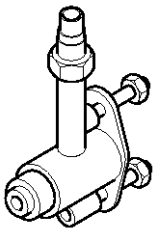
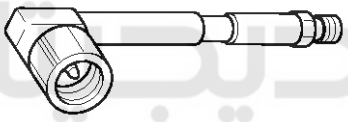
Engine Control System

Item	kgf.m	N.m	lb-ft
ECM installation bolt/nut	0.4 ~ 0.6	3.9 ~ 5.9	2.9 ~ 4.3
Manifold absolute pressure sensor installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
Engine coolant temperature sensor installation	2.0 ~ 4.0	19.6 ~ 39.2	14.5 ~ 28.9
Throttle position sensor installation screw	0.15 ~ 0.25	1.5 ~ 2.5	1.1 ~ 1.8
Crankshaft position sensor installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
Camshaft position sensor installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
Knock sensor installation bolt	1.7 ~ 2.7	16.7 ~ 26.4	12.3 ~ 19.5
Heated oxygen sensor (Bank 1 / Sensor 1) installation	4.0 ~ 5.0	39.2 ~ 49.1	28.9 ~ 36.2
Heated oxygen sensor (Bank 1 / Sensor 2) installation	4.0 ~ 5.0	39.2 ~ 49.1	28.9 ~ 36.2
CVVT oil temperature sensor installation	2.0 ~ 4.0	19.6 ~ 39.2	14.5 ~ 28.9
Idle speed control actuator installation bolt	0.8 ~ 1.2	7.8 ~ 11.8	5.8 ~ 8.7
CVVT oil control valve installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
Ignition coil installation bolt/nut	1.9 ~ 2.7	18.6 ~ 26.4	13.7 ~ 19.5
Throttle body installation nut	1.9 ~ 2.7	18.6 ~ 26.4	13.7 ~ 19.5

Fuel Delivery System

Item	kgf.m	N.m	lb-ft
Fuel tank band installation bolt	4.5 ~ 6.0	44.1 ~ 58.8	32.5 ~ 43.4
Fuel pump installation bolt	0.2 ~ 0.3	2.0 ~ 2.9	1.4 ~ 2.2
Sub fuel sender installation nut	0.2 ~ 0.3	2.0 ~ 2.9	1.4 ~ 2.2
Delivery pipe installation bolt	1.9 ~ 2.4	18.6 ~ 23.5	13.7 ~ 17.4

Special Service Tools

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

Basic Troubleshooting

Basic Troubleshooting Guide

1	**Bring Vehicle to Workshop**

2	**Analyze Customer's Problem**

- Ask the customer about the conditions and environment relative to the issue (Use CUSTOMER PROBLEM ANALYSIS SHEET).

3	**Verify Symptom, and then Check DTC and Freeze Frame Data**

- Connect Hi-Scan (Pro) to Diagnostic Link Connector (DLC).
- Record the DTC and freeze frame data.

NOTE

To erase DTC and freeze frame data, refer to Step 5.

4	**Confirm the Inspection Procedure for the System or Part**

- Using the SYMPTOM TROUBLESHOOTING GUIDE CHART, choose the correct inspection procedure for the system or part to be checked.

5	**Erase the DTC and Freeze Frame Data**

WARNING

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

6	**Inspect Vehicle Visually**

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

7	**Recreate (Simulate) Symptoms of the DTC**

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

8	**Confirm Symptoms of Problem**

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

9	**Recreate (Simulate) Symptom**

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

10	**Check the DTC**

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

11	**Perform troubleshooting procedure for DTC**

12	**Adjust or repair the vehicle**

13	**Confirm test**

14	**END**

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Customer Problem Analysis Sheet

1. VEHICLEINFORMAITON

VIN No.		Transmission	☐ M/T ☐ A/T ☐CVT ☐ etc.
Production date		Driving type	☐ 2WD (FF) ☐ 2WD (FR) ☐ 4WD
Odometer Reading	_____km/mile	CPF (Diesel Engine)	☐ With CPF ☐ Without CPF

2. SYMPTOMS

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

3. ENVIRONMENT

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

4. MIL/DTC

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

5. ECM/PCM INFORMATION

ECM/PCM Part No.	
ROM ID	

SFDF28233L

Basic Inspection Procedure

Measuring Condition of Electronic Parts' Resistance

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

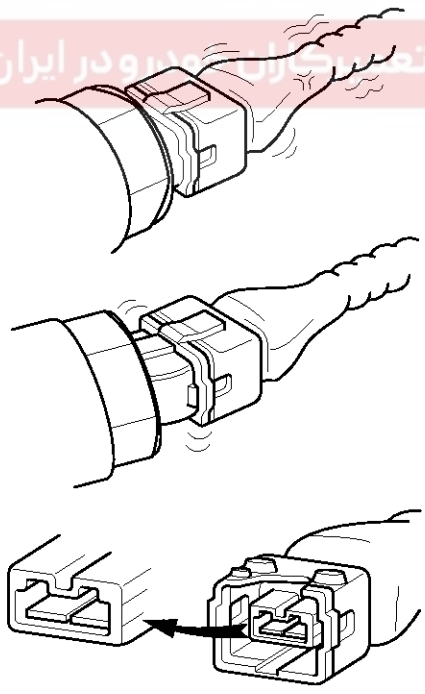
NOTICE

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

Intermittent Problem Inspection Procedure

Sometimes the most difficult case in troubleshooting is when a problem symptom occurs but does not occur again during testing. An example would be if a problem appears only when the vehicle is cold but has not appeared when warm. In this case, 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

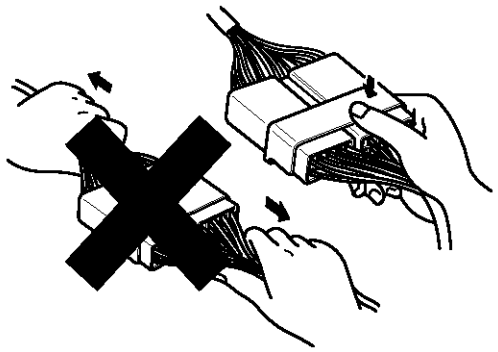
DO NOT sprinkle water directly into the engine compartment or electronic components.

● Simulating Electrical Load

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

Connector Inspection Procedure

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



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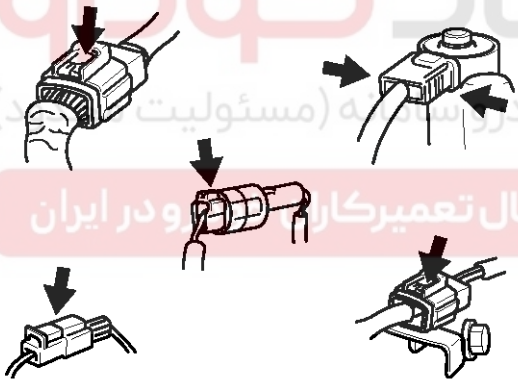
   b. When removing the connector with a lock, press or pull locking lever.



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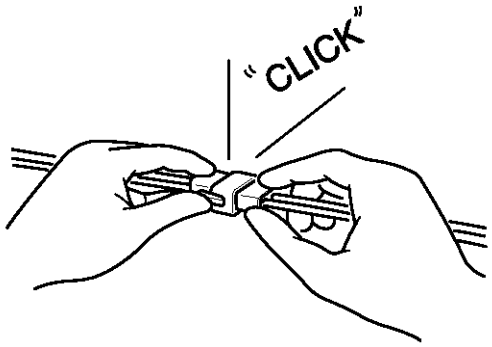
   c. Listen for a click when locking connectors. This sound indicates that they are securely locked.



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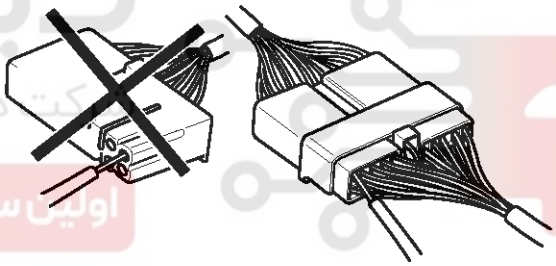
   d. When a tester is used to check for continuity, or to measure voltage, always insert tester probe from wire harness side.



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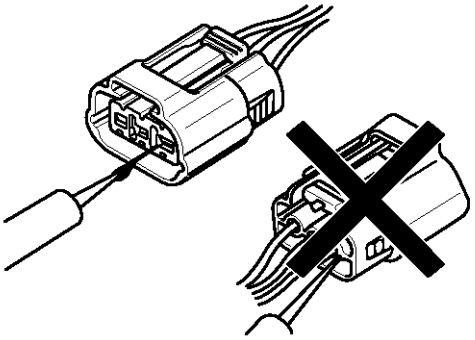
e. Check waterproof connector terminals from the connector side. Waterproof connectors cannot be accessed from harness side.



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NOTICE

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

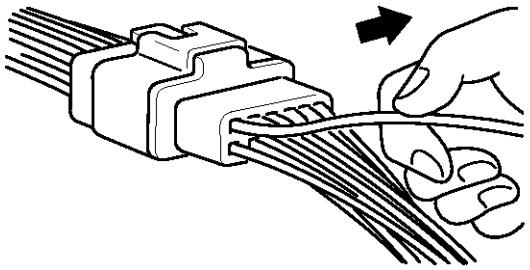
2. Checking Point for Connector

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.

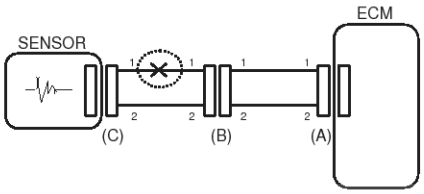
Electrical Circuit Inspection Procedure

● 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 side to side.

Specification (Resistance)

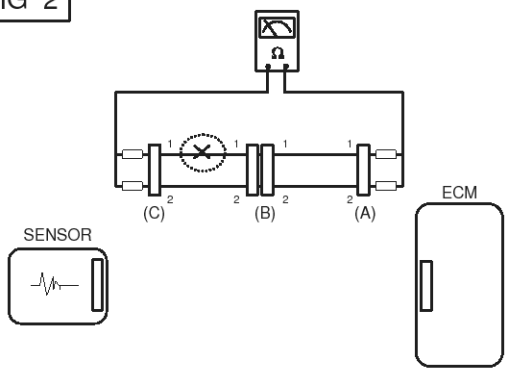
1Ω or less → Normal Circuit

1㏁ or Higher → Open Circuit

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

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

FIG 2



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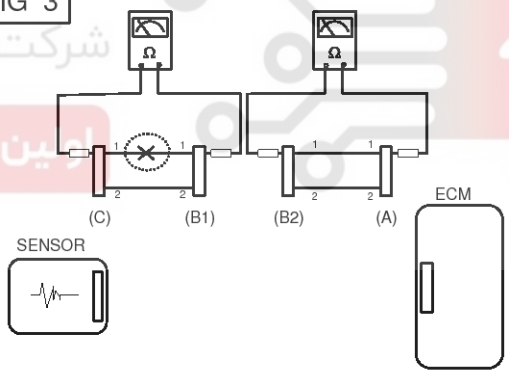
b. Disconnect connector (B), and measure for resistance between connector (C) and (B1) and between (B2) and (A) as shown in [FIG. 3].

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

FIG 3



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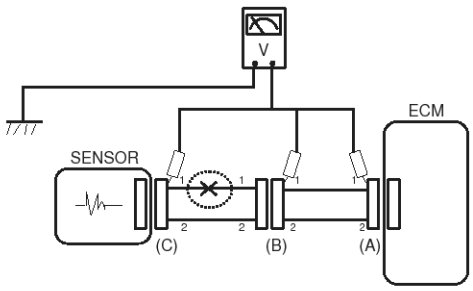
3. Voltage Check Method

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

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

FIG 4



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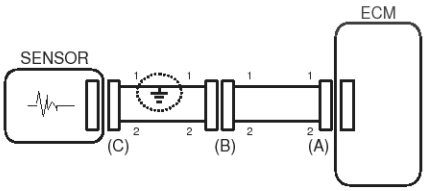
● Check Short Circuit

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

   If short to ground circuit occurs as shown in [FIG. 5], the broken point can be found by performing 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.

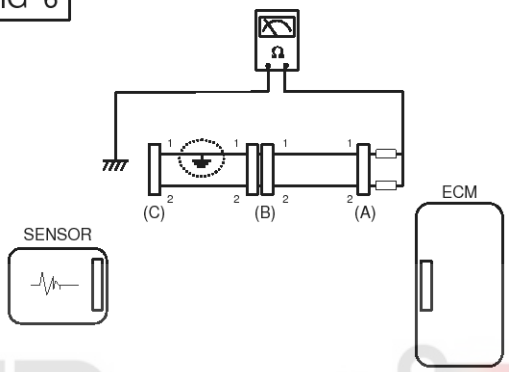
Specification (Resistance)

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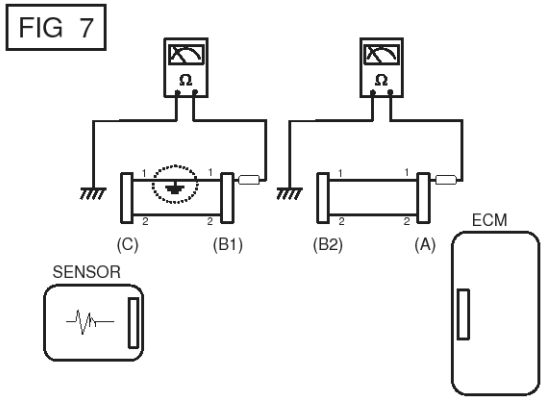
b. Disconnect connector (B), and measure the resistance between connector (A) and chassis ground, and between (B1) and chassis ground as shown in [FIG. 7].

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

FIG 7



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Symptom Troubleshooting Guide Chart

Main symptom	Diagnostic procedure	Also check for
Unable to start (Engine does not turn over)	1. Test the battery 2. Test the starter 3. Inhibitor switch (A/T) or clutch start switch (M/T)	
Unable to start (Incomplete combustion)	1. Test the battery 2. Check the fuel pressure 3. Check the ignition circuit 4. Troubleshooting the immobilizer system (In case of immobilizer lamp flashing)	• DTC • Low compression • Intake air leaks • Slipped or broken timing belt • Contaminated fuel
Difficult to start	1. Test the battery 2. Check the fuel pressure 3. Check the ECT sensor and circuit (Check DTC) 4. Check the ignition circuit	• DTC • Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark
Poor idling (Rough, unstable or incorrect Idle)	1. Check the fuel pressure 2. Check the Injector 3. Check the long term fuel trim and short term fuel trim (Refer to CUSTOMER DATASTREAM) 4. Check the idle speed control circuit (Check DTC) 5. Inspect and test the Throttle Body 6. Check the ECT sensor and circuit (Check DTC)	• DTC • Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark
Engine stall	1. Test the Battery 2. Check the fuel pressure 3. Check the idle speed control circuit (Check DTC) 4. Check the ignition circuit 5. Check the CKPS Circuit (Check DTC)	• DTC • Intake air leaks • Contaminated fuel • Weak ignition spark
Poor driving (Surge)	1. Check the fuel pressure 2. Inspect and test Throttle Body 3. Check the ignition circuit 4. Check the ECT Sensor and Circuit (Check DTC) 5. Test the exhaust system for a possible restriction 6. Check the long term fuel trim and short term fuel trim (Refer to CUSTOMER DATASTREAM)	• DTC • Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark
Knocking	1. Check the fuel pressure 2. Inspect the engine coolant 3. Inspect the radiator and the electric cooling fan 4. Check the spark plugs	• DTC • Contaminated fuel
Poor fuel economy	1. Check customer's driving habitsIs · A/C on full time or the defroster mode on? · Are tires at correct pressure? · Is excessively heavy load being carried? · Is acceleration too much, too often? 2. Check the fuel pressure 3. Check the injector 4. Test the exhaust system for a possible restriction 5. Check the ECT sensor and circuit	• DTC • Low compression • Intake air leaks • Contaminated fuel • Weak ignition spark

Main symptom	Diagnostic procedure	Also check for
Hard to refuel (Overflow during refueling)	1. Test the canister close valve 2. Inspect the fuel filler hose/pipe · Pinched, kinked or blocked? · Filler hose is torn 3. Inspect the fuel tank vapor vent hose between the EVAP. canister and air filter 4. Check the EVAP. canister	• Malfunctioning gas station filling nozzle (If this problem occurs at a specific gas station during refueling)

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 HI-SCAN (Pro).

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.

[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.

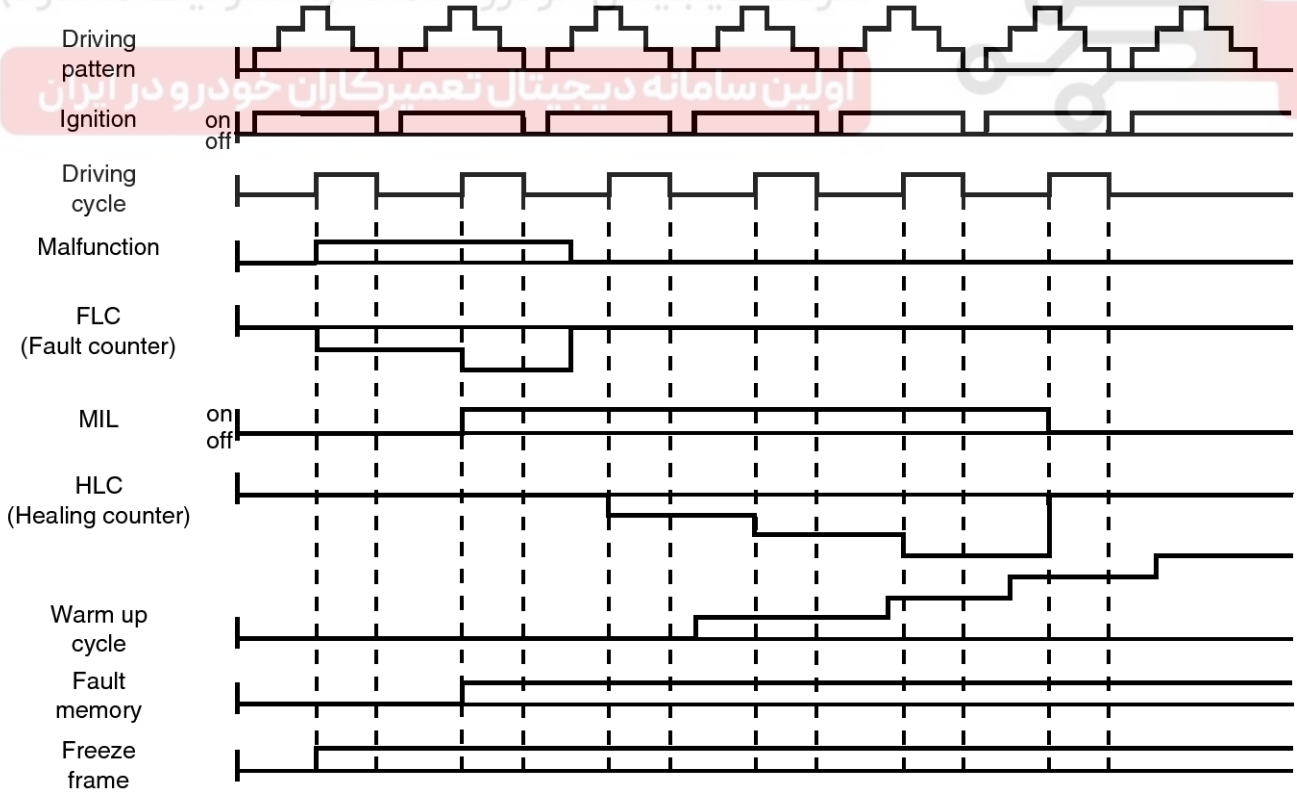
Self-Diagnosis

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 HI-SCAN (Pro). Diagnostic Trouble Codes (DTC) will remain in the ECM as long as battery power is maintained. The diagnostic trouble codes will, however, be erased when the battery terminal or ECM connector is disconnected, or by the HI-SCAN (Pro).

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

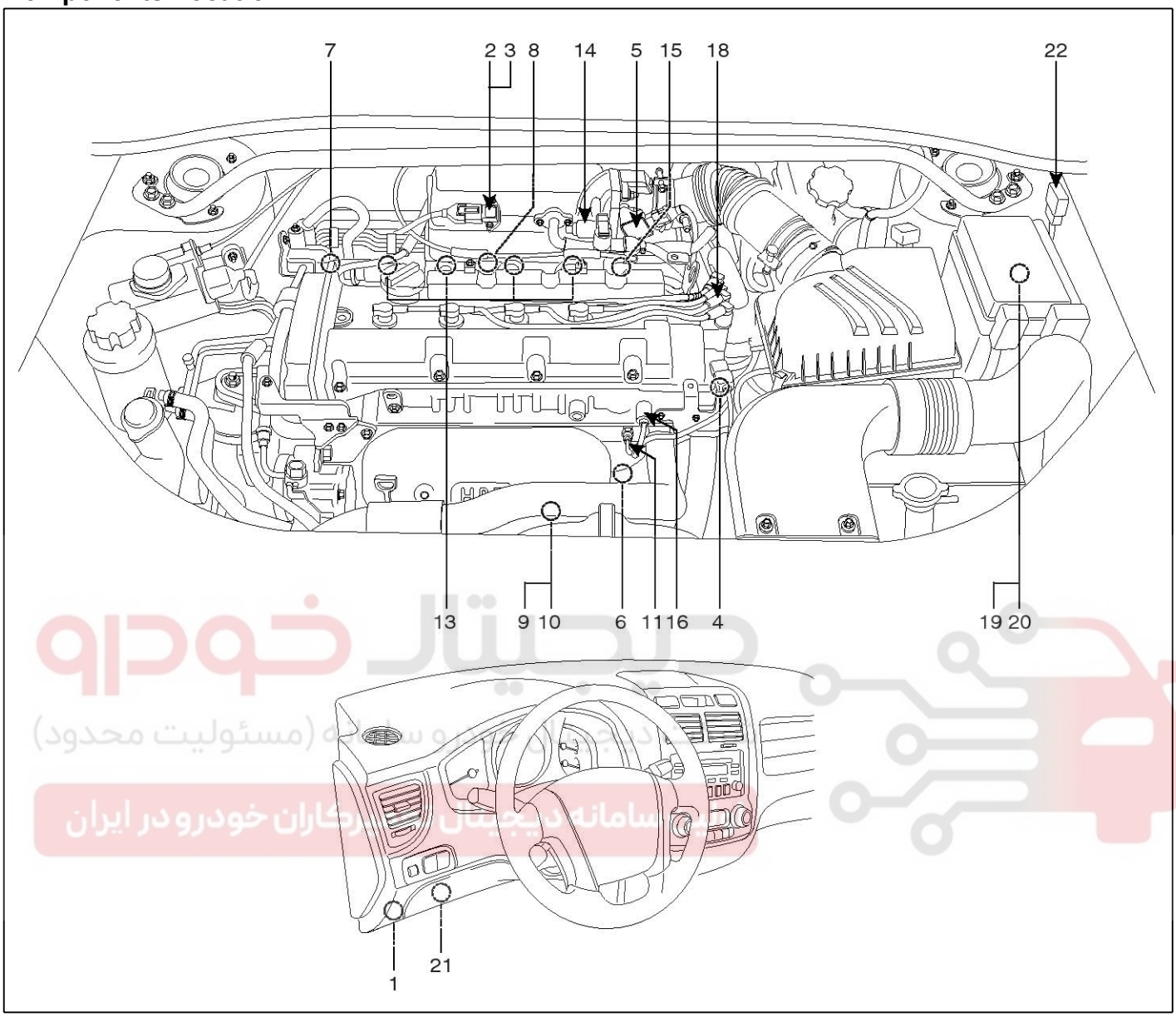
1. When the same malfunction is detected and maintained during two sequential driving cycles, the MIL will automatically illuminate.
2. The MIL will go off automatically if no fault is detected after 3 sequential driving cycles.
3. A Diagnostic Trouble Code(DTC) is recorded in ECM memory when a malfunction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

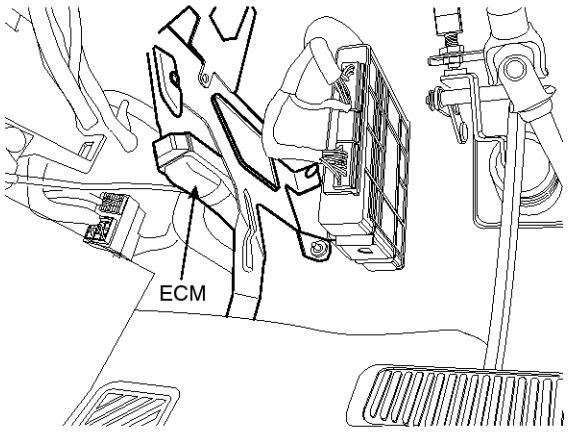
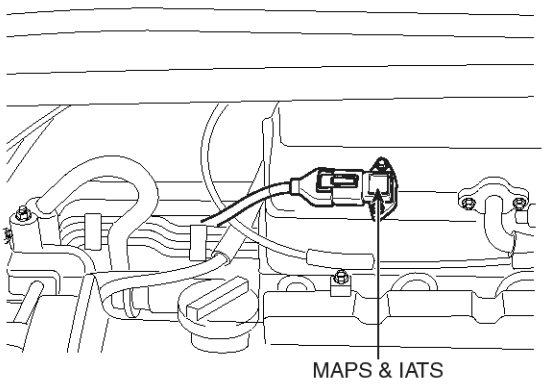
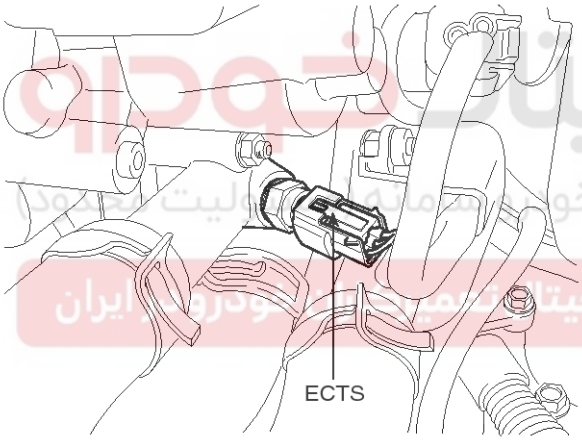
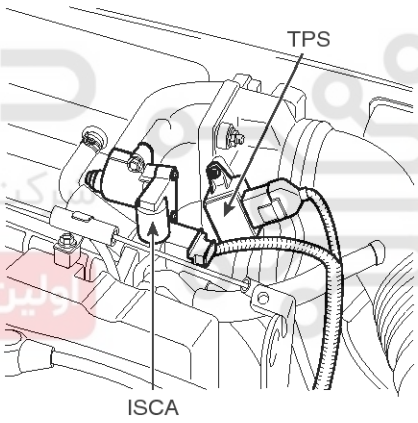
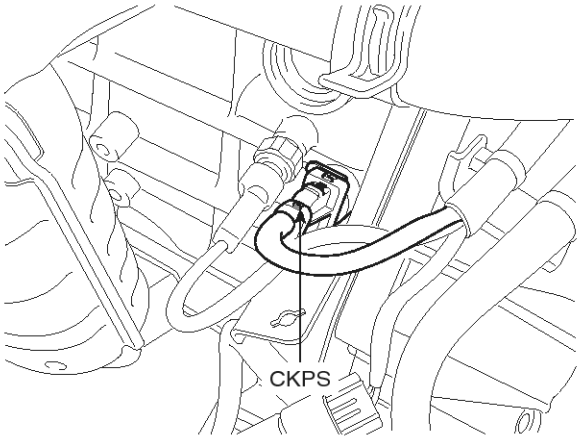
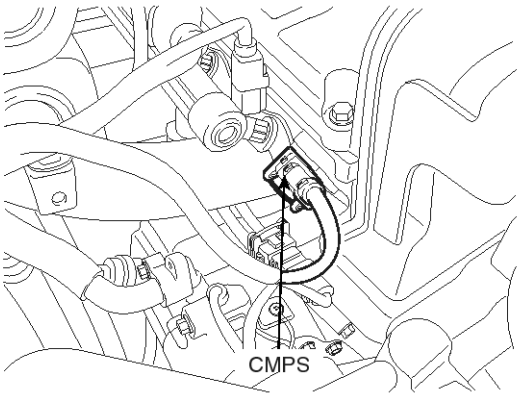
- *A "warm-up cycle" means sufficient vehicle operation such that the coolant temperature has risen by at least 40 degrees Fahrenheit from engine starting and reaches a minimum temperature of 160 degress Fahrenheit.*
- *A "driving cycle" consists of engine startup, vehicle operation beyond the beginning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

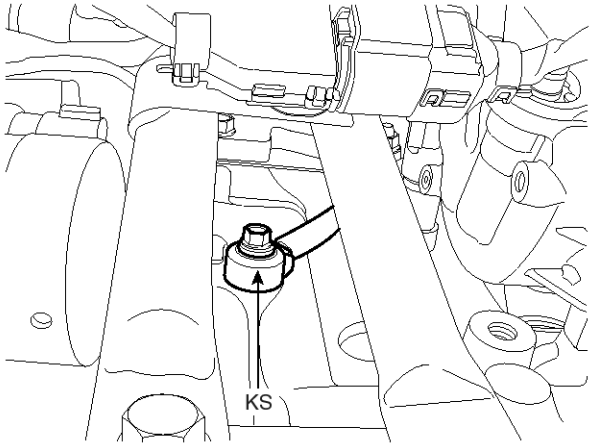
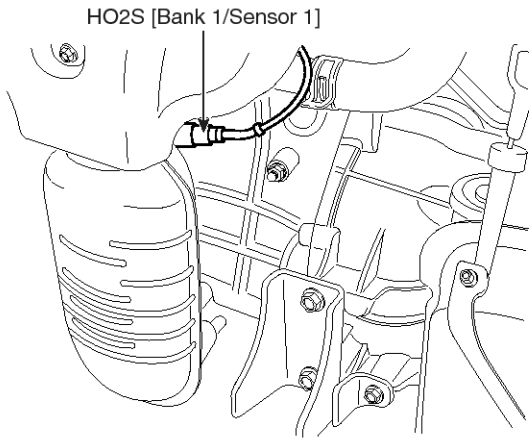
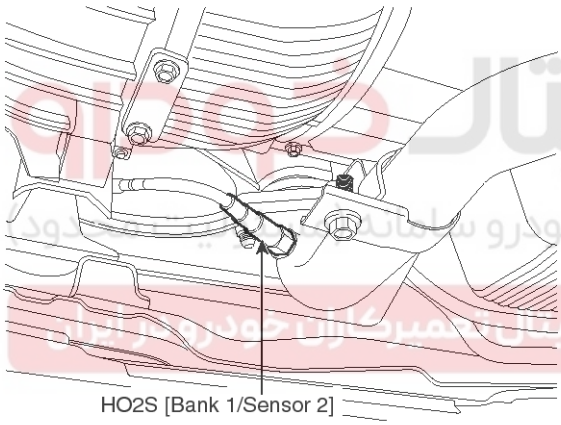
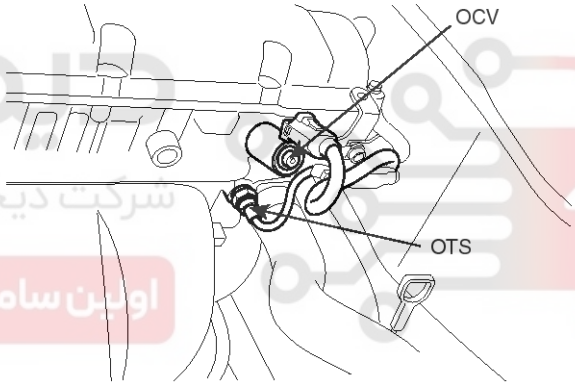
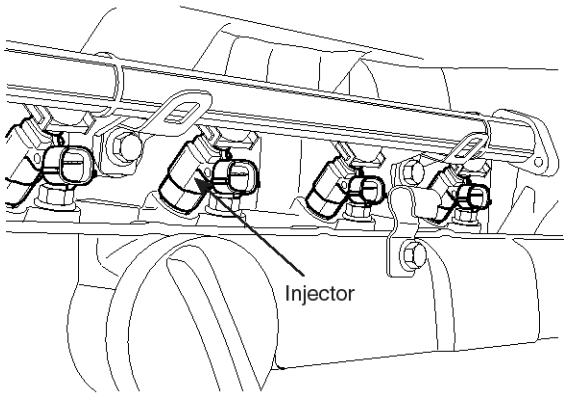
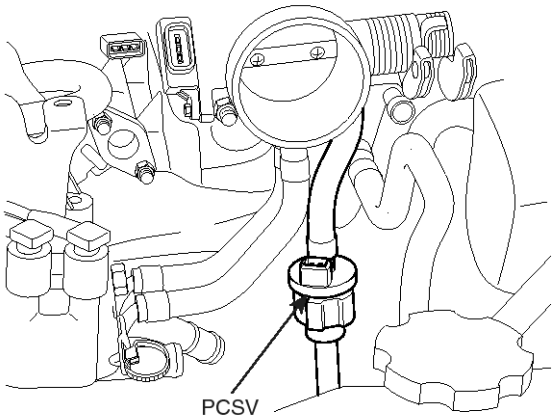
Components Location

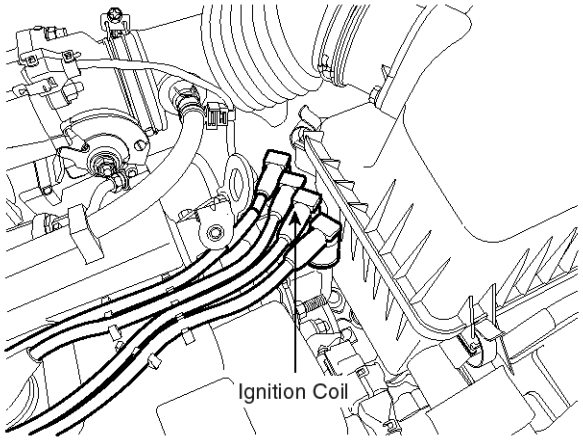
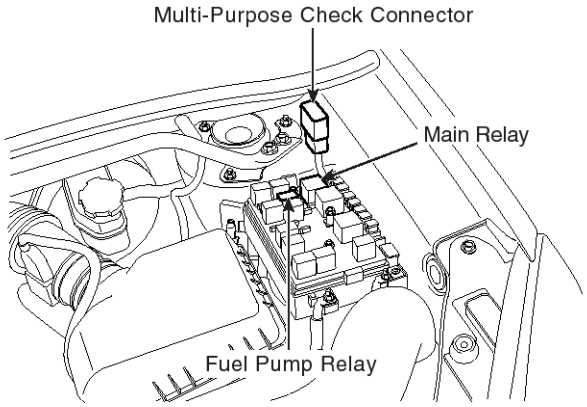


SJMFL9100N

1. Engine Control Module (ECM)
2. Manifold Absolute Pressure Sensor (MAPS)
3. Intake Air Temperature Sensor (IATS)
4. Engine Coolant Temperature Sensor (ECTS)
5. Throttle Position Sensor (TPS)
6. Crankshft Position Sensor (CKPS)
7. Camshaft Position Sensor (CMPS)
8. Knock Sensor (KS)
9. Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1]
10. Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2]
11. CVVT Oil Temperature Sensor (OTS)
13. Injector
14. Idle Speed Control Actuator (ISCA)
15. Purge Control Solenoid Valve (PCSV)
16. CVVT Oil Control Valve (OCV)
18. Ignition Coil
19. Main Relay
20. Fuel Pump Relay
21. Data Link Connector (DLC)
22. Multi-Purpose Check Connector

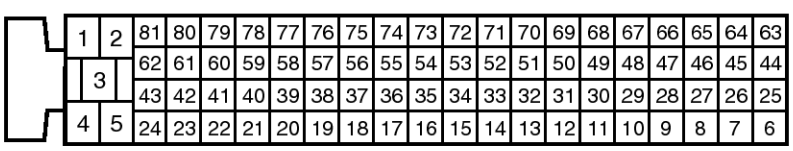
1. Engine Control Module (ECM)	2. Manifold Absolute Pressure Sensor (MAPS) 3. Intake Air Temperature Sensor (IATS)
 SKMFL7122D	 SJMFL9101N
4. Engine Coolant Temperature Sensor (ECTS)	5. Throttle Position Sensor (TPS) 14. Idle Speed Control Actuator (ISCA)
 SHDF18100C	 SJMFL9102N
6. Crankshft Position Sensor (CKPS)	7. Camshaft Position Sensor (CMPS)
 SHDF18101C	 SEDF17001L

8. Knock Sensor (KS)	9. Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1]
 SHDF16108L	 SJMFL9103N
10. Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2]	11. CVVT Oil Temperature Sensor (OTS) 16. CVVT Oil Control Valve (OCV)
 SJMFL9104N	 LGIF007J
13. Injector	15. Purge Control Solenoid Valve (PCSV)
 LGIF007H	 LGIF007L

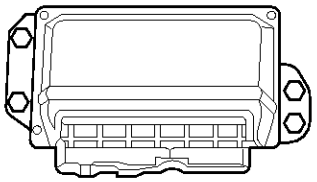
18. Ignition Coil	19. Main Relay 20. Fuel Pump Relay 22. Multi-Purpose Check Connector
 SHDF16113L	 SJMFL9105N

Engine Control Module (ECM)

1. ECM HARNESS CONNECTOR



ECM Harness Side Connector



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2. ECM TERMINAL FUNCTION

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

Pin No.	Description	Connected to	Remark
24	Injector output (cyl. 1)	Injector (cyl. 1)	
25	Spare Sensor supply	Sensors	
26	Purge Control Solenoid Valve (PCSV) PWM o-utput	Purge Control Solenoid Valve (PCSV)	
27	Crankshaft Position Sensor ground	Crankshaft Position Sensor	
28	Not connected	-	
29	Crankshaft Position Sensor input	Crankshaft Position Sensor	
30	Camshaft Position Sensor ground	Camshaft Position Sensor	
31	Engine Coolant Temperature Sensor input	Engine Coolant Temperature Sensor	
32	Throttle Position Sensor input	Throttle Position Sensor	
33	Not connected	-	
34	Not connected	-	
36	Not connected	-	
37	HO2S (B1/S2) ground	HO2S (B1/S2)	
38	Throttle Position Sensor ground	Throttle Position Sensor	
39	Vehicle Speed Sensor input	Vehicle Speed Sensor	Except for EO-BD
40	Not connected	-	
41	Not connected	-	
42	HO2S (B1/S2) input	HO2S (B1/S2)	EOBD ONLY
43	HO2S (B1/S1) input	HO2S (B1/S1)	Except for LE-ADED
44	Sensor Power (+5V)	MAPS	
45	Throttle Position Sensor supply	Throttle Position Sensor	
46	Spare Sensor supply 2	Sensors	
47	Immobilizer Data Line	Immobilizer	With Immobiliz-er
48	MAPS, IATS ground	MAPS, IATS	
49	Not connected	-	
50	Air Conditioner Compressor Switch input	Triple Switch	
51	Air Conditioner Pressure switch input	Triple Switch	
52	Oil Temperature Sensor input	Oil Temperature Sensor	
53	Not connected	-	
54	Knock Sensor ground	Knock Sensor	
55	Ignition shield ground	Ignition Coil	
56	Intake Air Temperature Sensor input	MAFS, IATS	

Pin No.	Description	Connected to	Remark
57	Not connected	-	
58	Air Conditioner Request Switch input	Air Conditioner Request Switch	
59	HO2S (B1/S1) ground	HO2S (B1/S1)	Except for LE-ADED
60	MAPS signal input	MAPS	
61	Injector output (cyl.3)	Injector (cyl.3)	
62	Injector output (cyl.2)	Injector (cyl.2)	
63	Not connected	-	
64	Cooling Fan Relay - High control output	Cooling Fan Relay	
65	Cooling Fan Relay - Low control output	Cooling Fan Relay	
66	Engine Speed signal output	Tachometer	
67	Main Relay control output	Main Relay	
68	Air Conditioner Compressor Relay control output	Air Conditioner Compressor Relay	
69	Electric Fuel Pump Relay control output	Electric Fuel Pump Relay	
70	Malfunction Indicating Lamp (MIL) output	Malfunction Indicating Lamp (MIL)	
71	Immobilizer ground	Immobilizer	With Immobilizer
72	Camshaft Position Sensor input	Camshaft Position Sensor	
73	Engine Coolant Temperature Sensor ground	Engine Coolant Temperature Sensor	
74	Throttle Position PWM output		
75	Fuel Consumption signal output	Trip Computer	
76	Oil Temperature Sensor ground	Oil Temperature Sensor	
77	Diagnostic Data Line (k-Line)	Data Link Conector (DLC)	
78	Idle Speed Control Actuator PWM output 2 (CLOSE)	Idle Speed Control Actuator	
79	Not connected	-	
80	Idle Speed Control Actuator PWM output 1 (OPEN)	Idle Speed Control Actuator	
81	Immobilizer Lamp output	Immobilizer	With Immobilizer

3. ECM TERMINAL INPUT/OUTPUT SIGNAL

Pin No.	Description	Input, Output Value		Vehicle State	Test Result
		Type	Range		
1	ECM ground	Static Signal	0 ~ 0.5V	Always	0.3V
2	Power stage ground	Static Signal	0 ~ 0.5V	Always	0.3V
3	Direct battery voltage s-upply	Static Signal	Vbatt	Others	12.5 V (Vbatt Level)
				Running	13.7 V (Vbatt Level)
4	Ignition coil output 1,4	Pulse		Engine run	High: 14.03V Low: 0.78~1.13V Peak voltage: 348V Idle : 17.2Hz
5	Ignition coil output 2,3	Pulse		Engine run	High: 14.03V Low: 0.78~1.13V Peak voltage: 348V Idle : 17.2Hz
6	CAN LOW	DC (PWM)	2.0 ~ 3.0V	Recessive	
			0.5 ~ 2.25V	Dominant	
7	CAN HIGH	DC (PWM)	2.0 ~ 3.0V	Recessive	
			2.75~4.5V	Dominant	
8	HO2S Heater (B1/S1)	PWM		Engine run	High: 14.01V Low: 0.4V Frequency:10Hz
9	HO2S Heater (B1/S2)	PWM		Engine run	High: 14.01V Low: 0.4V Frequency:10Hz
10	Knock Sensor Input	Frequency	-0.5 ~ 0.7V	Knocking	0.3V
			0V	Normal	0V
11	CVVT Oil Control Valve output	PWM		Engine run	High: 14.01V Low: 0.4V Frequency: 300Hz
12	Not connected				
13	Not connected				
14	Battery Voltage Supply after Main Relay	DC	Vbatt	IG ON	12.7V
			0 ~ 0.5V	IG OFF	0.3V

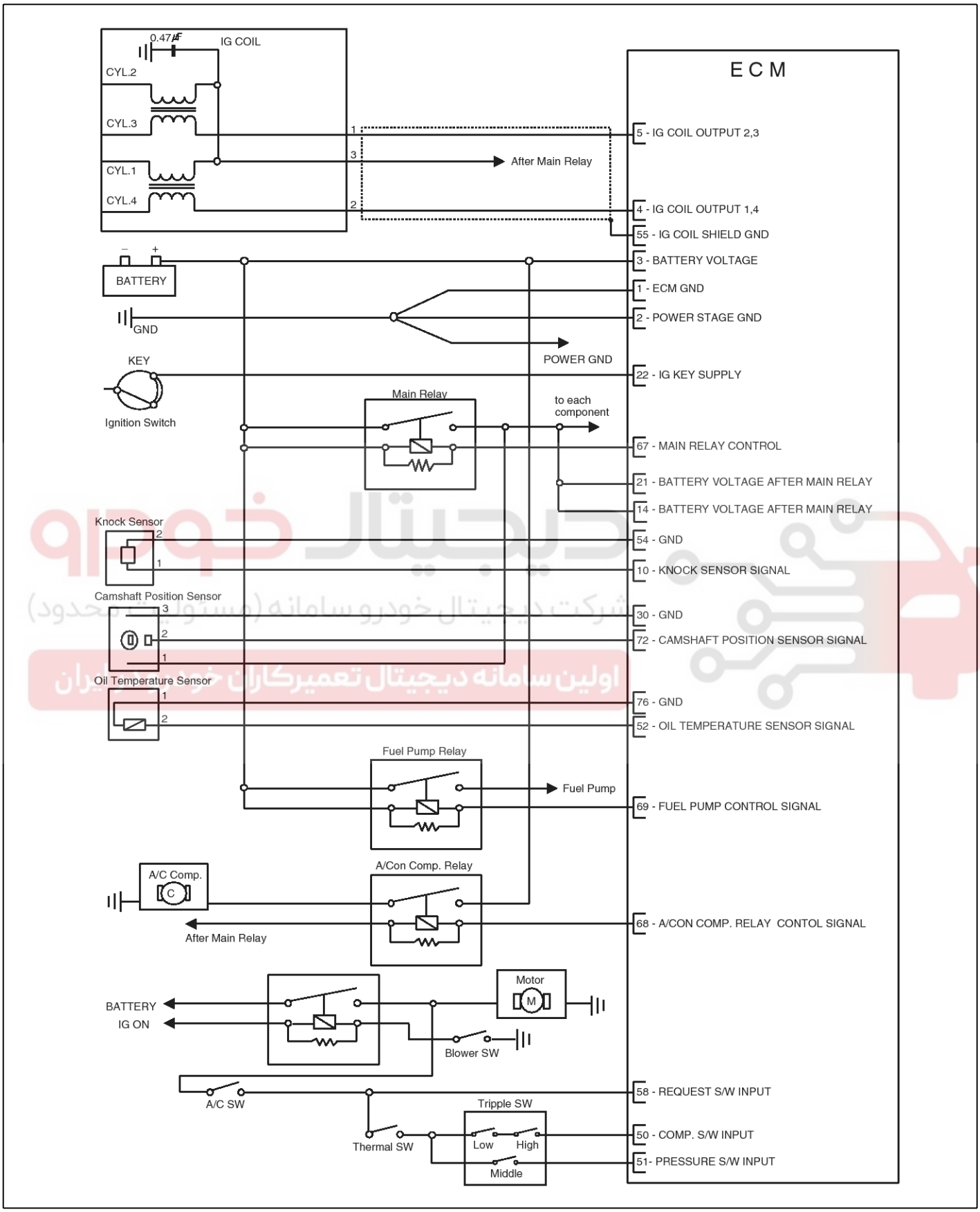
Pin No.	Description	Input, Output Value		Vehicle State	Test Result
		Type	Range		
15	Not connected				
16	Not connected				
17	Wheel Speed Sensor(-)	Sensor signal	Approximately 50rpm: 37Hz, 236mV (Peak to Peak) 100rpm: 76Hz, 376mV (Peak to Peak) 1000rpm: 769Hz, 1.64V (Peak to Peak)	Vehicle run	
18	Wheel Speed Sensor(+)	Sensor signal	Approximately 50rpm: 37Hz, 236mV (Peak to Peak) 100rpm: 76Hz, 376mV (Peak to Peak) 1000rpm: 769Hz, 1.64V (Peak to Peak)	Vehicle run	
19	Not connected				
20	Not connected				
21	Battery Voltage Supply after Main Relay	Static Signal	Vbatt	IG ON	12.7V
			0 ~ 0.5V	IG OFF	0.3V
22	Battery Voltage Supply after Ignition Key	Static Signal	Vbatt	IG ON	12.7V
			0 ~ 0.5V	IG OFF	0.3V
23	Injector output (cyl. 4)	Frequency		Idle: 6.25Hz 3000rpm: 12.6Hz	High: 14.01V Low: 0.3V Peak voltage: 58V
24	Injector output (cyl. 1)	Frequency		Idle: 6.25Hz 3000rpm: 12.6Hz	High: 14.01V Low: 0.3V Peak voltage: 58V
25	Spare Sensor supply	Static Signal	Vcc	IG ON	5V
			0 ~ 0.5V	IG OFF	0.3V
26	Purge Control Solenoid Valve (PCSV) PWM output	PWM Pulse		Inactive Active (after warm up & racing)	High: 14.01V Low: 0.3V Frequency: 20Hz
27	Crankshaft Position Sensor ground	Static Signal	0 ~ 0.5V	Always	0.2 V
28	Not connected				
29	Crankshaft Position Sensor input	Frequency		Idle: 740Hz	5V
				3000rpm: 3126Hz	0.3V

Pin No.	Description	Input, Output Value		Vehicle State	Test Result
		Type	Range		
30	Camshaft Position Sensor ground	Static Signal		Always	
31	Engine Coolant Temperature Sensor input	Analog	-40 ℃ ~ 145 ℃ 4.9V ~ 0.322V	80℃ [176°F]	1.25V
32	Throttle Position Sensor input	Analog	0.25 ~ 0.8V	Idle	0.3V
			4.15 ~ 4.7V	W.O.T	4.16V
33	Not connected				
34	Not connected				
35	Not connected				
36	Not connected				
37	HO2S (B1/S2) ground	Static Signal	0 ~ 0.5V	Always	0.3V
38	Throttle Position Sensor ground	Static Signal	0 ~ 0.5V	Always	0.3V
39	Vehicle Speed Sensor input	Pulse		Vehicle run	High : 5V Low : 0.9V
40	Not connected				
41	Not connected				
42	HO2S (B1/S2) input	Analog Pulse		3000rpm After warm up	0.8V 0.1V Frequency: 1.1Hz
43	HO2S (B1/S1) input	Analog Pulse	RICH : 0.6 ~ 1.0 V	Engine run	0.746 V
			LEAN : Max. 0.4 V		0.081 V
44	Sensor Power (+5V)	Static Signal	5V	IG ON	4.9V
			0 ~ 0.5V	IG OFF	0.4V
45	Throttle Position Sensor supply	Static Signal	5V	IG ON	4.9V
			0 ~ 0.5V	IG OFF	0.4V
46	Spare Sensor supply 2	Static Signal	5V	IG ON	5V
			0 ~ 0.5V	IG OFF	0.3V
47	Immobilizer Data Line	Pulse	High : Min. 8.5 V Low : Max. 3.5 V	When communicating after IG ON.	11.625 V 0.187 V
48	MAPS, IATS ground	Static Signal	0 ~ 0.5V	Always	0.4 V
49	Not connected				
50	Air Conditioner Compressor Switch input	DC	Vbatt	S/W ON	13V
			0 ~ 0.5V	S/W OFF	0.3V

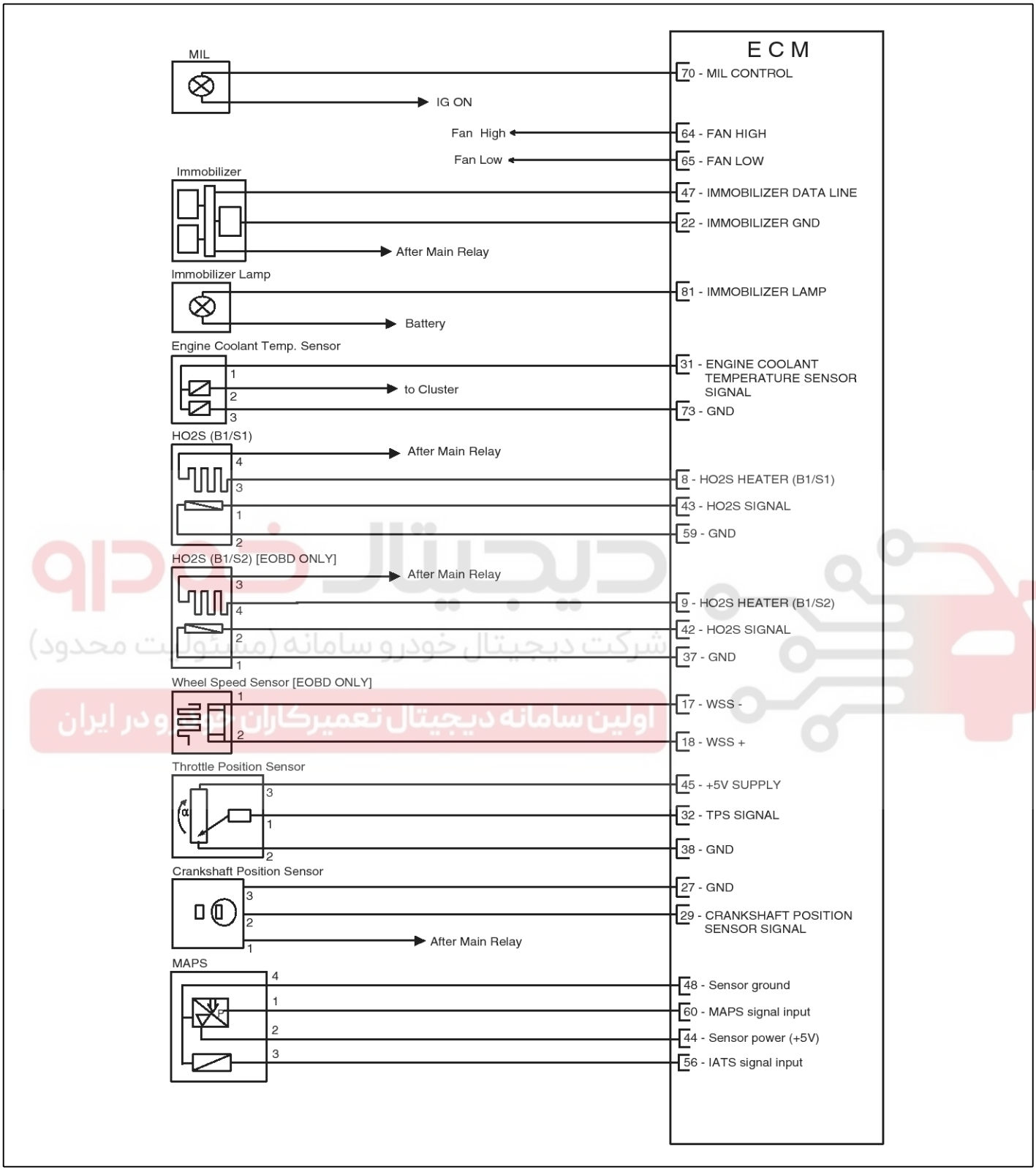
Pin No.	Description	Input, Output Value		Vehicle State	Test Result
		Type	Range		
51	Air Conditioner Pressure switch input	DC	Vbatt	S/W ON	12.9V
			0 ~ 0.5V	S/W OFF	0.4V
52	Oil Temperature Sensor input	Analog	-40 ℃ ~ 130 ℃ 4.9V ~ 0.4V	84℃ [183.2 °F]	1.29V
53	Not connected				
54	Knock Sensor ground	Static Signal	0 ~ 0.5V	Always	0.3V
55	Ignition shield ground	Static Signal	0 ~ 0.5V	Always	0.3V
56	Intake Air Temperature Sensor input	Analog	-40 ℃ ~ 266 ℃ 4.9V ~ 0.34 V	Idle	3.26 V (33℃ [91.4 °F])
57	Not connected				
58	Air Conditioner Request Switch input	DC	Vbatt	S/W ON	12.9V
			0 ~ 0.5 V	S/W OFF	0.4V
59	HO2S (B1/S1) ground	DC	Max. 50 mV	Idle	2.5 mV
60	MAPS signal input	Analog	0 ~ 2.0 V	Idle	1.0V
			1.0 ~ 4.5 V	3000 rpm	2.3V
61	Injector output (cyl.3)	Frequency		Idle: 6.25Hz 3000rpm: 12.6Hz	High: 14.01V Low: 0.3V Peak voltage: 58V
62	Injector output (cyl.2)	Frequency		Idle: 6.25Hz 3000rpm: 12.6Hz	High: 14.01V Low: 0.3V Peak voltage: 58V
63	Not connected				
64	Cooling Fan Relay - High control output	DC	Vbatt	S/W OFF	12.9V
				S/W ON	0.4V
65	Cooling Fan Relay - Low control output	DC	Vbatt	S/W OFF	13V
				S/W ON	0.5V
66	Engine Speed signal output	Frequency		Engine run	High: 10.5V Low: 0.4V Idle: 24.7Hz 3000 rpm: 104.6Hz
67	Main Relay control output	DC	0 ~ 1V	IG ON	0.9V
			Vbatt	IG OFF	13.5V
68	Air Conditioner Compressor Relay control output	DC	0 ~ 0.5V	A/C ON	0.2V
			Vbatt	A/C OFF	12.5V
69	Fuel Pump Relay control output	DC	Vbatt	IG ON	13.08V
			0 ~ 0.5V	Idle	0.3V

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

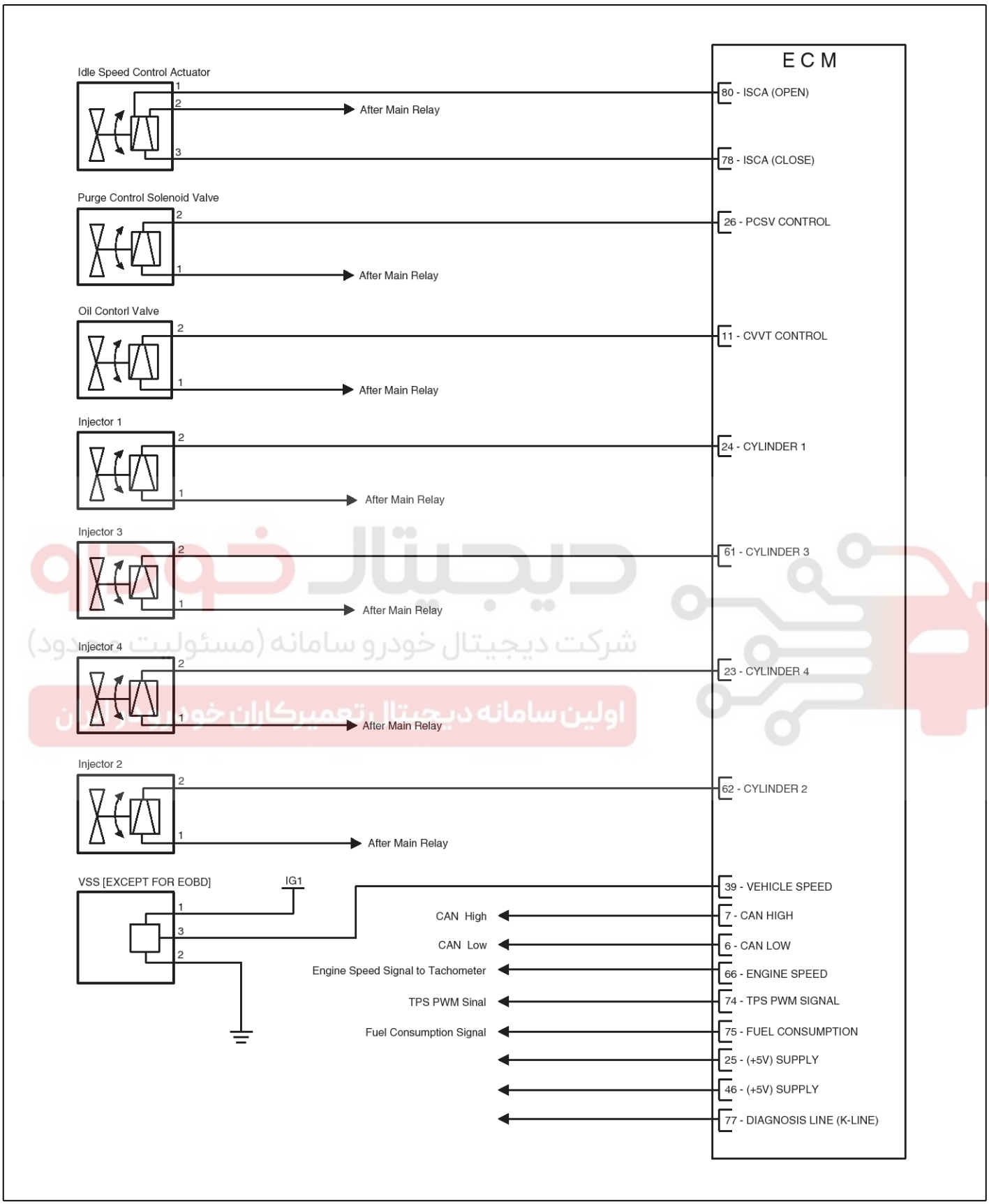
CIRCUIT DIAGRAM



LGIF501J



SKMFL9100L



LGIF501L

ECM PROBLEM INSPECTION PROCEDURE

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

Specification (Resistance): 1Ω or less

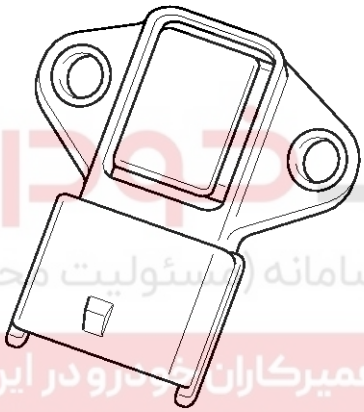
2. TEST ECM CONNECTOR: Disconnect the ECM connector and visually check the ground terminal on ECM side and harness side for bent pins or poor contact contact pressure, If the problem is found, repair it.
3. If problem is not found in Step 1 and 2, the ECM could be faulty. If so, replace the ECM with a new one, and then check the vehicle agaon. If the vehicle operates normally then the problem was likely with the ECM.
4. RE-TEST THE ORIGINAL ECM: Install the original ECM (may be broken) into a known-good vehicle and check the vehicle. If the problem occurs again, replace the original ECM with a new one. If problem dose not occur, this is intermittent problem (Refer to INTERMITTENT PROBLEM PROCEDURE in BASIC INSPECTION PROCEDURE).

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.

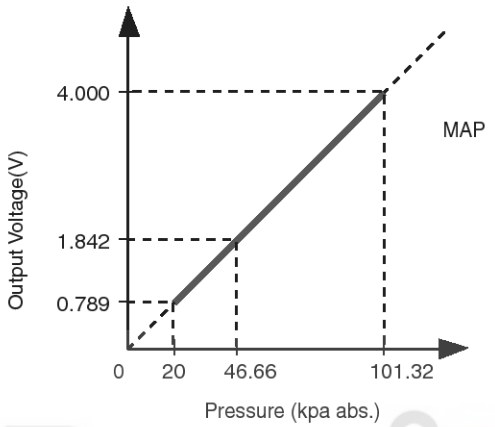
The MAPS consists of a piezo-electric element and a hybrid IC amplifying the element output signal. The element is silicon diaphragm type and adapts pressure sensitive variable resistor effect of semi-conductor. Because 100% vacuum and the manifold pressure apply to both sides of the sensor respectively,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



SHDFL8128C

Specification

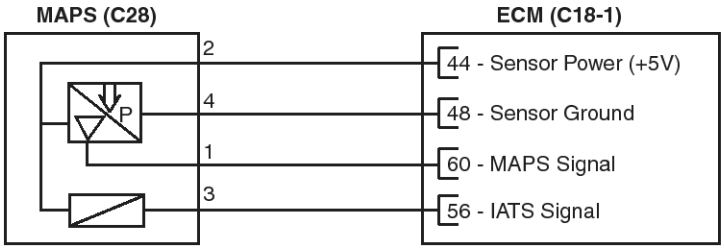
Pressure (kPa)	Output Voltage (V)
20.0	0.79
46.66	1.84
101.32	4.0



SHDFL8129C

Circuit Diagram

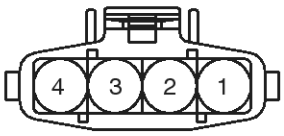
[CIRCUIT DIAGRAM]



[CONECTION INFORMATION]

Terminal	Conected to	Function
1	ECM C18-1 (60)	MAPS Signal
2	ECM C18-1 (44)	Sensor Power (+5V)
3	ECM C18-1 (56)	IATS Signal
4	ECM C18-1 (48)	Sensor Ground

[HARNESS CONNECTOR]



C28
MAPS

6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	5	4
25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	3	
44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62		
63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	2	1

C18-1
ECM

SKMFL9112N

Inspection

1. Connect a scan tool on Data Link Connector (DLC).
2. Check MAPS output voltage at idle and IG ON.

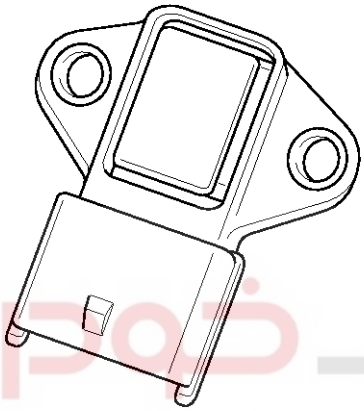
Condition	Output Voltage (V)
IG ON	3.9 ~ 4.1
Idle	0.8 ~ 1.6

Intake Air Temperature Sensor (IATS)

Description

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

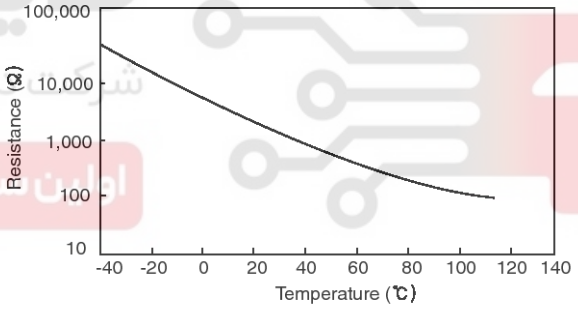
To calculate precise air quantity, correction of the air temperature is needed because air density varies according to the temperature. So the ECM uses not only MAPS signal but also IATS signal. This sensor has a Negative Temperature Coefficient (NTC) and its resistance is in inverse proportion to the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



SHDFL8128C

Specification

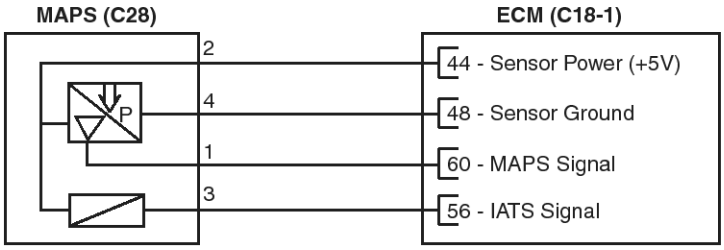
Temperature [℃(°F)]	Resistance(kΩ)
-40 (-40)	40.93 ~ 48.35
-30 (-22)	23.43 ~ 27.34
-20 (-4)	13.89 ~ 16.03
-10 (14)	8.50 ~ 9.71
0 (32)	5.38 ~ 6.09
10 (50)	3.48 ~ 3.90
20 (68)	2.31 ~ 2.57
25 (77)	1.90 ~ 2.10
30 (86)	1.56 ~ 1.74
40 (104)	1.08 ~ 1.21
60 (140)	0.54 ~ 0.62
80 (176)	0.29 ~ 0.34



SHDFL8132C

Circuit Diagram

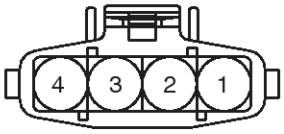
[CIRCUIT DIAGRAM]



[CONECTION INFORMATION]

Terminal	Conected to	Function
1	ECM C18-1 (60)	MAPS Signal
2	ECM C18-1 (44)	Sensor Power (+5V)
3	ECM C18-1 (56)	IATS Signal
4	ECM C18-1 (48)	Sensor Ground

[HARNESS CONNECTOR]



C28
MAPS

6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	5	4
25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	3	
44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62		
63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	2	1

C18-1
ECM

SKMFL9112N

Inspection

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

Specification: Refer to “Specification”

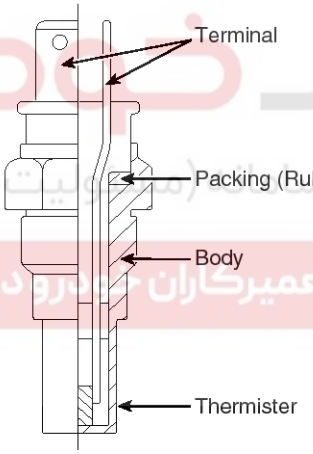
Engine Coolant Temperature Sensor (ECTS)

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.



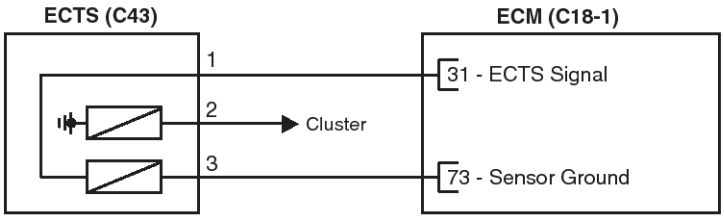
EGRF241A

Specification

Temperature [℃(°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

Circuit Diagram

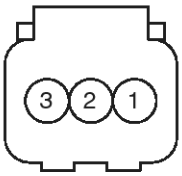
[CIRCUIT DIAGRAM]



[CONECTION INFORMATION]

Terminal	Conected to	Function
1	ECM C18-1 (31)	ECTS Signal
2	Cluster	
3	ECM C18-1 (73)	Sensor Ground

[HARNESS CONNECTOR]



C43
ECTS

6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	5	4
25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	3	
44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62		
63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	2	1

C18-1
ECM

SKMFL9113N

Inspection

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

Specification: Refer to “Specification”

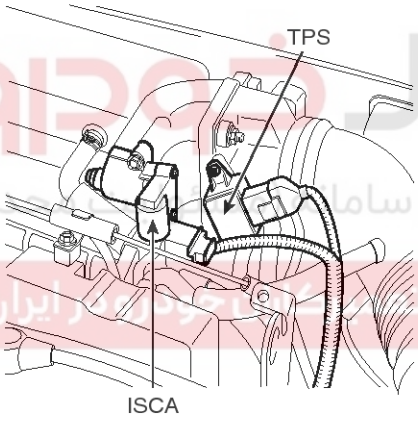
Throttle Position Sensor (TPS)

Description

The Throttle Position Sensor (TPS) is mounted on the throttle body and detects the opening angle of the throttle plate. The TPS has a variable resistor (potentiometer) which is changed according to the throttle angle.

During acceleration, the TPS resistance between the reference +5V and the signal terminal decreases and output voltage increases; during deceleration, the TPS resistance increases and TPS output voltage decreases. The TPS output voltage will vary from 0.25~0.9V at closed throttle to minimum 4.0V at wide-open throttle.

The ECM determines operating conditions such as idle (closed throttle), part load, acceleration / deceleration, and wide-open throttle by using the TPS signal. Also the ECM uses the Manifold Absolute Pressure Sensor (MAPS) signal along with the TPS signal to adjust fuel injection duration and ignition timing.



SJMFL9102N

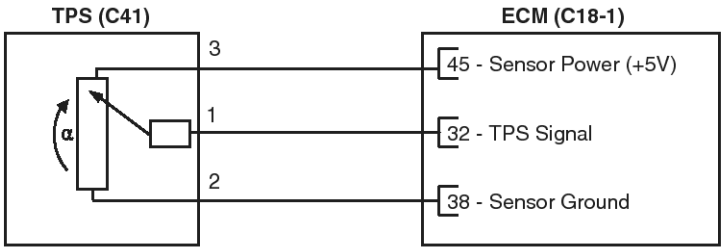
Specification

Throttle Angle	Output Voltage(V)
C.T	0.25 ~ 0.9
W.O.T	Min. 4.0

Item	Specification
Sensor Resistance(kΩ)	1.6 ~ 2.4[20℃(68°F)]

Circuit Diagram

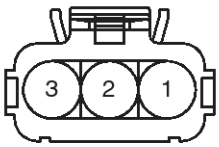
[CIRCUIT DIAGRAM]



[CONECTION INFORMATION]

Terminal	Conected to	Function
1	ECM C18-1 (45)	TPS Signal
2	ECM C18-1 (32)	Sensor Ground
3	ECM C18-1 (38)	Sensor Power (+5V)

[HARNESS CONNECTOR]



C41
TPS

6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	5	4
25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	3	
44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62		
63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	2	1

C18-1
ECM

SKMFL9114N

Inspection

1. Connect a scan tool on the Data Link Connector (DLC).
2. Start engine and check output voltages of TPS at C.T and W.O.T.

Specification: Refer to “Specification”

3. Turn ignition switch OFF and disconnect the scan tool from the DLC.
4. Disconnect TPS connector and measure resistance between TPS terminals 2 and 3.

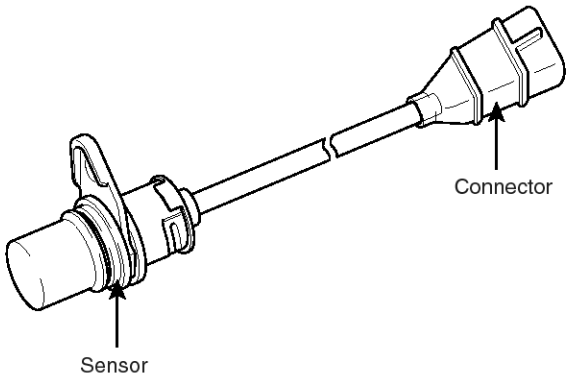
Specification: Refer to “Specification”

Crankshaft Position Sensor (CKPS)

Description

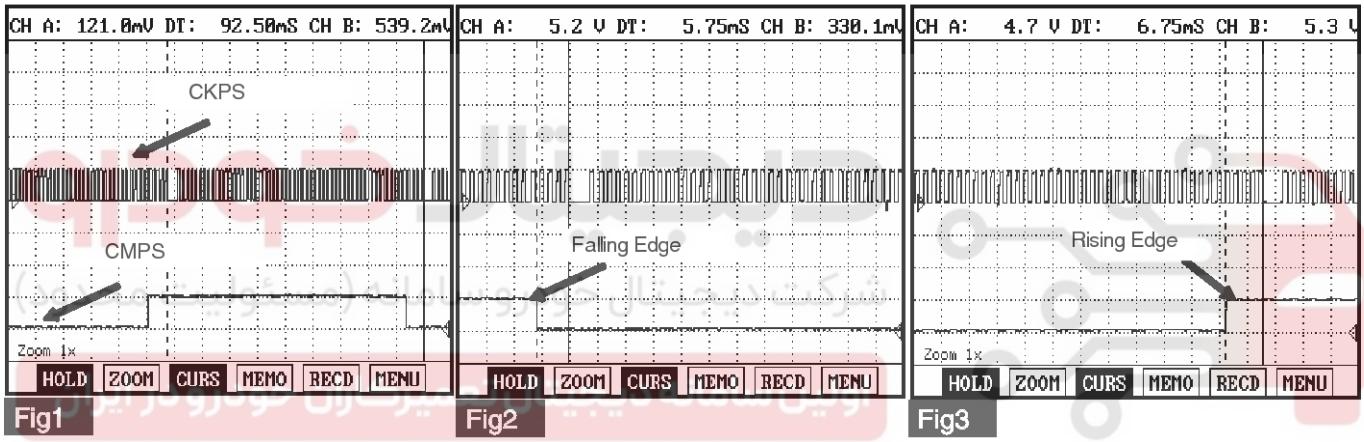
Crankshaft Position Sensor (CKPS) detects the crankshaft position and is one of the most important sensors of the engine control system. If there is no CKPS signal input, the engine may stop because of CKPS signal missing. This sensor is installed on the cylinder block or the transaxle housing and generates 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).



SHDFL8138C

Waveform



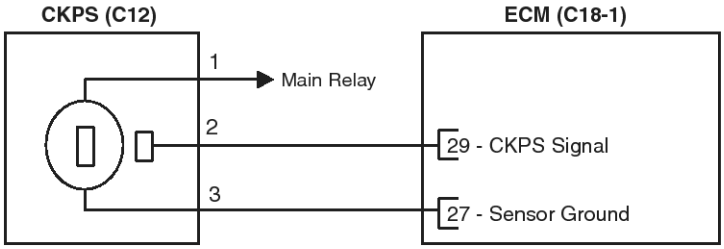
SHDF18122C

Fig.1) The square wave signal should be smooth and without any distortion.

Fig.2,3)The CMPS falling(rising) edge is coincided with 3~5 tooth of the CKP from one longer signal(missing tooth)

Circuit Diagram

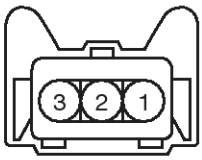
[CIRCUIT DIAGRAM]



[CONECTION INFORMATION]

Terminal	Conected to	Function
1	Main Relay	Battery Power (B+)
2	ECM C18-1 (29)	CKPS Signal
3	ECM C18-1 (27)	Sensor Ground

[HARNESS CONNECTOR]



C12
CKPS

6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	5	4
25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	3	
44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62		
63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	2	1

C18-1
ECM

SKMFL9115N

Inspection

1. Check signal waveform of CKPS and CMPS using a scan tool.

Specification: Refer to “Waveform”

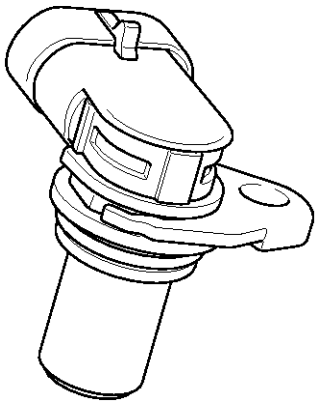
Camshaft Position Sensor (CMPS)

Description

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

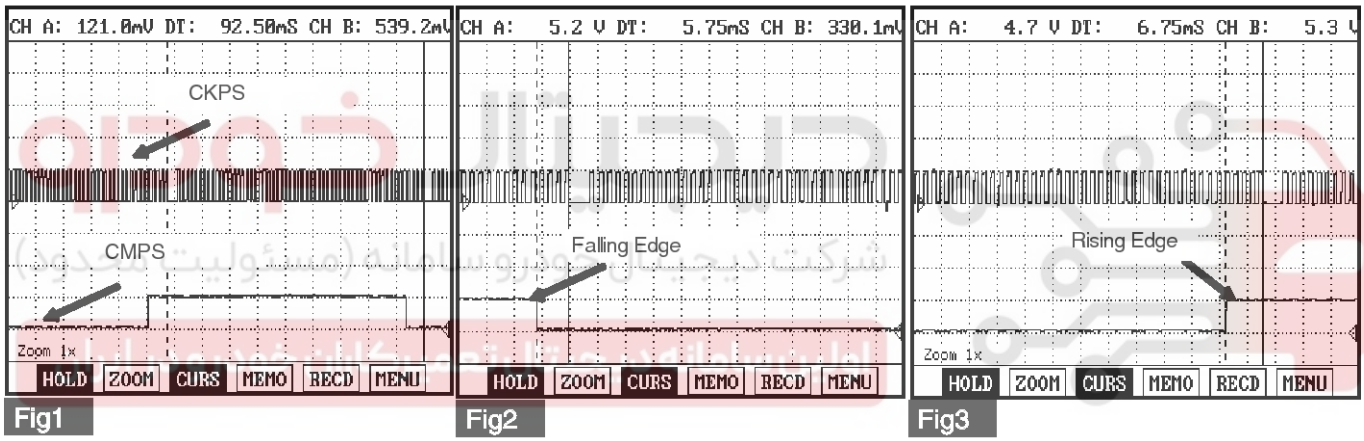
It is related with Crankshaft Position Sensor (CKPS) and detects the piston position of each cylinder which the CKPS can't detect.

The CMPS is installed on engine head cover and uses a target wheel installed on the camshaft. This sensor has a hall-effect IC which output voltage changes when magnetic field is made on the IC with current flow.



KFCF1022

Waveform



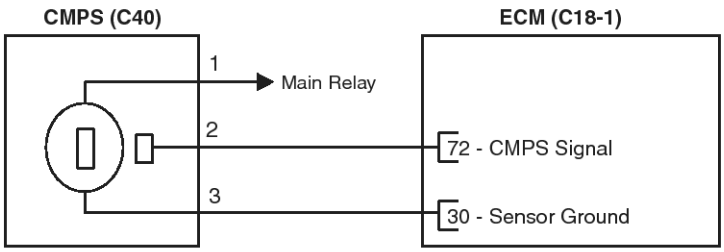
SHDF18122C

Fig.1) The square wave signal should be smooth and without any distortion.

Fig.2,3)The CMPS falling(rising) edge is coincided with 3~5 tooth of the CKP from one longer signal(missing tooth)

Circuit Diagram

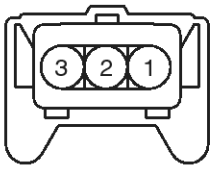
[CIRCUIT DIAGRAM]



[CONECTION INFORMATION]

Terminal	Conected to	Function
1	Main Relay	Battery Power (B+)
2	ECM C18-1 (72)	CMPS Signal
3	ECM C18-1 (30)	Sensor Ground

[HARNESS CONNECTOR]



C40
CMPS

6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	5	4
25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	3	
44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62		
63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	2	1

C18-1
ECM

SKMFL9116N

Inspection

1. Check signal waveform of CKPS and CMPS using a scan tool.

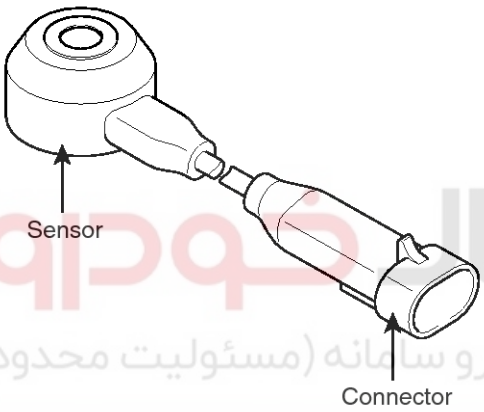
Specification: Refer to “Waveform”

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. At this time, this sensor transfers the voltage signal higher than the specified value to the ECM and the ECM retards the ignition timing. 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.



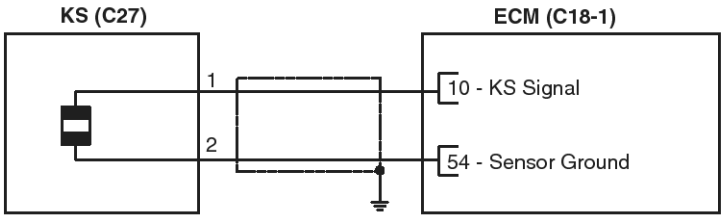
SHDFL8144C

Specification

Item	Specification
Capacitance(pF)	950 ~ 1,350
Resistance (MΩ)	4.87

Circuit Diagram

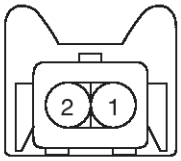
[CIRCUIT DIAGRAM]



[CONECTION INFORMATION]

Terminal	Conected to	Function
1	ECM C18-1 (10)	Knock Sensor Signal
2	ECM C18-1 (54)	Sensor Ground

[HARNESS CONNECTOR]



C27
KNOCK SENSOR

6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	5	4
25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	3	
44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62		
63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	2	1

C18-1
ECM

SKMFL9117N

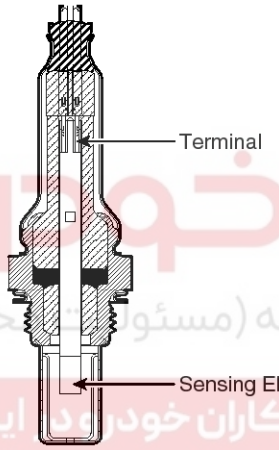
Heated Oxygen Sensor (HO2S)

Description

Heated Oxygen Sensor (HO2S) consists of zirconium and alumina and is installed on upstream and downstream of the Manifold Catalytic Converter (MCC).

After it compares oxygen consistency of the atmosphere with the exhaust gas, it transfers the corresponding voltage signal to the ECM. When A/F ratio is rich or lean, it generates approximately +1V or 0V respectively.

In order that this sensor normally operates, the temperature of the sensor tip must be higher than predetermined temperature. So it has a heater which is controlled by the ECM duty signal. When the exhaust gas temperature is lower than the specified value, the heater warms the sensor tip.



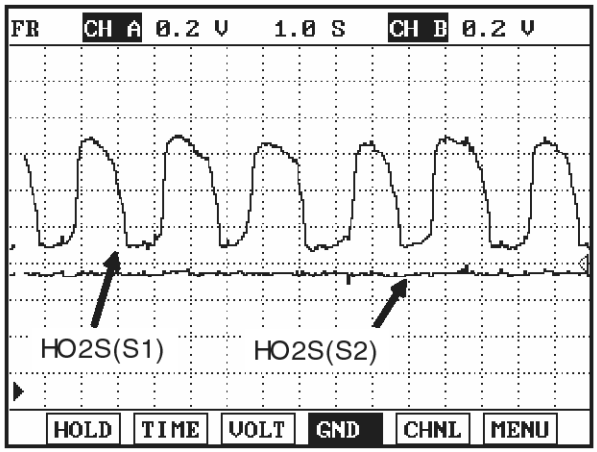
SHDFL8147C

Specification

A/F Ratio (λ)	Output Voltage(V)
Rich	0.6 ~ 1.0
Lean	0 ~ 0.4

Item	Specification
Heater Resistance(Ω)	Approx. 9.0[20℃(68˚F)]

Waveform



SHDFL8148C

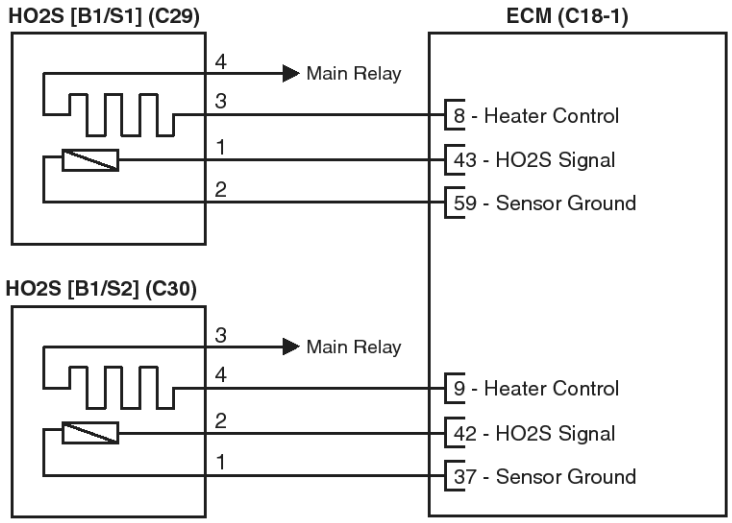
If you release the accelerator pedal suddenly after engine running about 4000 rpm, fuel supply will stop for short period and the O2 sensor service data in the Hi-Scan (Pro) will display values 200mV or lower. When you suddenly press on the accelerator pedal down, the voltage will reach 0.6 ~ 1.0 V.

When you let the engine idle again, the voltage will fluctuate between 200 mV or lower and 0.6 ~ 1.0 V.

In this case, the O2sensor can be determined as good.

Circuit Diagram

[CIRCUIT DIAGRAM]



[CONECTION INFORMATION]

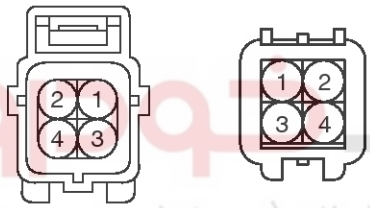
HO2S [B1/S1] (C29)

Terminal	Conected to	Function
1	ECM C18-1 (43)	HO2S [B1/S1] Signal
2	ECM C18-1 (59)	Sensor Ground
3	ECM C18-1 (8)	Heater Control
4	Main Relay	Battery Power (B+)

HO2S [B1/S2] (C30)

Terminal	Conected to	Function
1	ECM C18-1 (37)	Sensor Ground
2	ECM C18-1 (42)	HO2S [B1/S2] Signal
3	Main Relay	Battery Power (B+)
4	ECM C18-1 (9)	Heater Control

[HARNESS CONNECTOR]



C29
HO2S [B1/S1]

C30
HO2S [B1/S2]

6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	5	4
25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	3	
44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62		
63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	2	1

C18-1
ECM

SKMFL9118N

Inspection

1. Check signal waveform of HO2S using a scan tool.

Specification: Refer to "Waveform"

2. Disconnect the HO2S connector.
3. Measure resistance between HO2S heater terminals 3 and 4.
4. Check that the resistance is within the specification.

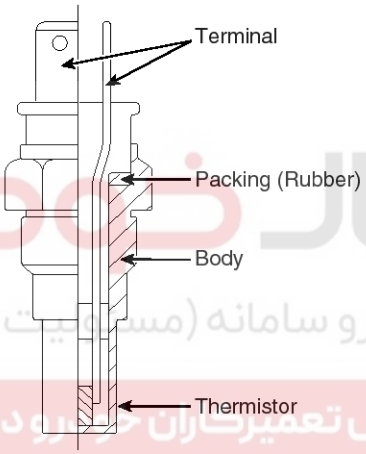
Specification: Refer to “Specification”

CVVT Oil Temperature Sensor (OTS)

Description

The Continuously Variable Valve Timing (CVVT) system controls the amount of valve overlap by varying the amount of oil flow into an assembly mounted on the intake camshaft through ECM control of an oil control valve. An Oil Temperature Sensor (OTS) is used to allow ECM monitoring of engine oil temperature. As oil is directed into the chambers of the CVVT assembly, the cam phase is changed to suit various performance and emissions requirements.

1. When camshaft rotates engine rotation-wise: Intake-Advance / Exhaust-Retard
2. When camshaft rotates counter engine rotation-wise: Intake- Retard / Exhaust- Advance



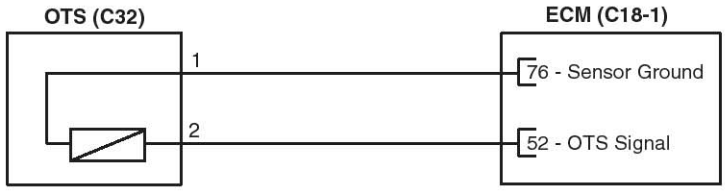
SBHFL9140L

Specification

Temperature		Resistance (kΩ)
℃	˚F	
-40	-40	52.15
-20	-4	16.52
0	32	6.0
20	68	2.45
40	104	1.11
60	140	0.54
80	176	0.29

Circuit Diagram

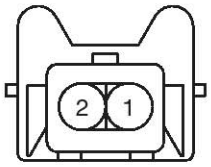
[Circuit Diagram]



[Connection Information]

Terminal	Connected to	Function
1	ECM C18-1 (76)	Sensor Ground
2	ECM C18-1 (52)	OTS Signal

[Harness Connector]



C32
OTS

6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	5	4
25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	3	
44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62		
63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	2	1

C18-1
ECM

SKMFL9119N

Inspection

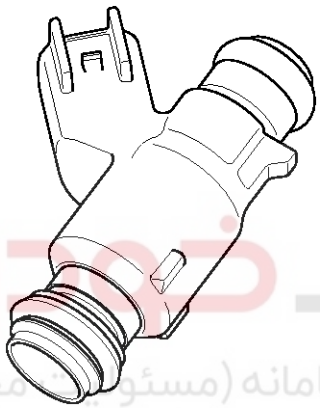
1. Turn the ignition switch OFF.
2. Disconnect the OTS connector.
3. Remove the OTS.
4. After immersing the thermistor of the sensor into engine coolant, measure resistance between the OTS terminals 1 and 2.
5. Check that the resistance is within the specification.

Specification: Refer to “Specification”

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.



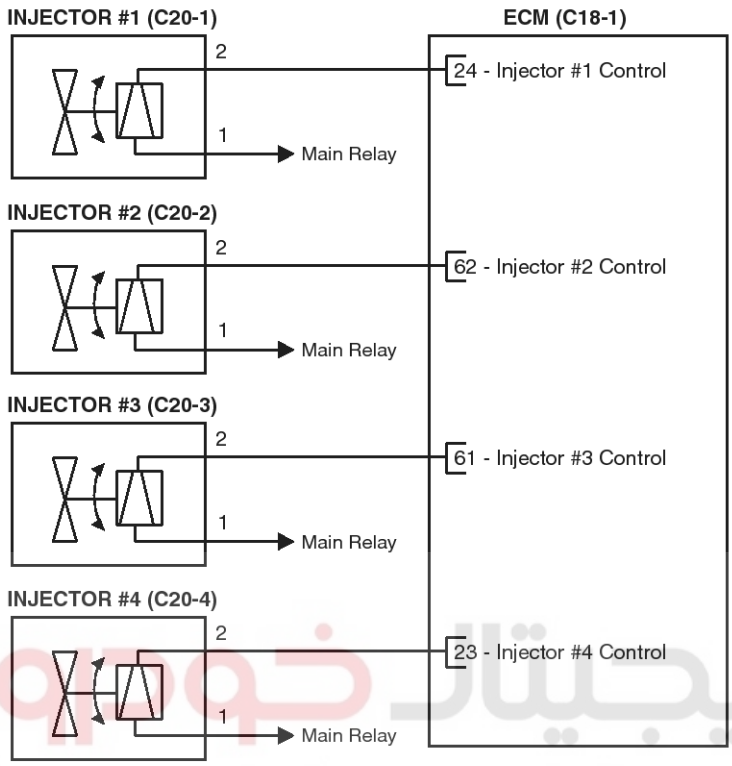
KFCF1026

Specification

Item	Specification
Coil Resistance (Ω)	13.8 ~ 15.2 [20℃(68°F)]

Circuit Diagram

[CIRCUIT DIAGRAM]



[CONECTION INFORMATION]

INJECTOR #1 (C20-1)

Terminal	Conected to	Function
1	Main Relay	Battery Power (B+)
2	ECM C18-1 (24)	Injector #1 Control

INJECTOR #2 (C20-2)

Terminal	Conected to	Function
1	Main Relay	Battery Power (B+)
2	ECM C18-1 (62)	Injector #2 Control

INJECTOR #3 (C20-3)

Terminal	Conected to	Function
1	Main Relay	Battery Power (B+)
2	ECM C18-1 (61)	Injector #3 Control

INJECTOR #4 (C20-4)

Terminal	Conected to	Function
1	Main Relay	Battery Power (B+)
2	ECM C18-1 (23)	Injector #4 Control

[HARNESS CONNECTOR]

C20-1
INJECTOR #1

C20-2
INJECTOR #2

C20-3
INJECTOR #3

C20-4
INJECTOR #4

6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	5	4
25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	3	
44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62		
63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	2	1

C18-1
ECM

SKMFL9121N

Inspection

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

Specification: Refer to “Specification”

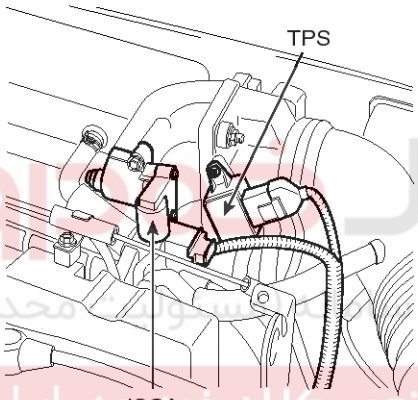
Idle Speed Control Actuator (ISCA)

Description

The Idle Speed Control Actuator (ISCA) is installed on the throttle body and controls the intake airflow that is bypassed around the throttle plate to keep constant engine speed when the throttle valve is closed.

The function of the ISCA is to maintain idle speed according to various engine loads and conditions, and also to provide additional air during starting.

The ISCA consists of an opening coil, a closing coil, and a permanent magnet. Based on information from various sensors, the ECM controls both coils by grounding their control circuits. According to the control signals from the ECM, the valve rotor rotates to control the by-pass airflow into the engine.



SJMFL9102N

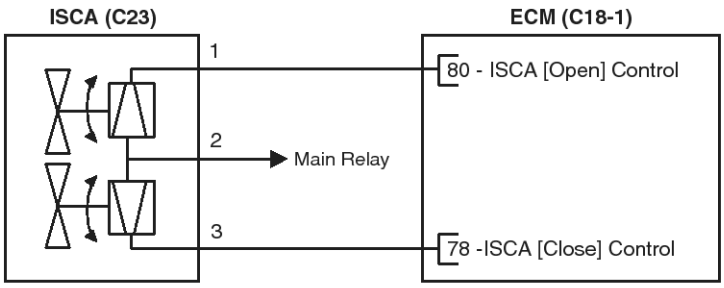
Specification

Item	Specification
Opening Coil Resistance (Ω)	14.6 ~ 16.2 [20℃(68°F)]
Closing Coil Resistance (Ω)	11.1 ~ 12.7 [20℃(68°F)]

Duty (%)	Air Flow Rate (m³/h)
15	1.0 ~ 2.3
35	7.5 ~ 12.7
70	43.0 ~ 55.0
96	63.0 ~ 71.0

Circuit Diagram

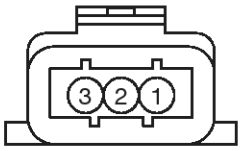
[CIRCUIT DIAGRAM]



[CONECTION INFORMATION]

Terminal	Conected to	Function
1	ECM C18-1 (80)	ISCA [Open] Control
2	Main Relay	Battery Power (B+)
3	ECM C18-1 (78)	ISCA [Close] Control

[HARNESS CONNECTOR]



C23
ISCA

6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	5	4
25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	3	
44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62		
63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	2	1

C18-1
ECM

SKMFL9122N

Inspection

1. Turn ignition switch OFF.
2. Disconnect ISCA connector.
3. Measure resistance between ISCA terminals 2 and 1 [Opening Coil].
4. Measure resistance between ISCA terminals 2 and 3 [Closing Coil].
5. Check that the resistance is within the specification.

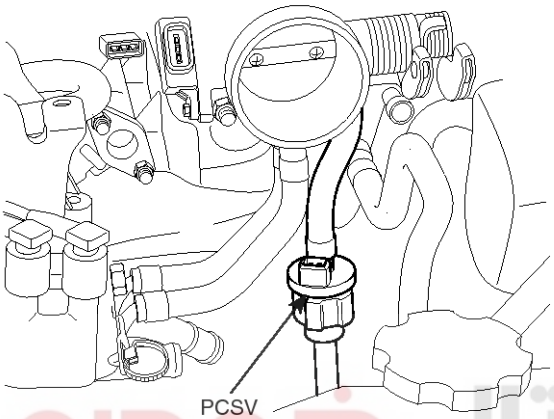
Specification: Refer to “Specification”

Purge Control Solenoid Valve (PCSV)

Description

Purge Control Solenoid Valve (PCSV) is a solenoid valve and is installed on the surge tank and controls the passage between the canister and the intake manifold.

The evaporative gases gathered in the canister are delivered to the intake manifold when the PCSV is open by ECM control signal.



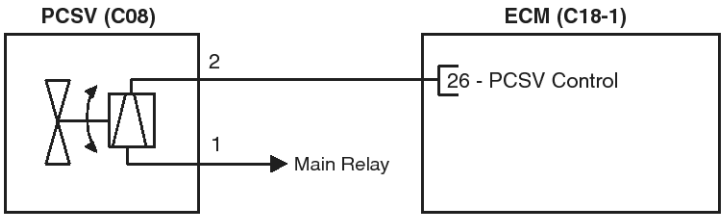
LGIF007L

Specification

Item	Specification
Coil Resistance (Ω)	26 [20℃(68˚F)]

Circuit Diagram

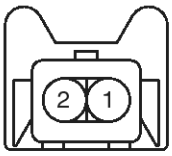
[CIRCUIT DIAGRAM]



[CONECTION INFORMATION]

Terminal	Conected to	Function
1	Main Relay	Battery Power (B+)
2	ECM C18-1 (26)	PCSV Control

[HARNESS CONNECTOR]



C08
PCSV

6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	5	4
25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	3	
44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62		
63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	2	1

C18-1
ECM

SKMFL9123N

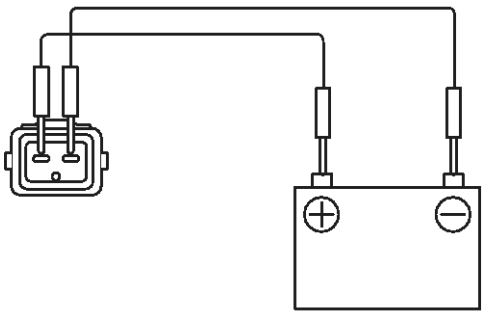
INSPECTION

NOTICE

When disconnecting the vacuum hose, make an identification mark on it so that it can be reconnected to its original position.

1. Disconnect the vacuum hose from the solenoid valve.
2. Detach the harness connector.
3. Connect a vacuum pump to the nipple to which the red-striped vacuum hose was connected.
4. Apply vacuum and check when voltage is applied to the PCSV and when the voltage is discontinued.

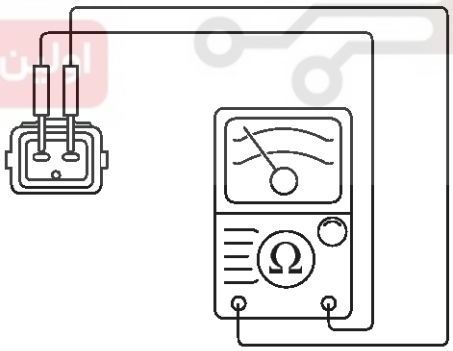
Battery voltage	Normal condition
When applied	Vacuum is released
When discontinued	Vacuum is maintained



LEIF603G

5. Measure the resistance between the terminals of the solenoid valve.

PCSV coil resistance (Ω):
24.5 ~ 27.5 Ω at 20℃ (68˚F)



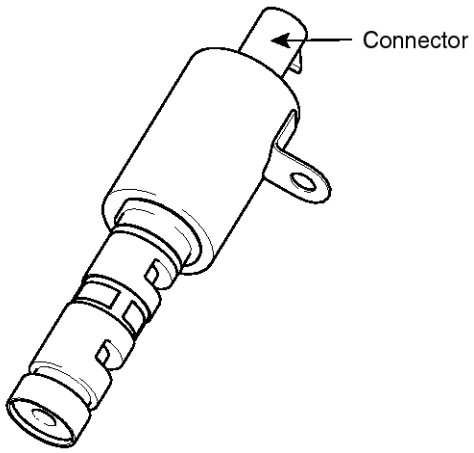
LEIF603H

CVVT Oil Control Valve (OCV)

Description

The Continuously Variable Valve Timing (CVVT) system controls the amount of valve overlap by varying the amount of oil flow into an assembly mounted on the intake camshaft through ECM control of an oil control valve. An Oil Temperature Sensor (OTS) is used to allow ECM monitoring of engine oil temperature. As oil is directed into the chambers of the CVVT assembly, the cam phase is changed to suit various performance and emissions requirements.

1. When camshaft rotates engine rotation-wise: Intake-Advance / Exhaust-Retard
2. When camshaft rotates counter engine rotation-wise: Intake- Retard / Exhaust- Advance



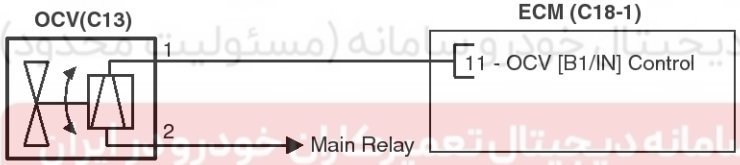
SJMFL9124N

Specification

Item	Specification
Coil Resistance (Ω)	6.7 ~ 7.7 [20℃(68°F)]

Circuit Diagram

[Circuit Diagram]



[Connection Information]

Terminal	Connected to	Function
1	ECM C18-1 (11)	OCV Control
2	Main Relay	Battery Power (B+)

[Harness Connector]

C13
OCV

6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	5	4
25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	3	
44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62		
63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	2	1

C18-1
ECM

SKMFL9125N

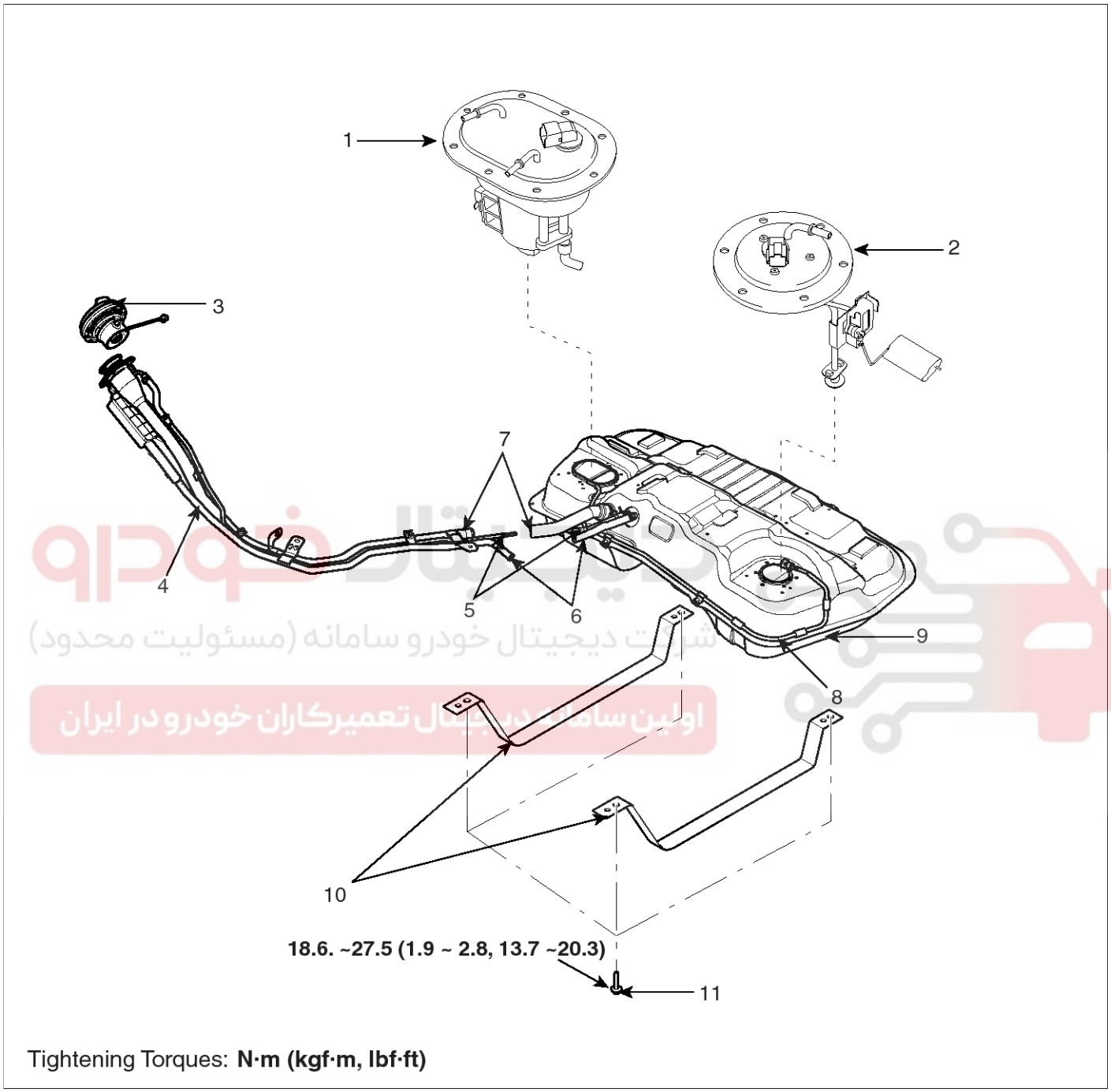
Inspection

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”

Fuel Delivery System

COMPONENTS LOCATION



Tightening Torques: **N·m (kgf·m, lbf·ft)**

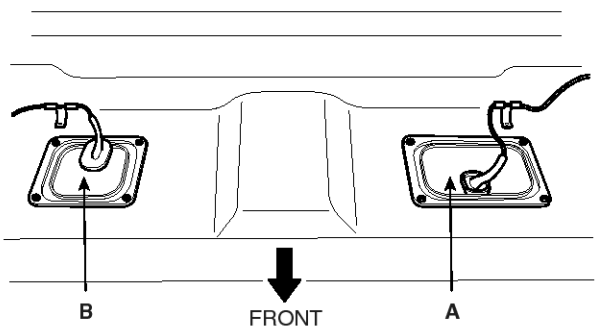
1. Fuel Pump Assembly (Including Fuel Filter and Fuel Pressure Regulator)
2. Sub Fuel Sender
3. Fuel Filler Cap
4. Fuel Filler Neck assembly
5. Leveling Hose
6. Ventilation Hose
7. Fuel Filler Hose
8. Suction Hose
9. Fuel Tank
10. Fuel Tank Band
11. Mounting Bolts - Fuel Tank Band

LGIF007U

FUEL PRESSURE TEST

1. PREPARING

1. Remove the rear seat (Refer to ""BD"" group in this WORKSHOP MANUAL).
2. Open the service cover (A) under the rear seat.

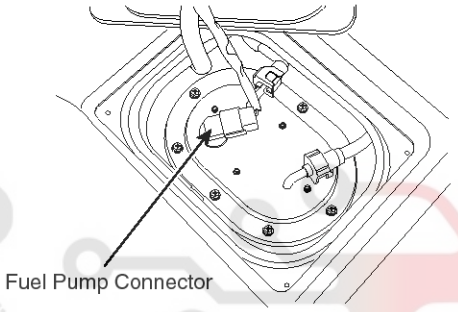


2. RELEASE THE INTERNAL PRESSURE

1. Disconnect the fuel pump connector.
2. Start the engine and wait until fuel in fuel line is exhausted.
3. After the engine stalls, turn the ignition switch to OFF position and diconnect the negative (-) terminal from the battery.

NOTE

Be sure to reduce the fuel pressure before disconnecting the fuel feed hose, otherwise fuel will spill out.



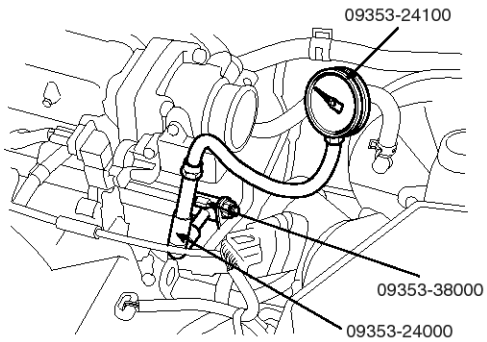
3. INSTALL THE SPECIAL SERVICE TOOL (SST) FOR MEASURING THE FUEL PRESSURE

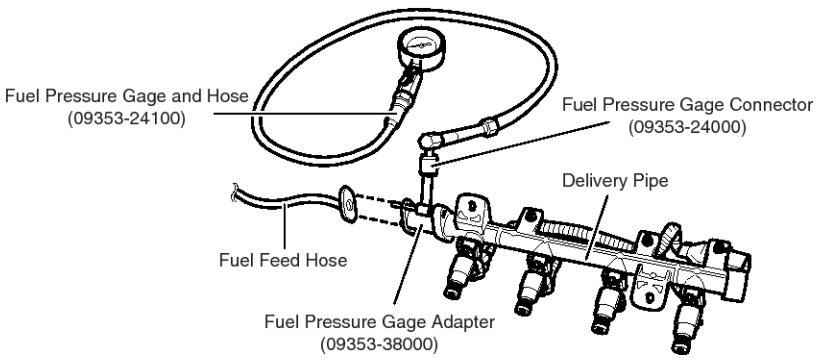
1. Disconnect the fuel feed hose from the delivery pipe.

CAUTION

Cover the hose connection with a shop towel to prevent splashing of fuel caused by residual pressure in the fuel line.

2. Install the Fuel Pressure Gage Adapter (09353-38000) between the delivery pipe and the fuel feed hose.
3. Connect the Fuel Pressure Gage Connector (09353-24000) to the Fuel Pressure Gage Adapter (09353-38000).
4. Connect the Fuel Pressure Gage and Hose (09353-24100) to Fuel Pressure Gage Connector (09353-24000).
5. Connect the fuel feed hose to the Fuel Pressure Gage Adapter (09353-38000).





LGIF108I

4. INSPECT FUEL LEAKAGE ON CONNECTION

1. Connect the battery negative (-) terminal.
2. Apply battery voltage to the fuel pump terminal and activate the fuel pump. With fuel pressure applied, check that there is no fuel leakage from the fuel pressure gauge or connection part.

5. FUEL PRESURE TEST

1. Diconnect the negative (-) terminal from the battery.
2. Connect the fuel pump connector.
3. Connect the battery negative (-) terminal.
4. Start the engine and measure the fuel pressure at idle.

Standard Value: 350 kpa (3.5 kg/cm², 49.8 psi)

- If the measured fuel pressure differs from the standard value, perform the necessary repairs using the table below.

Condition	Probable Cause	Supected Area
Fuel Pressure too low	Clogged fuel filter	Fuel filter
	Fuel leak on the fuel-pressure regulator that is assembled on fuel pump because of poor seating of the fuel-pressure regulator.	Fuel Pressure Regulator
Fuel Pressure too High	Sticking fuel pressure regulator	Fuel Pressure Regulator

5. Stop the engine and check for a change in the fuel pressure gauge reading.

After engine stops, the gage reading should hold for about 5 minutes

- Observing the declination of the fuel pressure when the gage reading drops and perform the necessary repairs using the table below.

Condition	Probable Cause	Supected Area
Fuel pressure drops slowly after engine is stopped	Injector leak	Injector
Fuel pressure drops immediately after engine is stopped	The check valve within the fuel pump is open	Fuel Pump

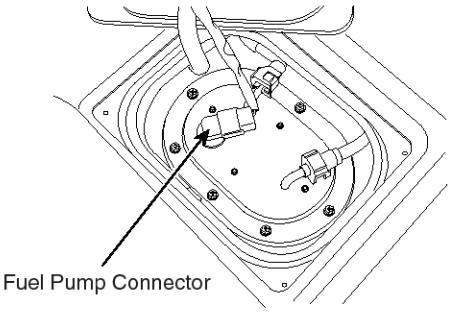
LGIF008J

6. RELEASE THE INTERNAL PRESSURE

1. Disconnect the fuel pump connector.
2. Start the engine and wait until fuel in fuel line is exhausted.
3. After the engine stalls, turn the ignition switch to OFF position and diconnect the negative (-) terminal from the battery.

NOTE

Be sure to reduce the fuel pressure before disconnecting the fuel feed hose, otherwise fuel will spill out.



7. REMOVE THE SPECIAL SERVICE TOOL (SST) AND CONNECT THE FUEL LINE

1. Disconnect the Fuel Pressure Gage and Hose (09353-24100) from the Fuel Pressure Gage Connector (09353-24000).
2. Disconnect the Fuel Pressure Gage Connector (09353-24000) from the Fuel Pressure Gage Adapter (09353-38000).
3. Disconnect the fuel feed hose from the Fuel Pressure Gage Adapter (09353-38000).
4. Disconnect the Fuel Pressure Gage Adapter (09353-38000) from the delivery pipe.

CAUTION

Cover the hose connection with a shop towel to prevent splashing of fuel caused by residual pressure in the fuel line.

5. Conenct the fuel feed hose to the delivery pipe.

8. INSPECT FUEL LEAKAGE ON CONNECTION

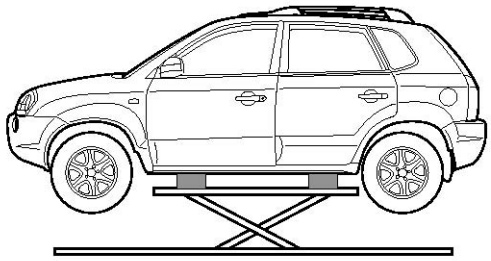
1. Connect the battery negative (-) terminal.
2. Apply battery voltage to the fuel pump terminal and activate the fuel pump. With fuel pressure applied, check that there is no fuel leakage from the fuel pressure gauge or connection part.
3. If the vehicle is normal, connect the fuel pump connector.

LWIF108K

Fuel Tank

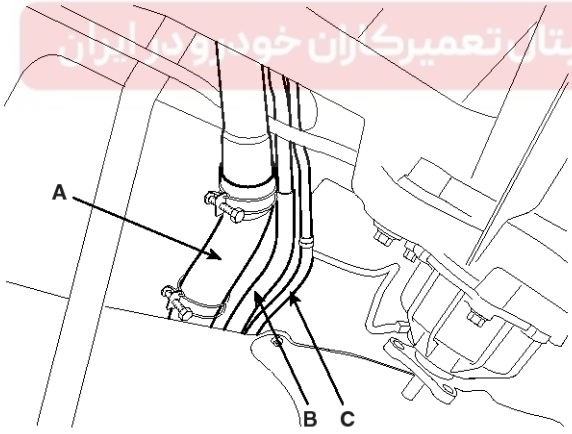
REMOVAL

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



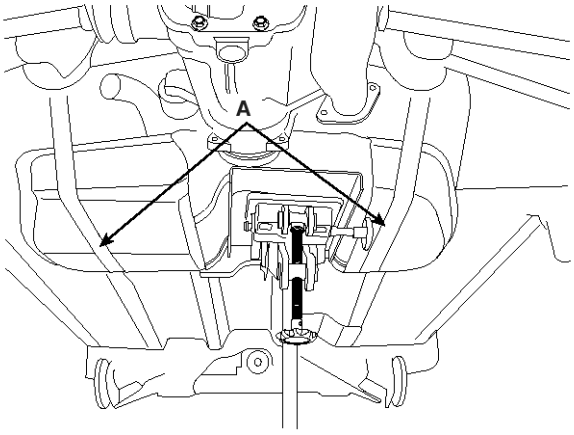
LGIF104V

1. Remove the front and main muffler assembly (Refer to group “EM” in this Workshop Manual).
2. Remove the propeller-shaft (For 4WD only).
3. Disconnect the fuel filler hose (A), fuel leveling hose (B) and ventilation hose (C).



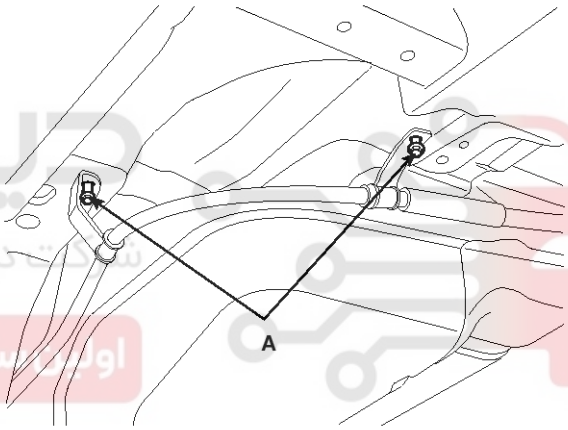
LGIF104G

4. Lift the vehicle and support the fuel tank with a jack, and then remove the two fuel tank band.



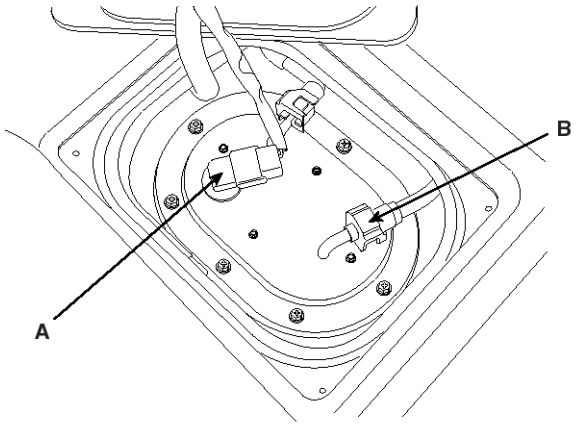
LGIF104H

5. Remove the four parking brake mounting bolts(A).



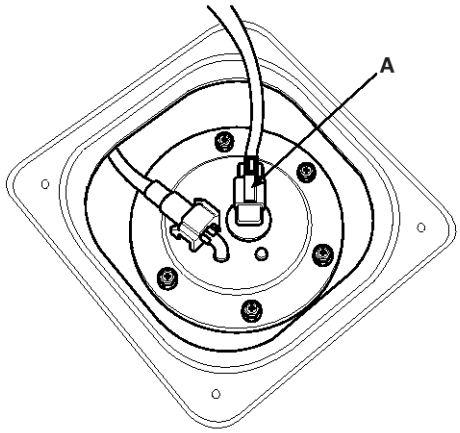
LGIF004I

6. Down the fuel tank until work space is made, and then disconnect the fuel pump connector (A) and fuel feed hose(B).



LWIF107T

7. Disconnect the sub fuel sender connector (A).



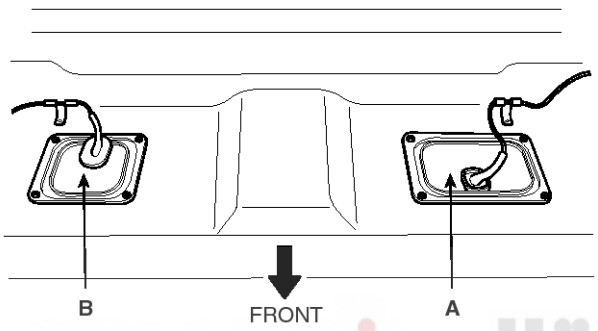
AFIE011K

8. Remove the fuel tank.

Fuel Pump

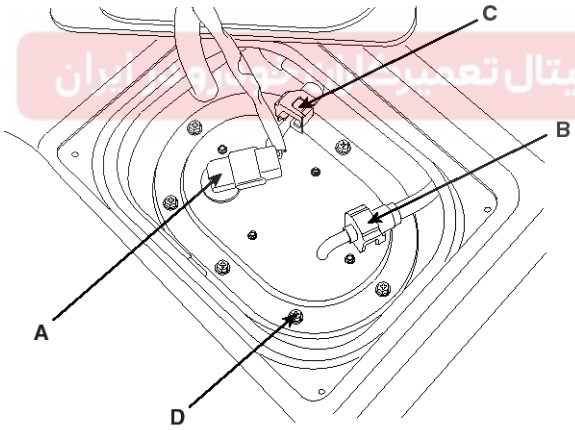
REMOVAL (INCLUDING FUEL FILTER AND FUEL PRESSURE REGULATOR)

1. Turn ignition switch to “OFF” and disconnect the battery negative (-) terminal.
2. Remove the rear seat (Refer to group “BD” in this Workshop Manual).
3. Remove the service cover (A) under the carpet.



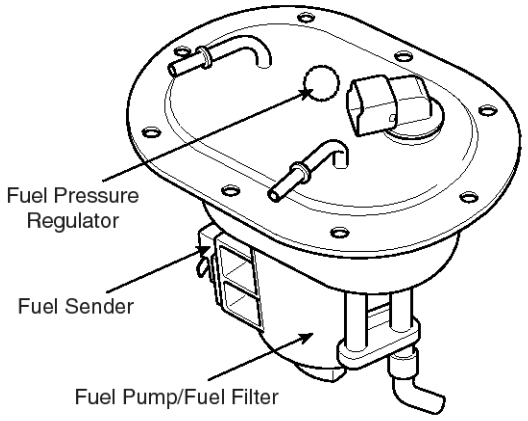
LGIF011L

4. Disconnect the fuel pump wiring connector (A).



LWIF107R

5. Remove the fuel feed hose (B) and suction hose (C).
6. Remove the fuel pump plate mounting bolts (D).
7. Remove the fuel pump assembly.

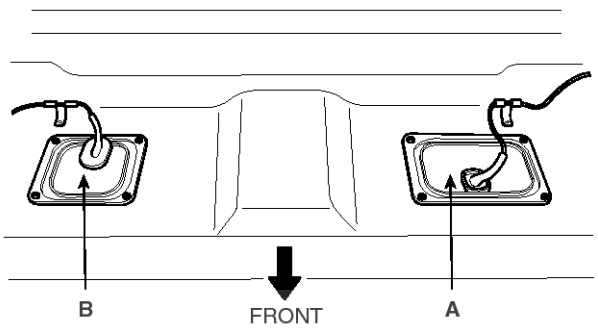


LGIF007S

Sub Fuel Sender

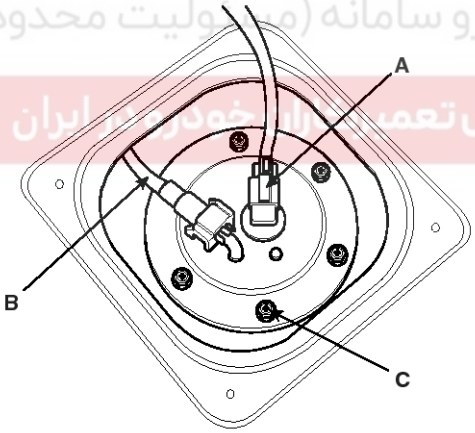
REMOVAL

1. Turn ignition switch to “OFF” and disconnect the battery negative (-) terminal.
2. Remove the rear seat (Refer to group “BD” in this Workshop Manual).
3. Remove the service cover (B) under the carpet.



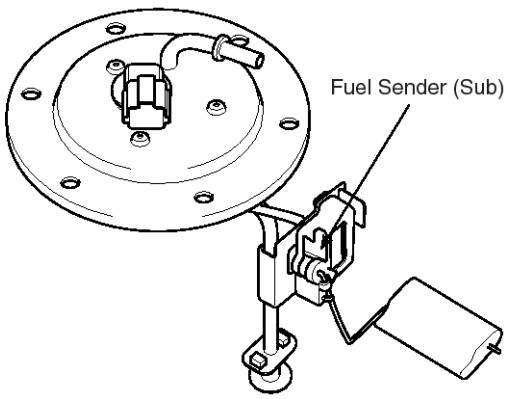
LGIF011L

4. Disconnect the sub fuel sender wiring connector (A).



AFIE011O

5. Disconnect the suction hose (B).
6. Remove the sub fuel sender plate mounting bolt (C).
7. Remove the sub fuel sender assembly.



LGIF011P