General Information

Specifications

Fuel Delivery System

Items	Specification	
Fuel Tank	Capacity	70 lit. (18.5 U.S.gal., 74.0 U.S.qt., 61.6 Imp.qt.)
Fuel Filter	Type	Paper type
Fuel Pressure Regulator	Regulated Fuel Pressure	343 kPa (3.50 kgf/㎠, 49.7 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 [℃(˚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 [℃(˚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) [Vref = 5.0V]	
	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

Throttle Angle(˚)	Output Voltage (V) [Vref = 5.0V]	
	TPS1	TPS2
100	4.76	0.24
105	5.0	0

		C.T	W.O.T
TPS1	Throttle Angle (˚)	6.3 ~ 14.7	93.45 ~ 101.85
	Output Voltage [Vref=5V]	0.3 ~ 0.7	4.45 ~ 4.85
TPS2	Throttle Angle (˚)	90.3 ~ 98.7	3.15 ~ 11.55
	Output Voltage [Vref=5V]	4.3 ~4.7	0.15 ~ 0.55

Item	Resistance (kΩ)
TPS	0.875 ~ 1.625 [20℃(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]: Euro 5 only

▷ Type: Zirconia (ZrO2) [Linear] type

▷ Specification

Item	Specification
Heater Resistance (Ω)	2.5 ~ 4.0 [20℃(69.8˚F)]

Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1]: Except Euro 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℃(69.8˚F)]

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

▷ 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℃(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

Actuators

Injector

▷ Specification

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

ETC Motor [integrated into ETC Module]

▷ Specification

Item	Specification
Coil Resistance (Ω)	1.2 ~ 1.8 [20℃(68˚F)]

Purge Control Solenoid Valve (PCSV)

▷ Specification

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

CVVT Oil Control Valve (OCV)

▷ Specification

Item	Specification
Coil Resistance (Ω)	6.9 ~ 7.9 [20℃(68˚F)]

Variable Intake Solenoid (VIS) Valve

▷ Specification

Item	Specification
Coil Resistance (Ω)	30.0 ~ 35.0 [20℃(68˚F)]

Ignition Coil

▷ Type: Stick type

▷ Specification

Item	Specification
1st Coil Resistance (Ω)	0.62 ± 10%[20℃(68˚F)]
2nd Coil Resistance (kΩ)	7.0 ± 15%[20℃(68˚F)]

Service Standard

Item			Specification	
Ignition Timing (˚)			BTDC 6˚ ± 5˚	
Idle Speed (rpm)	A/C OFF	AT	N, P-range	600 ± 100
			D-range	600 ± 100
		MT	Neutral	650 ± 100
	A/C ON	AT	N, P-range	600 ± 100
			D-range	600 ± 100
		MT	Neutral	650 ± 100

Tightening Torques

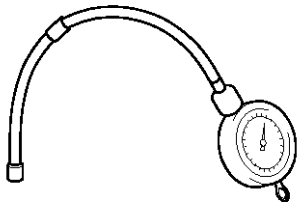
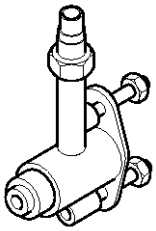
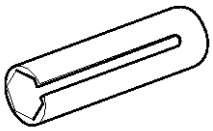
Engine Control System

Item	kgf.m	N.m	lb-ft
ECM installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
ECM bracket installation bolt	1.0 ~ 1.2	9.8 ~ 11.8	7.2 ~ 8.7
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 cover installation bolt (M8)	1.9 ~ 2.4	18.6 ~ 23.5	13.7 ~ 17.4
Crankshaft position sensor cover 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	3.6 ~4.6	35 ~ 45	25.8 ~ 33.2
Heated oxygen sensor (Bank 1 / sensor 2) installation	3.6 ~4.6	35 ~ 45	25.8 ~ 33.2
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 band installation nut	4.0 ~ 5.5	39.2 ~ 54.0	28.9 ~ 39.8
Fuel pump plate cover installation bolt	0.2 ~0.3	2.0 ~ 2.9	1.4 ~ 2.2
Filler-neck assembly bracket installation nut	0.4 ~ 0.6	3.9 ~ 5.9	2.9 ~ 4.3
Accelerator pedal module installation bolt	0.9 ~ 1.4	8.8 ~ 13.7	6.5 ~ 10.1
Accelerator pedal module installation nut	1.0 ~ 1.5	9.8 ~ 14.7	7.2 ~ 10.9
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

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

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 the GDS 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**

STDFL0001N

Customer Problem Analysis Sheet

1. VEHICLE INFORMAITON

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

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	

SCMF10001L

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.

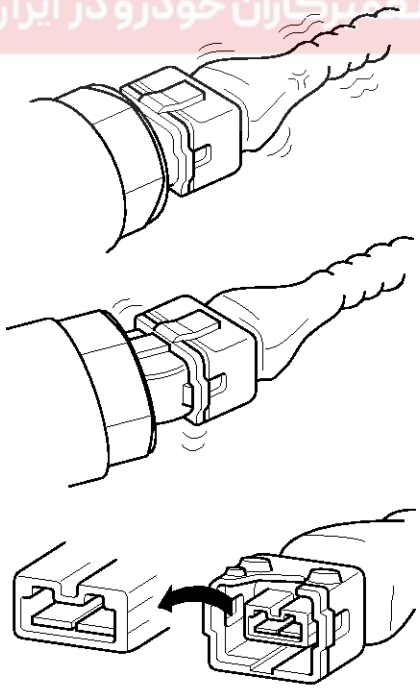
NOTICE

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

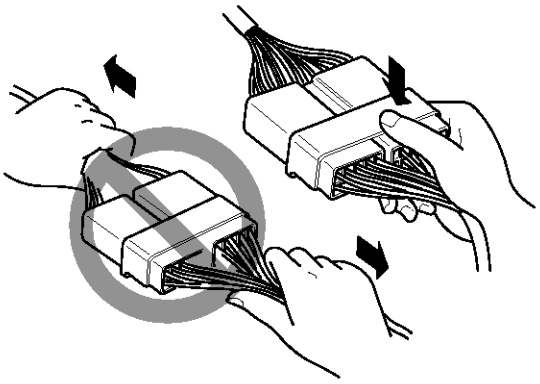
DO NOT sprinkle water directly into the engine compartment or electronic components.

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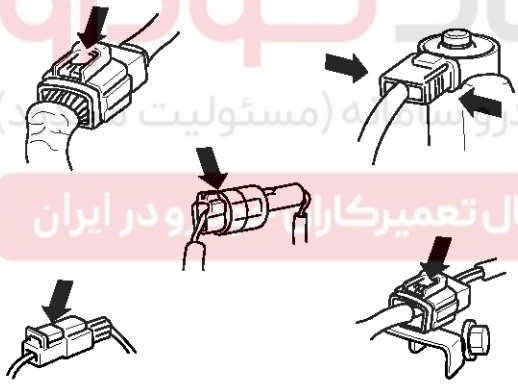
   b. When removing the connector with a lock, press or pull locking lever.



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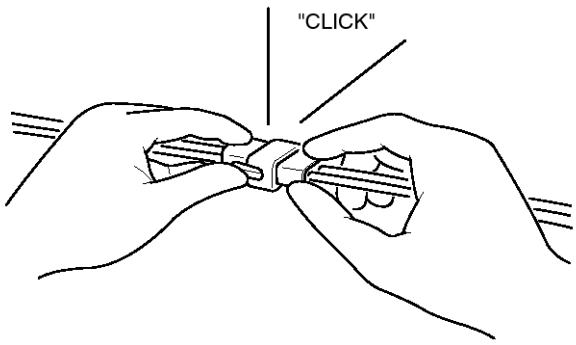
   c. Listen for a click when locking connectors. This sound indicates that they are securely locked.



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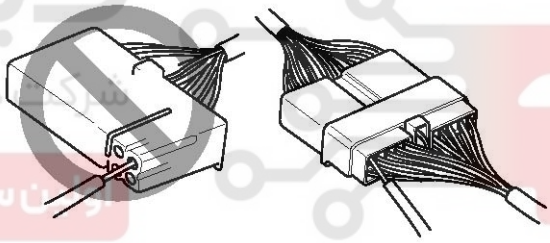
   d. When a tester is used to check for continuity, or to measure voltage, always insert tester probe from wire harness side.



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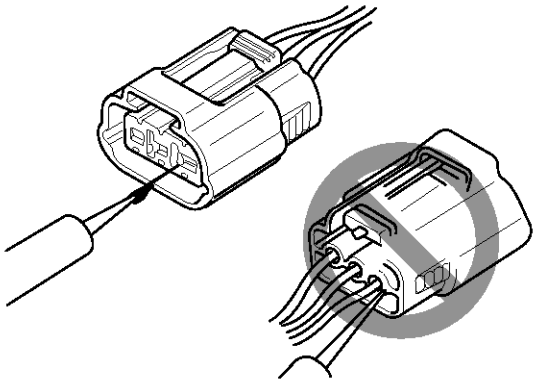
e. Check waterproof connector terminals from the connector side. Waterproof connectors cannot be accessed from harness side.



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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.*

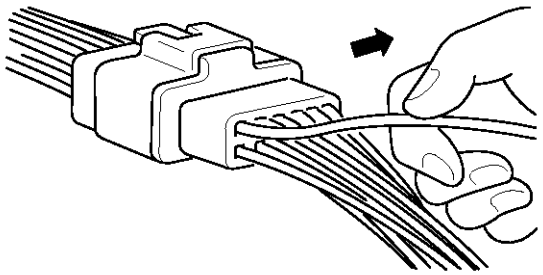
2. Checking Point for Connector

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.

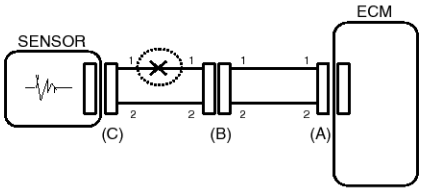
Electrical Circuit Inspection Procedure

● 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 from side to side.

Specification (Resistance)

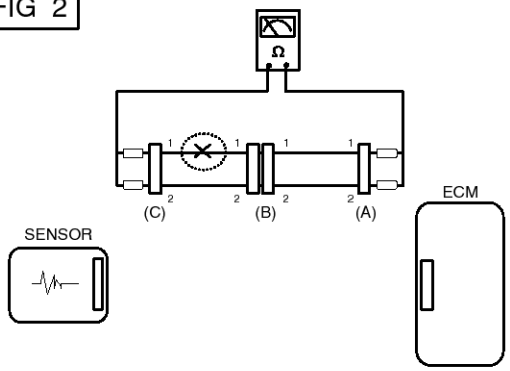
1Ω or less → Normal Circuit

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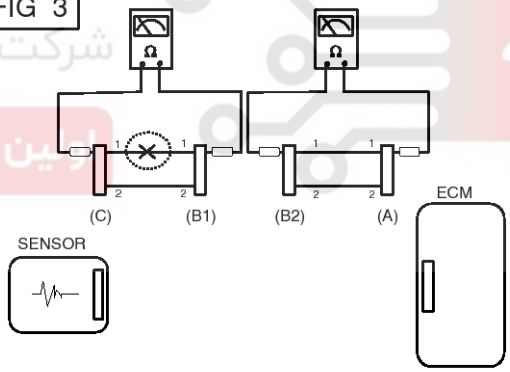
b. Disconnect connector (B), and measure for resistance between connector (C) and (B1) and between (B2) and (A) as shown in [FIG. 3].

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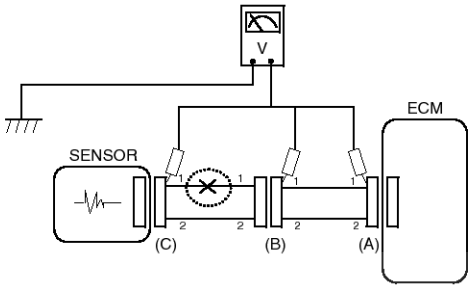
3. Voltage Check Method
   a. With each connector still connected, measure the voltage between the chassis ground and terminal 1 of each connectors (A), (B) and (C) as shown in [FIG. 4].

      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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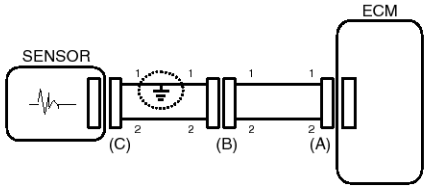
● Check Short Circuit

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.

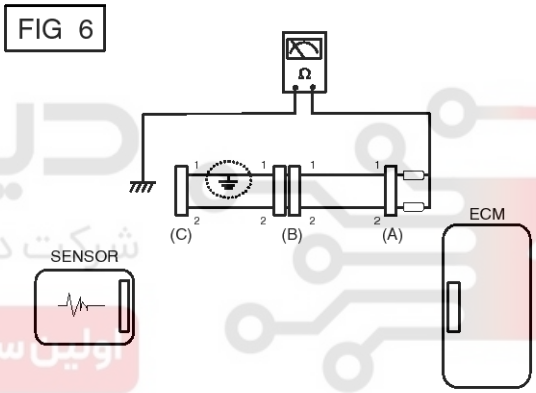
Specification (Resistance)

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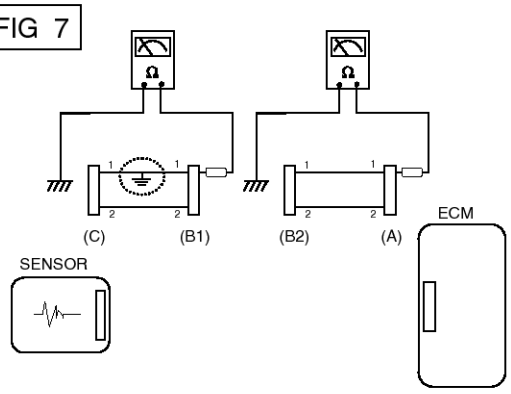
   b. Disconnect connector (B), and measure the resistance between connector (A) and chassis ground, and between (B1) and chassis ground as shown in [FIG. 7].

      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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● Testing For Voltage Drop

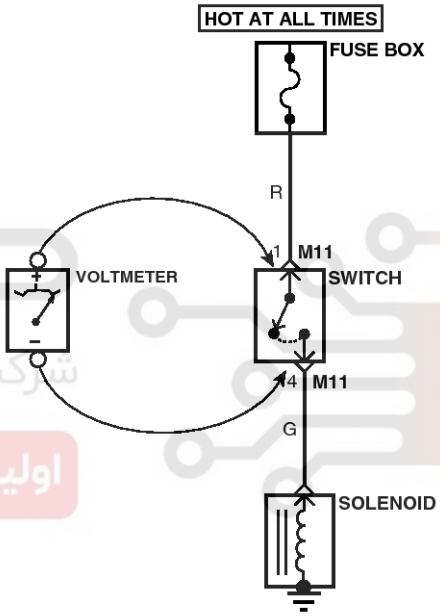
This test checks for voltage drop along a wire, or through a connection orswitch.

A. 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.

B. Connect the negative lead to the other end of the wire. (or the other side of the connector or switch)

C. Operate the circuit.

D. 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

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 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)
- ETC Module
- 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)
- 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)
- ETC Module
- Engine coolant temperature sensor (ECTS)
- 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.

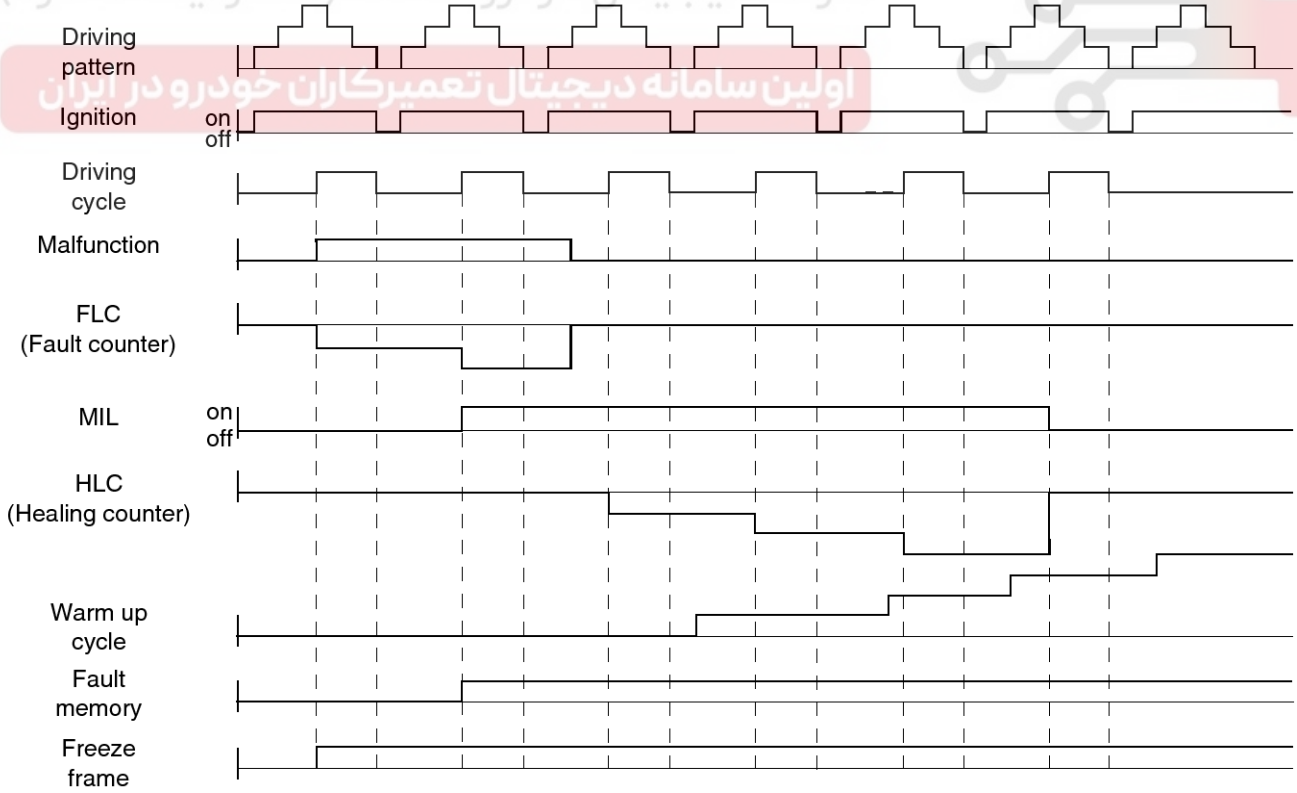
Self-Diagnosis

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

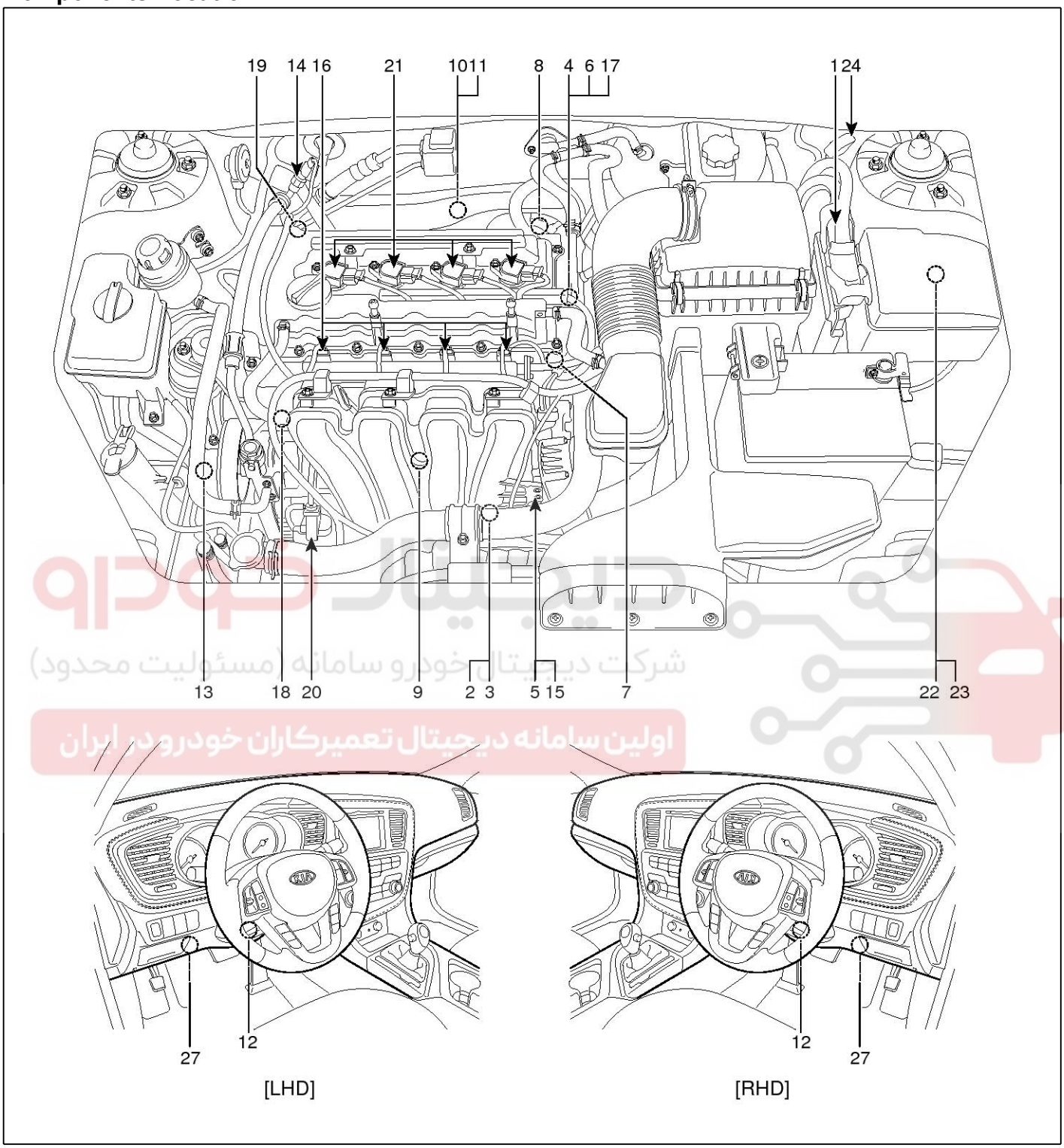
1. When the same malfunction is detected and maintained during two sequential driving cycles, the MIL will automatically illuminate.
2. The MIL will go off automatically if no fault is detected after 3 sequential driving cycles.
3. A Diagnostic Trouble Code(DTC) is recorded in ECM memory when a malfunction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

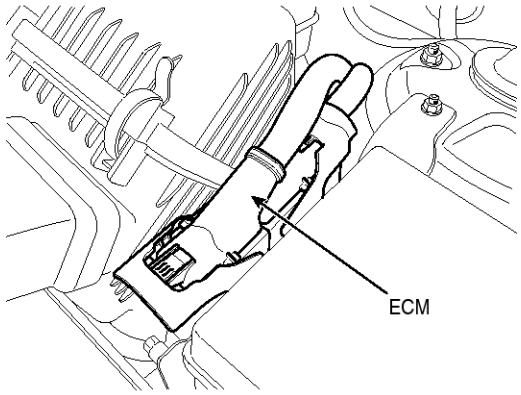
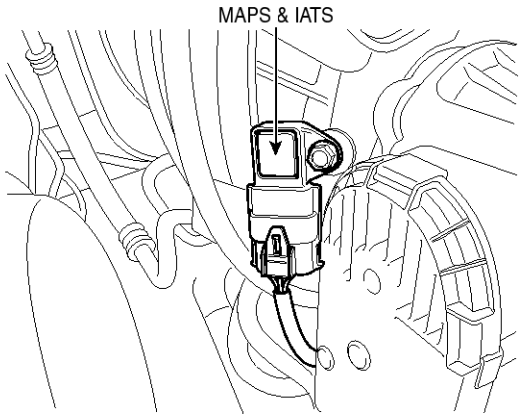
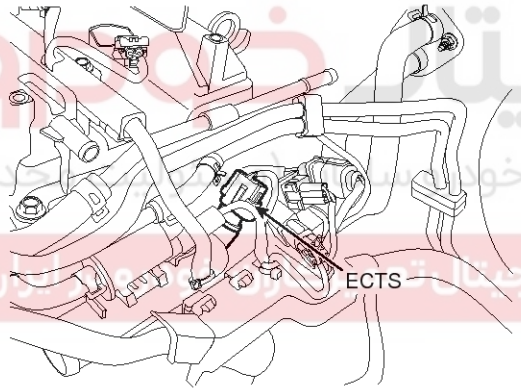
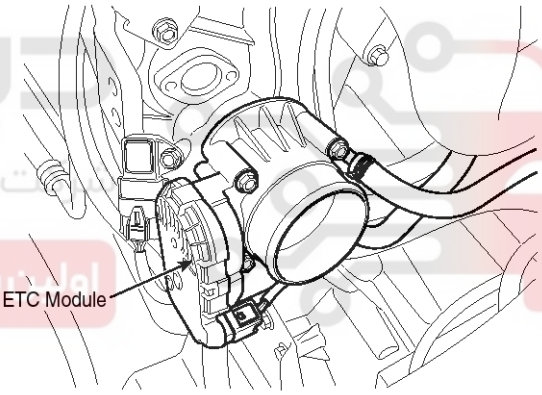
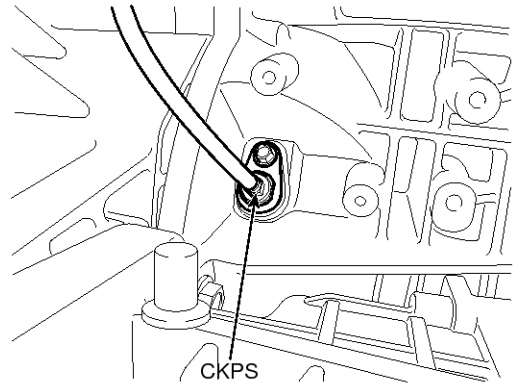
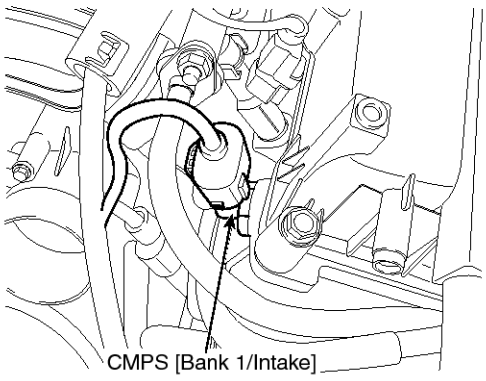
- *A "warm-up cycle" means sufficient vehicle operation such that the coolant temperature has risen by at least 40 degrees Fahrenheit from engine starting and reaches a minimum temperature of 160 degress Fahrenheit.*
- *A "driving cycle" consists of engine startup, vehicle operation beyond the beginning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

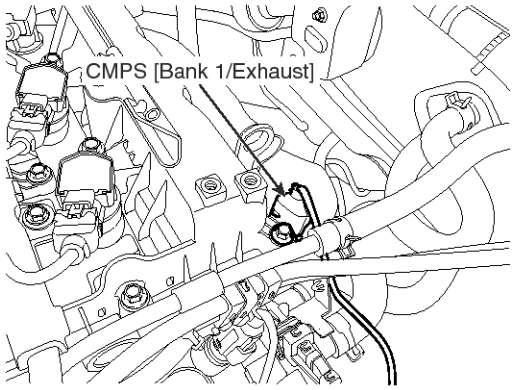
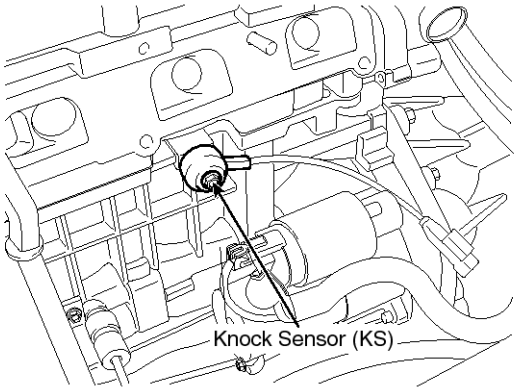
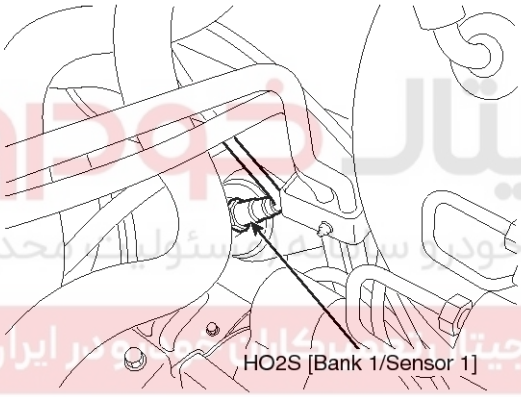
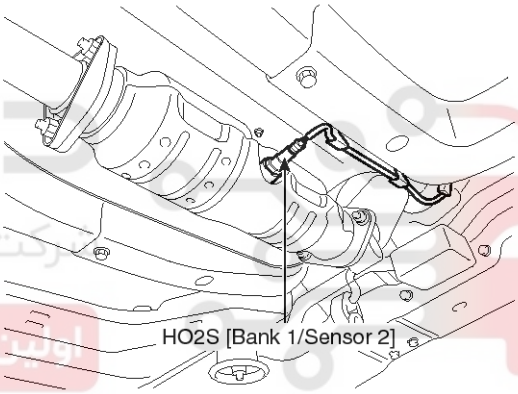
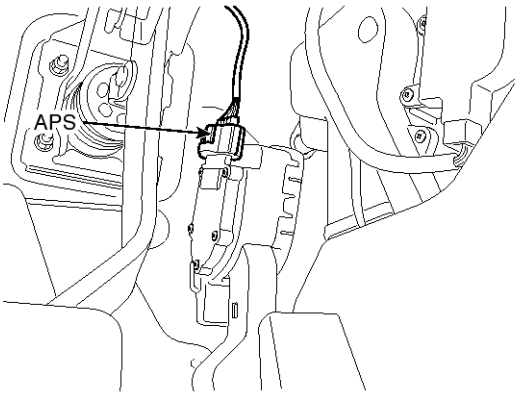
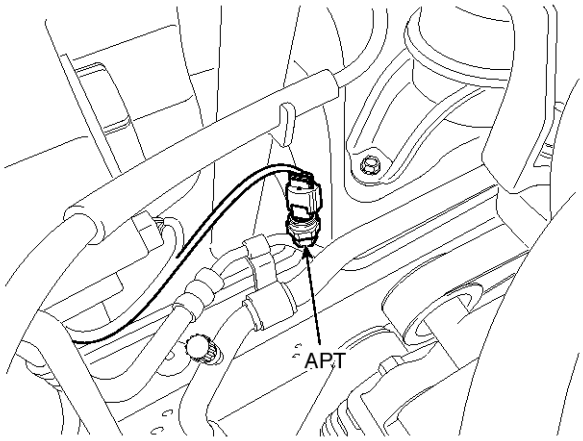
Components Location



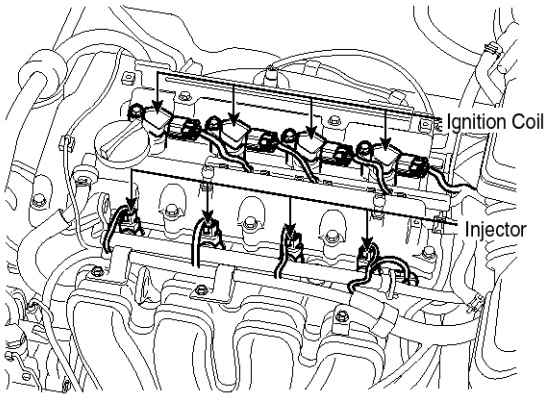
STFFL1001L

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. Power Steering Pressure Sensor (PSPS)
15. ETC Motor [integrated into ETC Module]
16. Injector
17. Purge Control Solenoid Valve (PCSV)
18. CVVT Oil Control Valve (OCV) [Bank 1 / Intake]
19. CVVT Oil Control Valve (OCV) [Bank 1 / Exhaust]
20. Variable Intake Solenoid (VIS) Valve
21. Ignition Coil
22. Main Relay
23. Fuel Pump Relay
24. Data Link Connector (DLC) [16 Pin]
25. Multi-Purpose Check Connector [20 Pin]

1. ECM (Engine Control Module)	2. Manifold Absolute Pressure Sensor (MAPS) 3. Intake Air Temperature Sensor (IATS)
 SXMF19102D	 SXMF19103D
4. Engine Coolant Temperature Sensor (ECTS)	5. Throttle Position Sensor (TPS) 14. ETC Motor
 SYFFL0001D	 SXMF10105L
6. Crankshaft Position Sensor (CKPS)	7. Camshaft Position Sensor (CMPS) [Bank 1 / Intake]
 STFFL1003D	 STDFL0106N

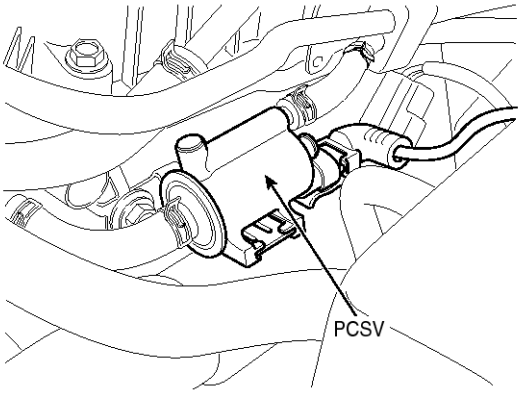
8. Camshaft Position Sensor (CMPS) [Bank 1 / Exhaust]	9. Knock Sensor (KS)
 STDFL0107N	 SNFFL9003N
10. Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1]	11. Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 2]
 SYFFL0139L	 SYFFL0140L
12. Accelerator Position Sensor (APS)	13. A/C Pressure Transducer (APT)
 STFFL1026D	 STFF11110D

16. Injector
21. Ignition Coil



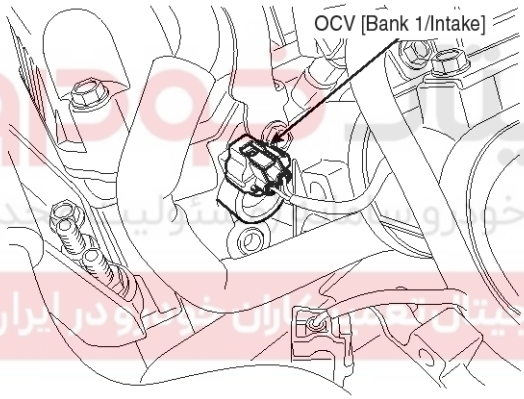
SXMF10114L

17. Purge Control Solenoid Valve (PCSV)



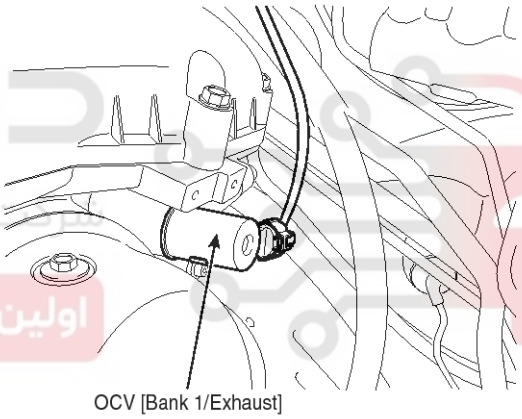
SXMF19115D

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



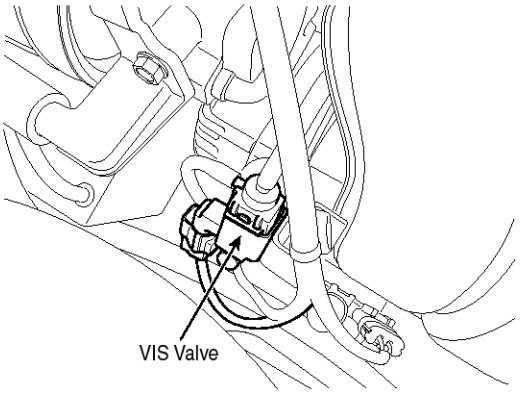
SXMF10117L

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



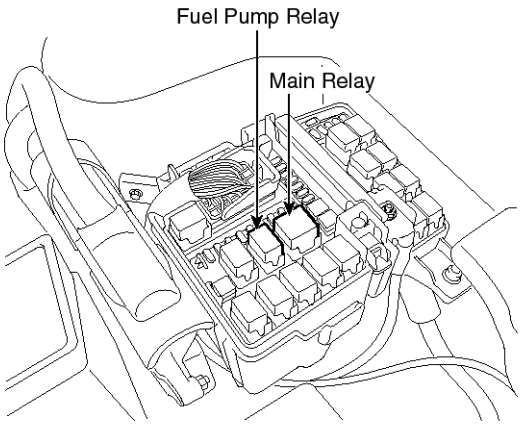
SXMF10118L

20. Variable Intake Solenoid (VIS) Valve

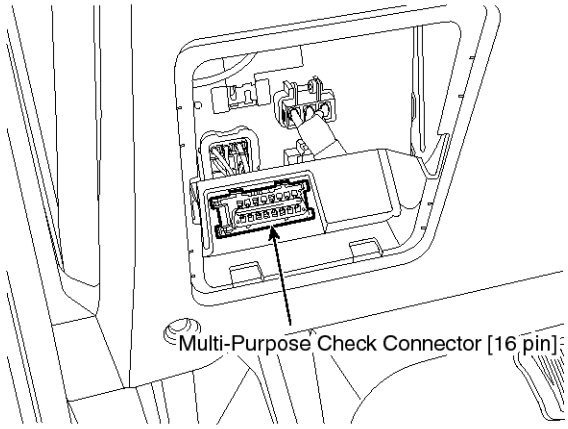
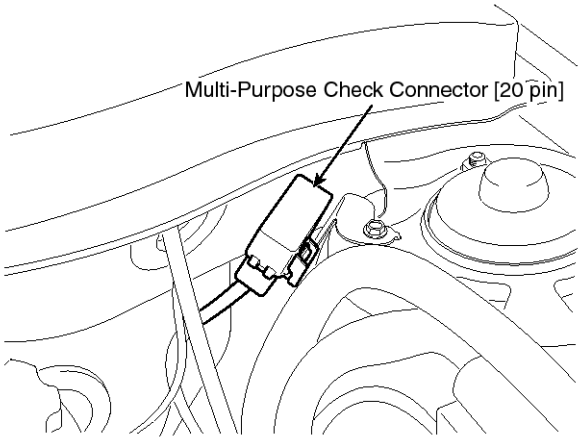


SXMF10119L

22. Main Relay
23. Fuel Pump Relay

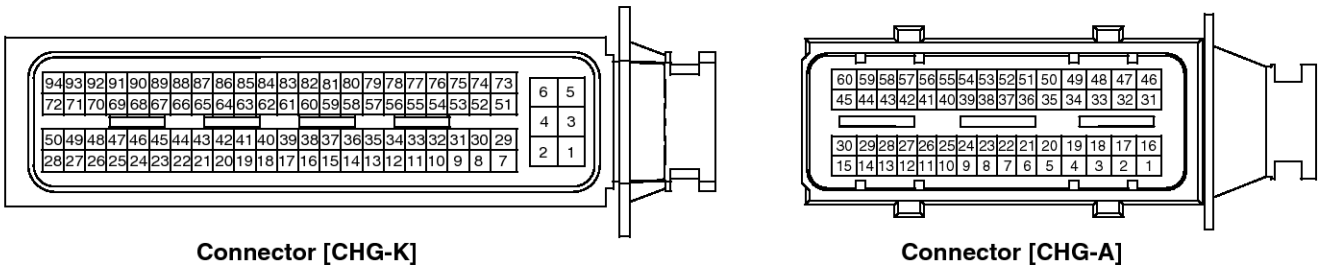


SYFFL0180L

24. Data Link Connector (DLC) [16 Pin]	25. Multi-Purpose Check Connector [20 Pin]
 STFFL1020L	 STFFL1021L

Engine Control Module (ECM)

ECM Terminal And Input/Output signal



Connector [CHG-K] Connector [CHG-A]

SYFFL0006L

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	Wheel Speed Sensor (WSS) [+] signal input	Wheel Speed Sensor (WSS) [Without ABS/ESP]
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] (Except Euro 5)
17	Crankshaft Position Sensor (CKPS) signal input	Crankshaft Position Sensor (CKPS)
18	Rc/Rp (Pump Cell Voltage)	Heated Oxygen Sensor [Bank 1/Sensor 1] (Euro 5 only)
19	VS+ (NERNST Cell Voltage)	Heated Oxygen Sensor [Bank 1/Sensor 1] (Euro 5 only)
20	VS-/IP- (Common Ground for VS, IP)	Heated Oxygen Sensor [Bank 1/Sensor 1] (Euro 5 only)

Pin No.	Description	Connected to
21	-	
22	-	
23	-	
24	Start overrun (Ground)	Start relay
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	Wheel Speed Sensor (WSS) [-] signal input	Wheel Speed Sensor (WSS) [Without ABS/ESP]
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] (Except Euro 5)
39	Sensor ground	Crankshaft Position Sensor (CKPS)
40	Vehicle speed signal input	ESP Control Module, ABS Control Module [Without MDPS]
41	Power Steering Pressure Sensor (PSPS) signal input	Power Steering Pressure Sensor (PSPS)
42	Rc (Compensative Resistance)	Heated Oxygen Sensor [Bank 1/Sensor 1] (Euro 5 only)
43	Sensor power (+5V)	A/C Pressure Transducer (APT)
44	-	
45	-	
46	Alternator (COM)	Alternator
47	-	
48	-	
49	-	
50	Variable Intake Solenoid (VIS) Valve control output	Variable Intake Solenoid (VIS) Valve
51	Battery power (B+)	Main Relay

Pin No.	Description	Connected to
52	-	
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	Immobilizer Control
76	LIN communication signal input	Battery Sensor
77	CAN [High]	Other control module, Data Link Connector (DLC),
78	CAN [Low]	Other control module, Data Link Connector (DLC),
79	-	
80	Throttle Position Sensor (TPS) 1 signal input	Throttle Position Sensor (TPS) 1
81	Sensor ground	Power Steering Pressure Sensor (PSPS) [Without MDPS]
82	Accelerator Position Sensor (APS) 1 signal input	Accelerator Position Sensor (APS) 1
83	Sensor ground	Camshaft Position Sensor (CMPS) [Bank 1/Intake]

Pin No.	Description	Connected to
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	-	
88	Cooling Fan Relay [High] control output	Cooling Fan Relay [High]
89	-	
90	-	
91	-	
92	-	
93	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1] Heater control output	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1] (Euro 5 only/ Except 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	Electrical load [Wiper] signal input	Wiper [Low] Relay
14	Alternator (FR)	Alternator
15	-	

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	I/P Junction Box, Transaxle Range Switch (A/T), Start Ralay (M/T)
29	Brake Switch 1 signal input	Brake Switch
30	-	
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

Pin No.	Description	Connected to
45	-	
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	-	
59	-	
60	-	

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	Wheel Speed Sensor (WSS) [+] signal input	Vehicle Run (30KPH)	SINE WAVE	15Hz: Min. 0.13Vpp	
				1000Hz: Min. 0.2Vpp	
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±50 mV	
				Rich: Max. Normal+150 mV	
				Lean: Min. Normal-150 mV	
19	VS+ (NERNST Cell Voltage)	Idle	Analog	Normal: 450±50 mV	
				Rich: Max. Normal+150 mV	
				Lean: Min. Normal-150 mV	

Pin No.	Description	Condition	Type	Level	Test Result
20	VS-/IP- (Common Ground for VS, I-P)	Idle	Analog	Reference for V_IP, V_N	
21	-				
22	-				
23	-				
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	Wheel Speed Sensor (WSS) [-] signal input	Vehicle Run (30KPH)	SINE WAVE	15Hz: Min. 0.13Vpp	
				1000Hz: Min. 0.2Vpp	
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

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 Run	Pulse	HI: Min. 4.5V	5.0V
				LO: Max. 0.5V	0V
				Frequency	46.9Hz at Idle
				Duty(-)	50.4% at Idle
41	Power Steering Pressure Sensor (PSPS) signal input				
42	Rc (Compensative Resistance)	Idle	Analog	| Rc-Rc/Rp | < ±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

Pin No.	Description	Condition	Type	Level	Test Result
55	-				
56	-				
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

Pin No.	Description	Condition	Type	Level	Test Result
71	ETC Motor [+] control output	Idle	Pulse	HI: Battery Voltage	13.4V
				LO: Max . 1.0V	0V
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	Sensor ground				
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	-				
88	Cooling Fan Relay [High] control output	Relay OFF	DC	Battery Voltage	
		Relay ON		Max. 1.0V	
89	-				
90	-				
91	-				
92	-				

Pin No.	Description	Condition	Type	Level	Test Result
93	Heated Oxygen Sensor (HO2S) [Bank 1/Sensor 1] Heater control output	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%

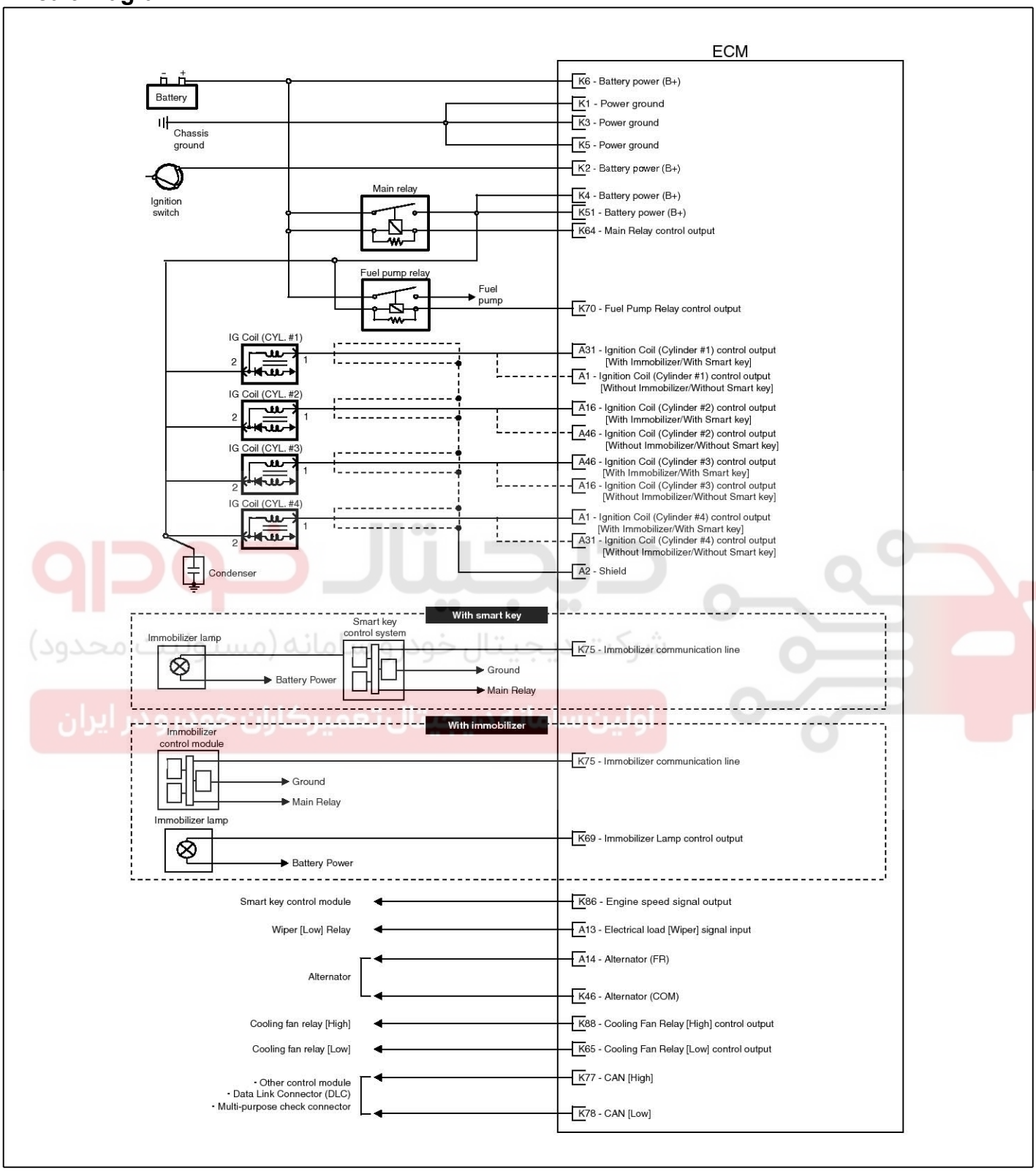
Connector [CHG-A]

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	-				

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	-				
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	-				
40	-				

Pin No.	Description	Condition	Type	Level	Test Result
41	-				
42	-				
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	-				
58	-				
59	-				
60	-				

Circuit Diagram



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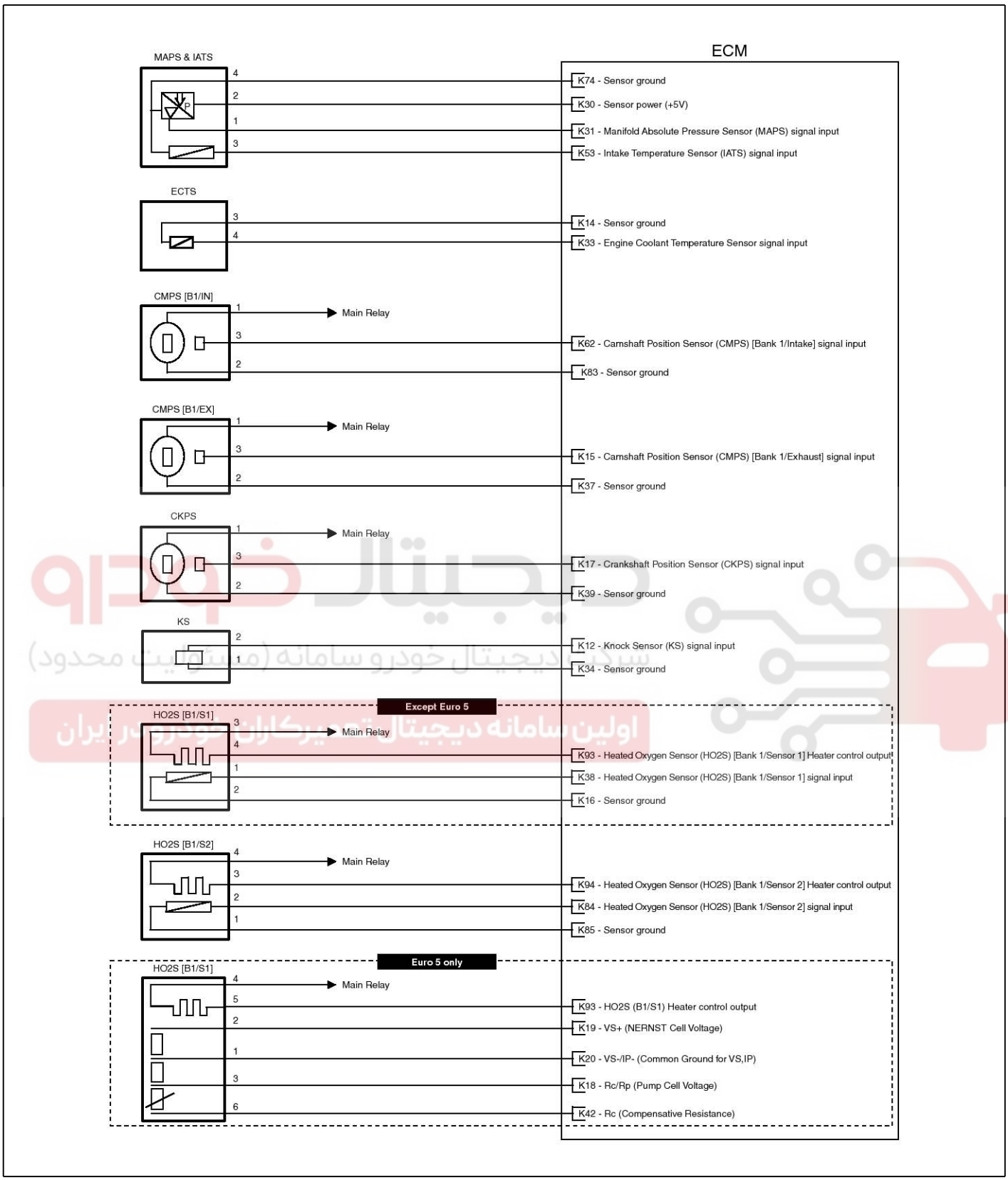

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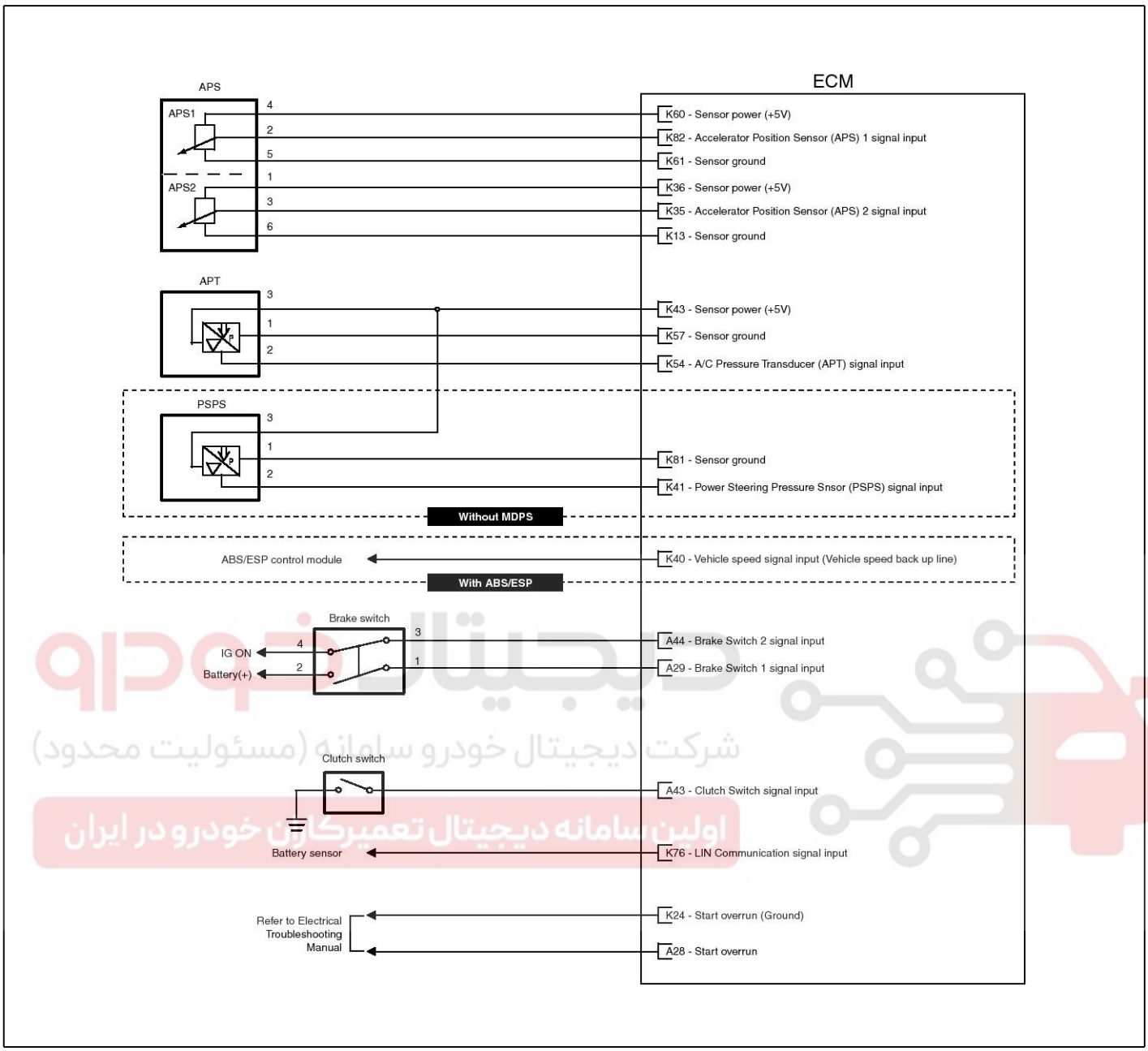

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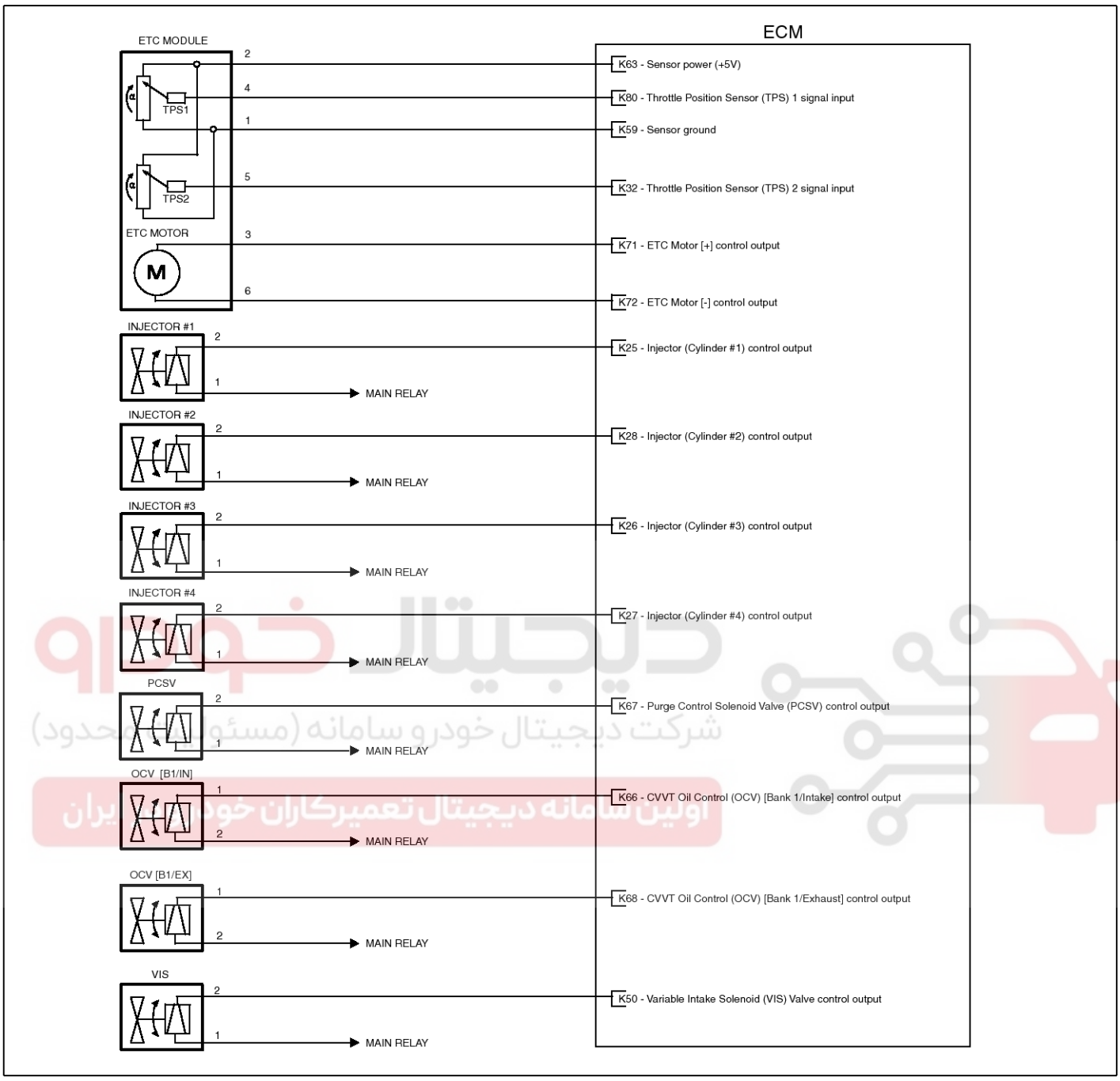


SXMF10134L

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]

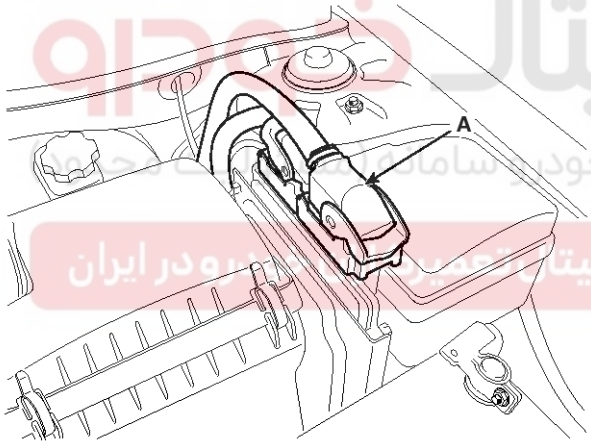
1. *Perform "ECM neutralization mode" procedure with GDS. (Refer to "Immobilizer" in BE group)*
2. *Insert the key and turn it to the IGN ON and OFF position. Then the ECM key register process is completed automatically.*

[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).



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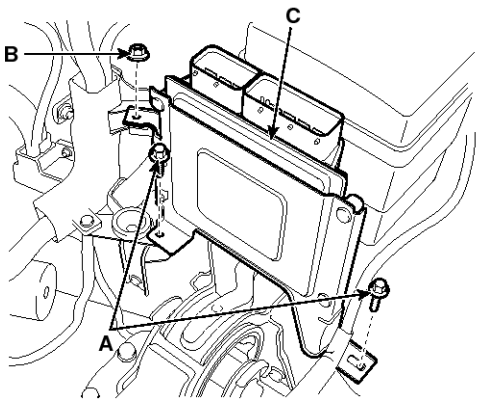
3. Remove the air cleaner assembly (Refer to "Intake And Exhaust System" in EM group).
4. Remove the mounting bolts (A)/nut (B), and then remove the ECM (C).



SYFFL0340D

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:
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)
ECM bracket installation bolt/nut:
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)

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.

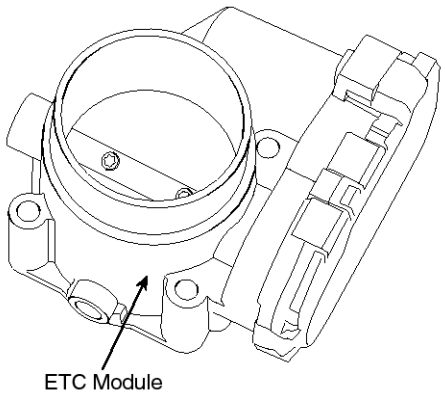
Specification: Below 1Ω

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).

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.



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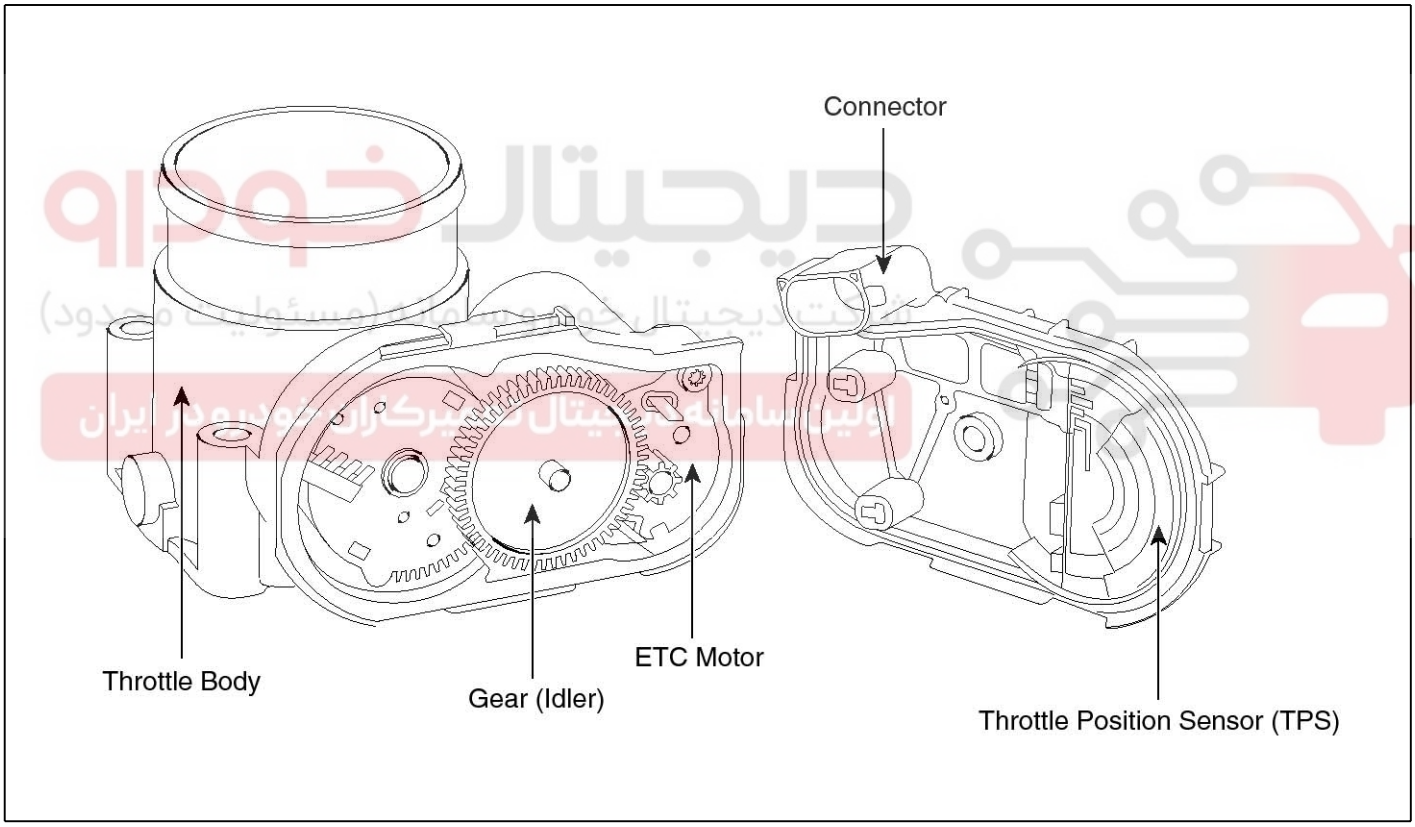
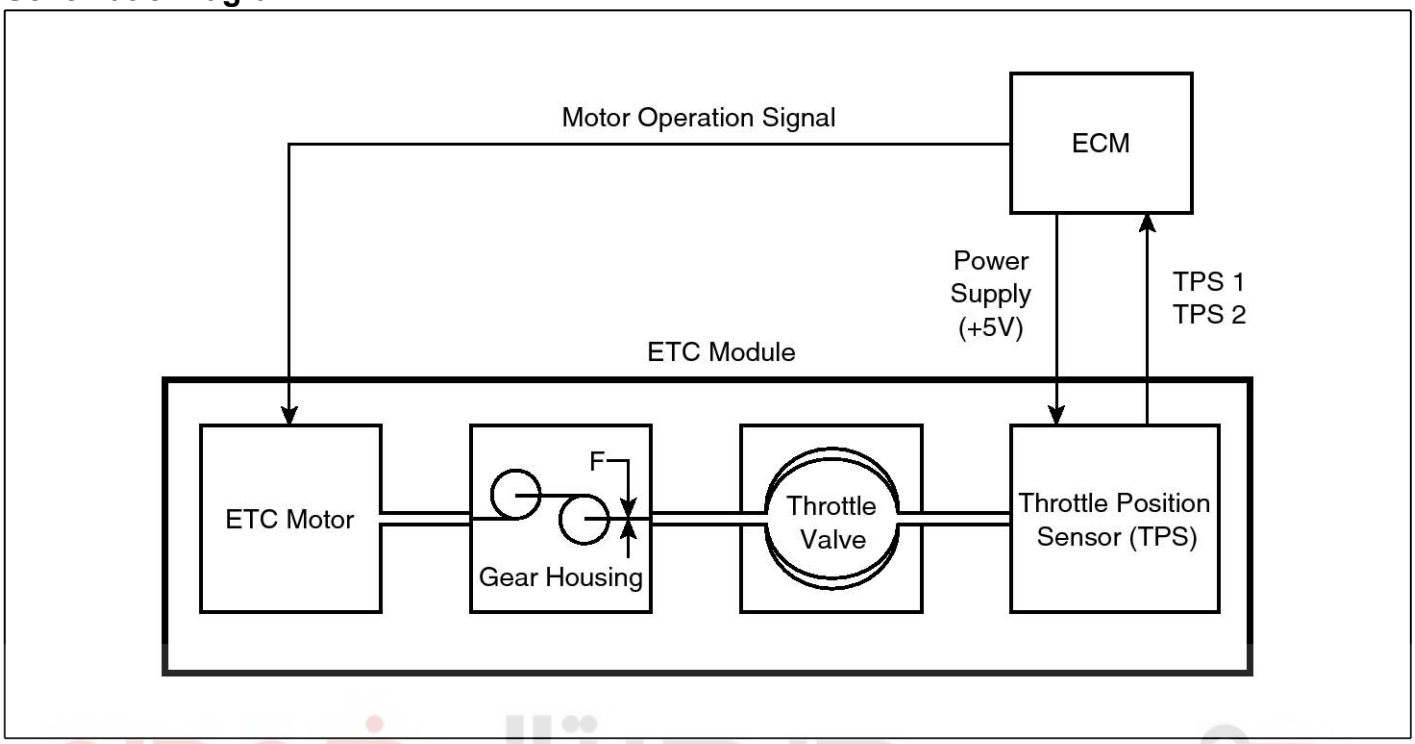


SBKFL9130L

Schematic Diagram



SBKFL9134N

Fail-Safe Mode

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

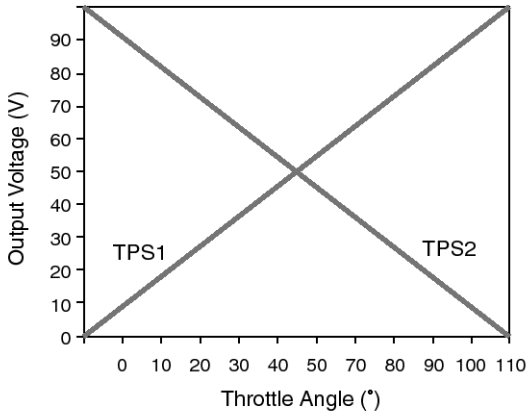
Specification

[Throttle Position Sensor (TPS)]

Throttle Angle(˚)	Output Voltage(V) [Vref = 5.0V]	
	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	W.O.T
TPS1	Throttle Angle (°)	6.3 ~ 14.7	93.45 ~ 101.85
	Output Voltage [Vref=5V]	0.3 ~ 0.7	4.45 ~ 4.85
TPS2	Throttle Angle (°)	90.3 ~ 98.7	3.15 ~ 11.55
	Output Voltage [Vref=5V]	4.3 ~4.7	0.15 ~ 0.55

[TPS CHARACTERISTIC GRAPH]



EGRF235A

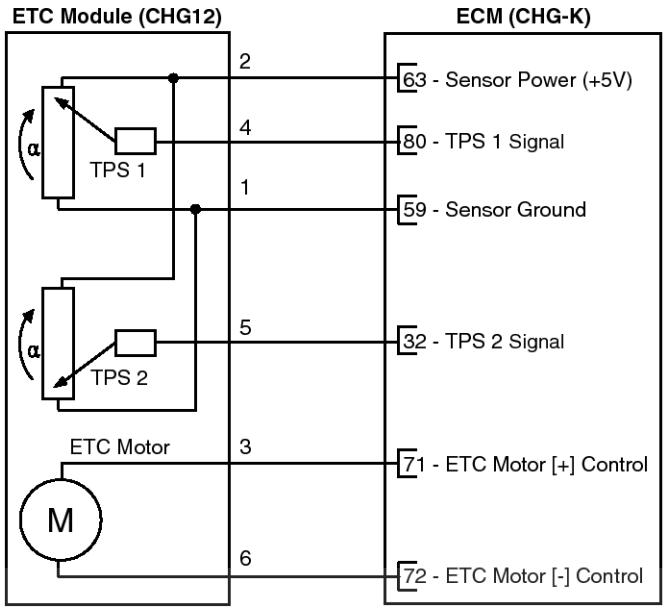
Item	Sensor Resistance(kΩ)
TPS	0.875 ~ 1.625 [20℃(68°F)]

[ETC Motor]

Item	Specification
Coil Resistance (Ω)	1.2 ~ 1.8 [20℃(68°F)]

Circuit Diagram

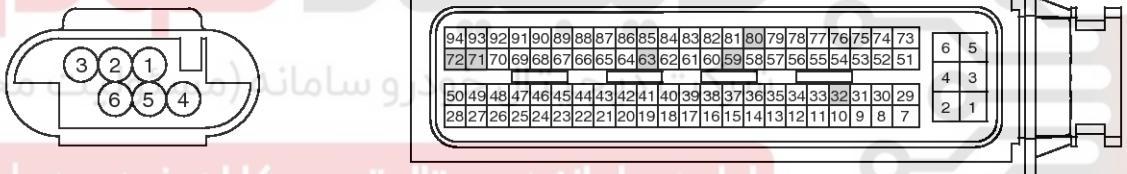
[Circuit Diagram]



[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]



CHG12
ETC Module

CHG-K
ECM

STFFL1005L

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) [Vref = 5.0V]	
	TPS 1	TPS 2
C.T	0.3 ~ 0.7	4.3 ~ 4.7
W.O.T	4.45 ~ 4.85	0.15 ~ 0.55

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”

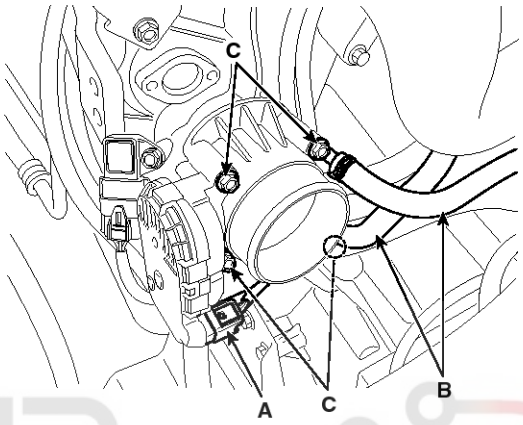
ETC Motor

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”

Removal

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

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.

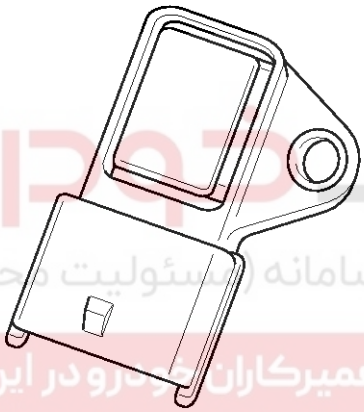
Electronic throttle body Installation bolt:
7.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 5.8 ~ 8.7 lb-ft)

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.

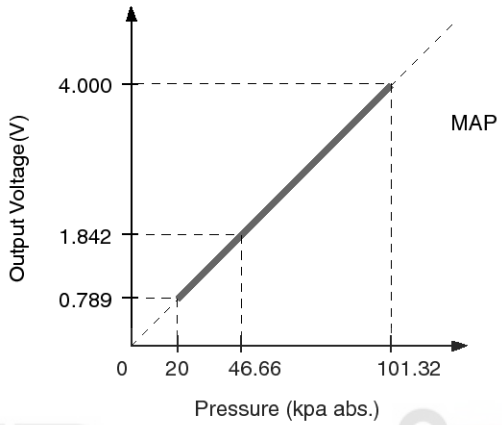
The MAPS consists of a piezo-electric element and a hybrid IC amplifying the element output signal. The element is silicon diaphragm type and adapts pressure sensitive variable resistor effect of semi-conductor. Because 100% vacuum and the manifold pressure apply to both sides of the sensor respectively,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



SMGF19111L

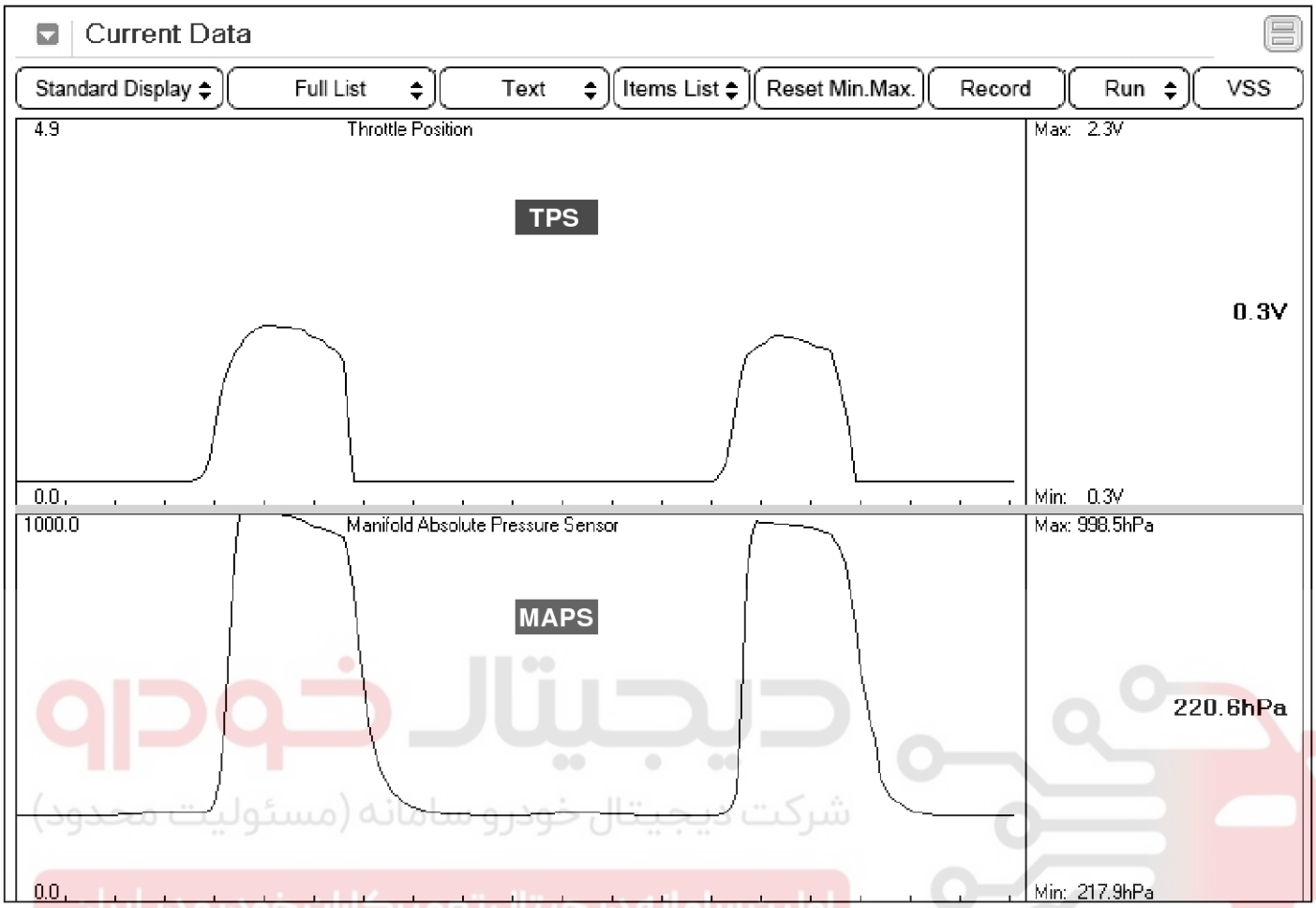
Specification

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



SHDFL8129C

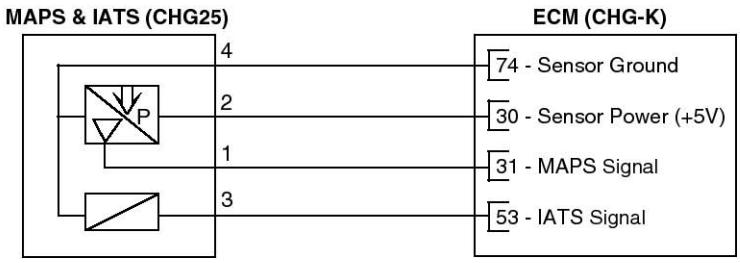
Waveform



SXMF19197D

Circuit Diagram

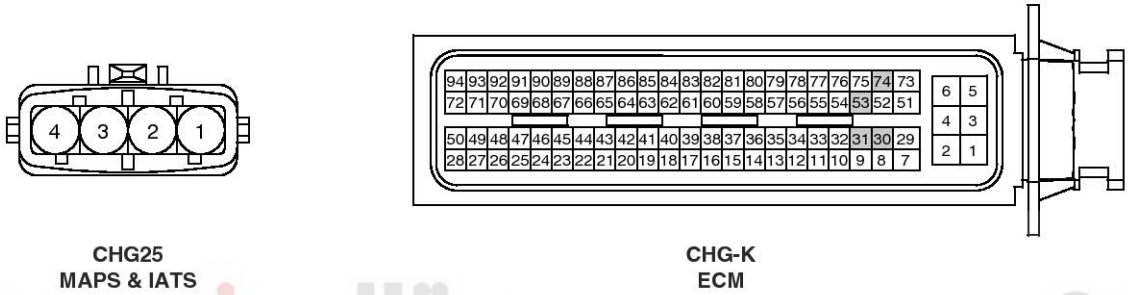
[Circuit Diagram]



[Connection Information]

Terminal	Connected to	Function
1	ECM CHG-K (31)	MAPS #1 Signal
2	ECM CHG-K (30)	Sensor Power (+5V)
3	ECM CHG-K (53)	IATS Signal
4	ECM CHG-K (74)	Sensor Ground

[Harness Connector]



CHG25
MAPS & IATS

CHG-K
ECM

STFFL1006L

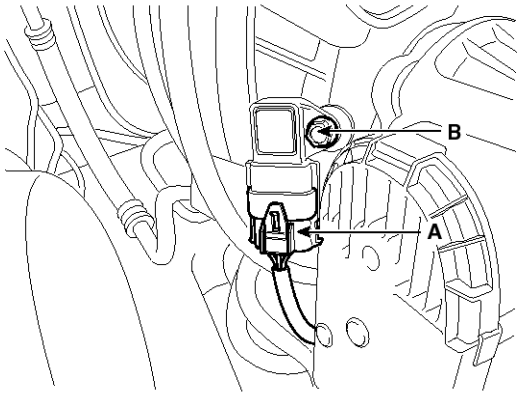
Inspection

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

Test 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.



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.

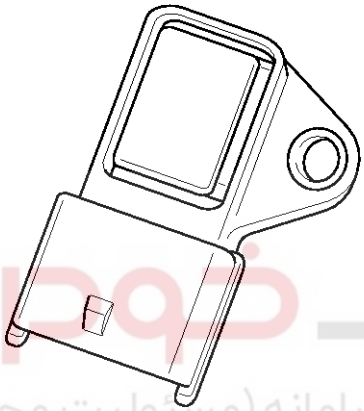
Manifold absolute pressure sensor installation bolt:
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)

Intake Air Temperature Sensor (IATS)

Description

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

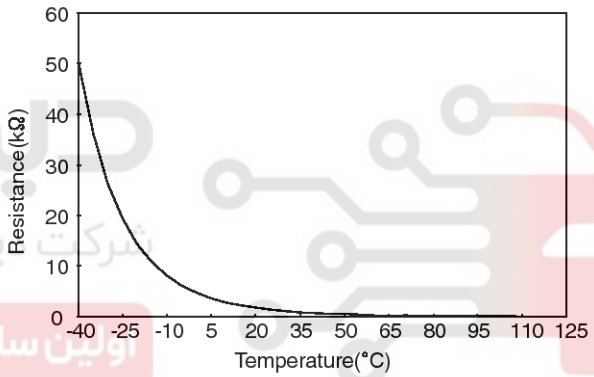
To calculate precise air quantity, correction of the air temperature is needed because air density varies according to the temperature. So the ECM uses not only MAPS signal but also IATS signal. This sensor has a Negative Temperature Coefficient (NTC) Thermister and it's resistance changes in reverse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



SAMF19005N

Specification

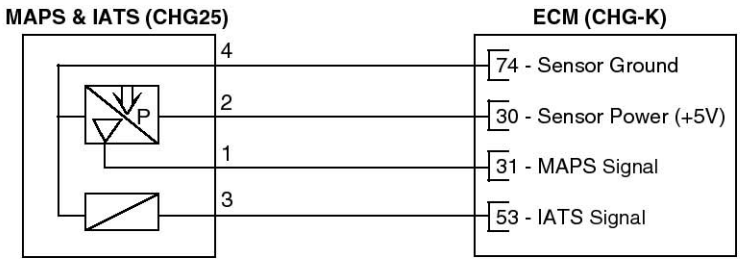
Temperature [℃(˚F)]	Resistance (kΩ)
-40(-40)	40.93 ~ 48.35
-20(-4)	13.89 ~ 16.03
0(32)	5.38 ~ 6.09
10(50)	3.48 ~ 3.90
20(68)	2.31 ~ 2.57
40(104)	1.08 ~ 1.21
50(122)	0.76 ~ 0.85
60(140)	0.54 ~ 0.62
80(176)	0.29 ~ 0.34



STFFL1007L

Circuit Diagram

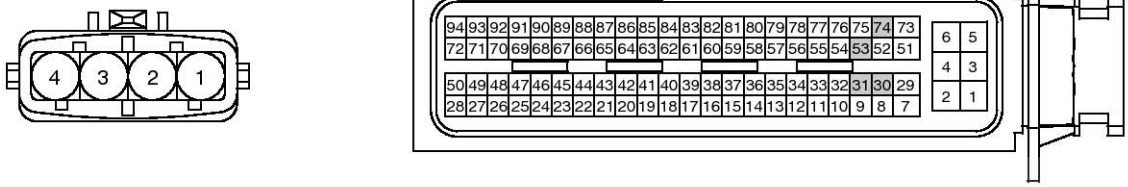
[Circuit Diagram]



[Connection Information]

Terminal	Connected to	Function
1	ECM CHG-K (31)	MAPS #1 Signal
2	ECM CHG-K (30)	Sensor Power (+5V)
3	ECM CHG-K (53)	IATS Signal
4	ECM CHG-K (74)	Sensor Ground

[Harness Connector]



CHG25
MAPS & IATS

CHG-K
ECM

STFFL1006L

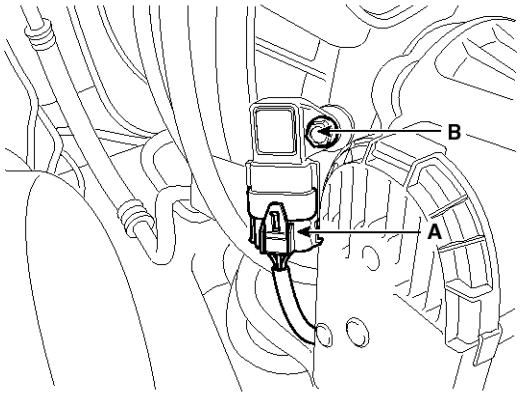
Inspection

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)

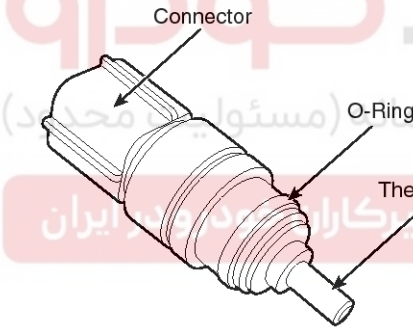
Engine Coolant Temperature Sensor (ECTS)

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.



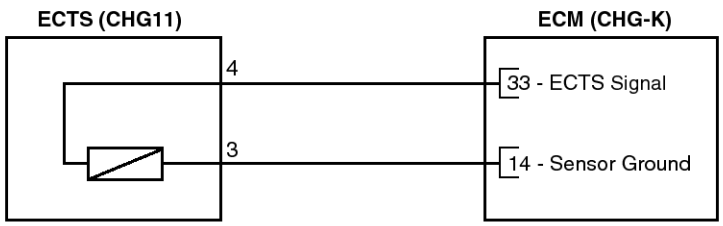
STDFL0127N

Specification

Temperature		Resistance (kΩ)
℃	˚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

Circuit Diagram

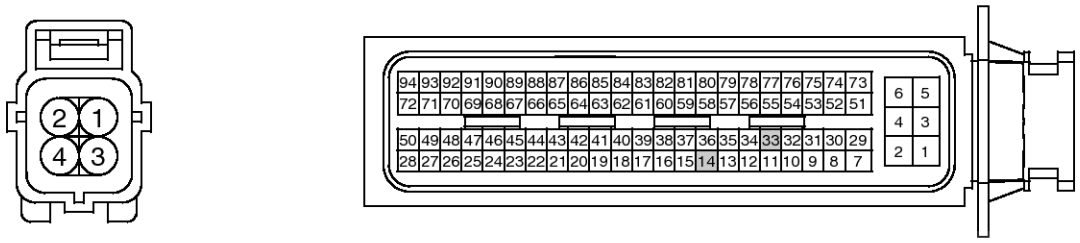
[Circuit Diagram]



[Connection Information]

Terminal	Connected to	Function
1	-	-
2	-	-
3	ECM CHG-K (14)	Sensor Ground
4	ECM CHG-K (33)	ECTS Signal

[Harness Connector]



CHG11
ECTS

CHG-K
ECM

STFFL1008L

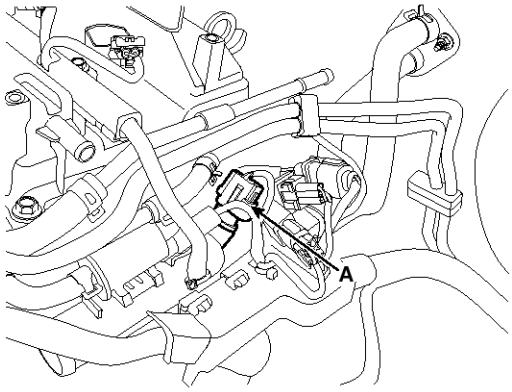
Inspection

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”

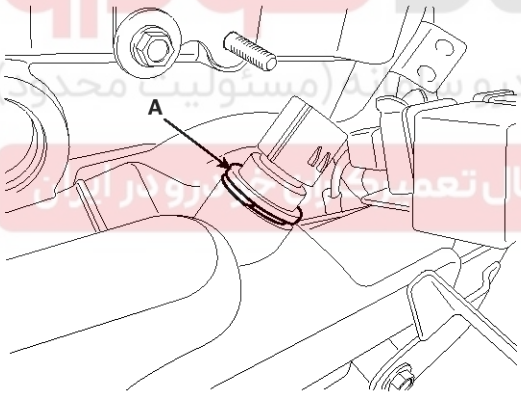
Removal

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



SYFFL0002D

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.**

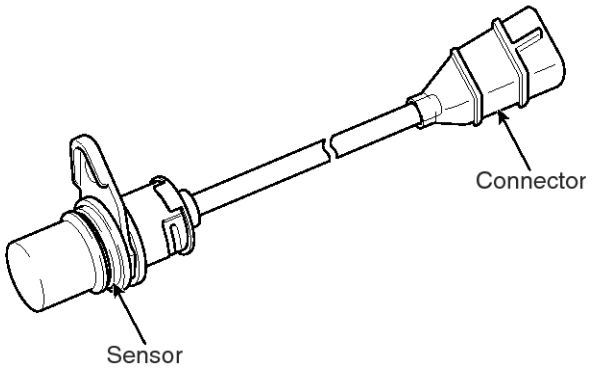
1. Installation is reverse of removal.

Crankshaft Position Sensor (CKPS)

Description

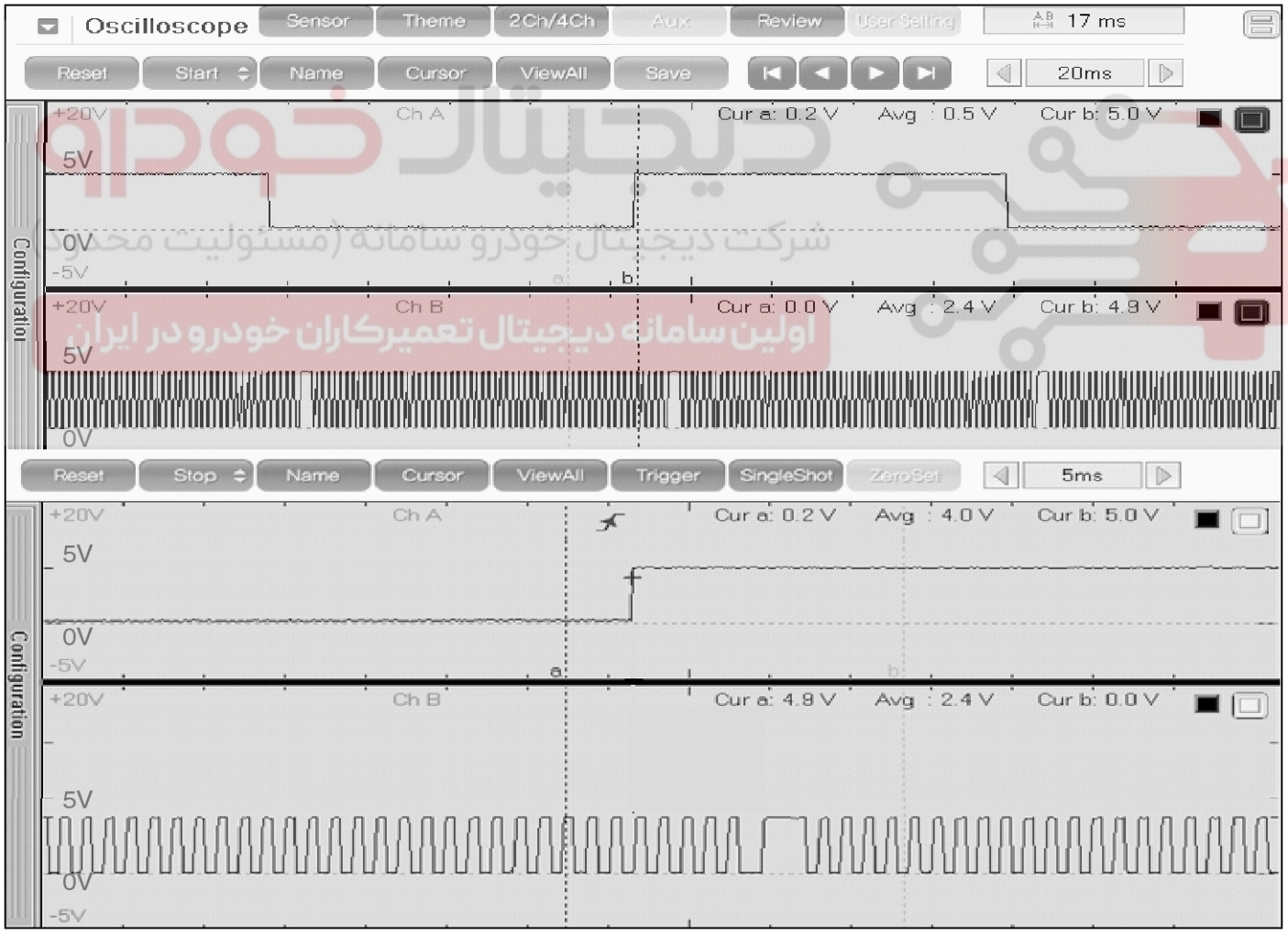
Crankshaft Position Sensor (CKPS) detects the crankshaft position and is one of the most important sensors of the engine control system. If there is no CKPS signal input, the engine may stop because of CKPS signal missing. This sensor is installed on the cylinder block or the transaxle housing and generates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

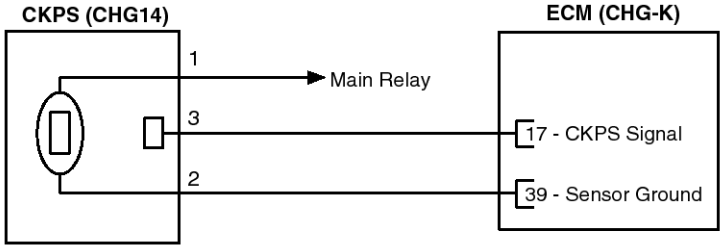
Wave Form



SBKFL9136L

Circuit Diagram

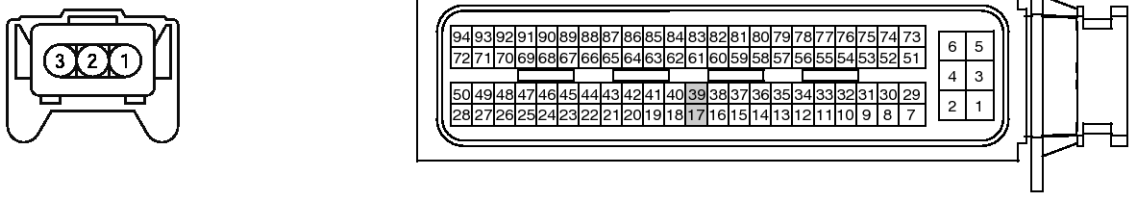
[Circuit Diagram]



[Connection Information]

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

[Harness Connector]



CHG14
CKPS

CHG-K
ECM

STFFL1009L

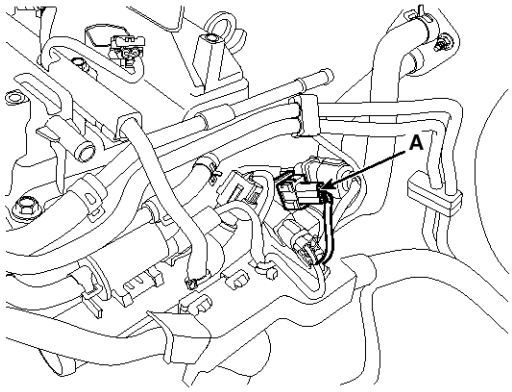
Inspection

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

Specification: Refer to “Wave Form”

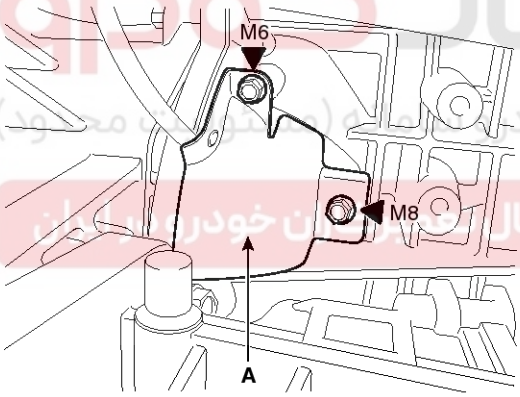
Removal

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



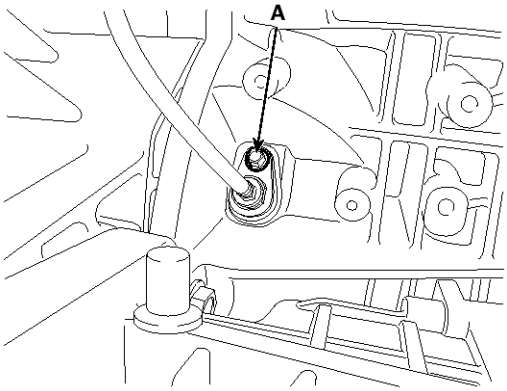
SYFFL0003D

3. Remove the protector (A).



STFFL1005D

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



STFFL1006D

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)

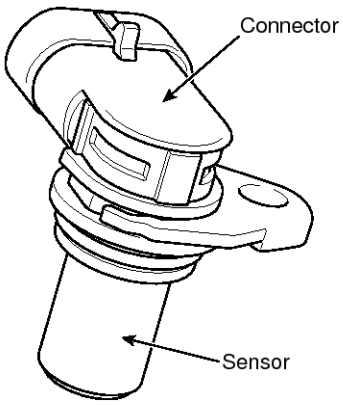
Camshaft Position Sensor (CMPS)

Description

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

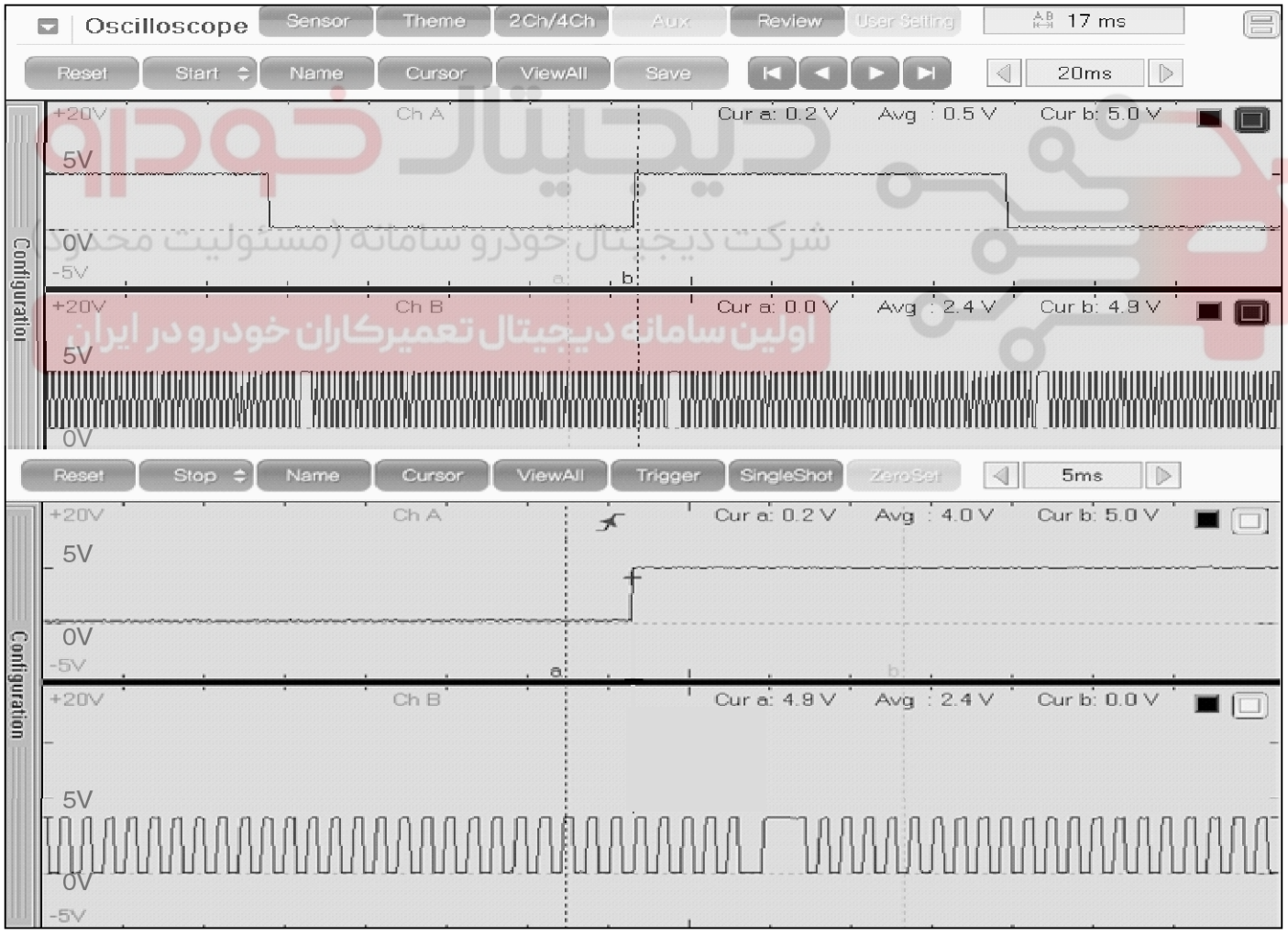
It is related with Crankshaft Position Sensor (CKPS) and detects the piston position of each cylinder which the CKPS can't detect.

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

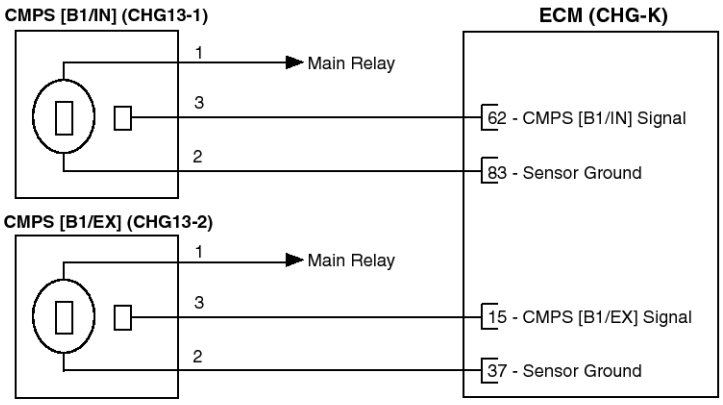
Wave Form



SBKFL9136L

Circuit Diagram

[Circuit Diagram]



[Connection Information]

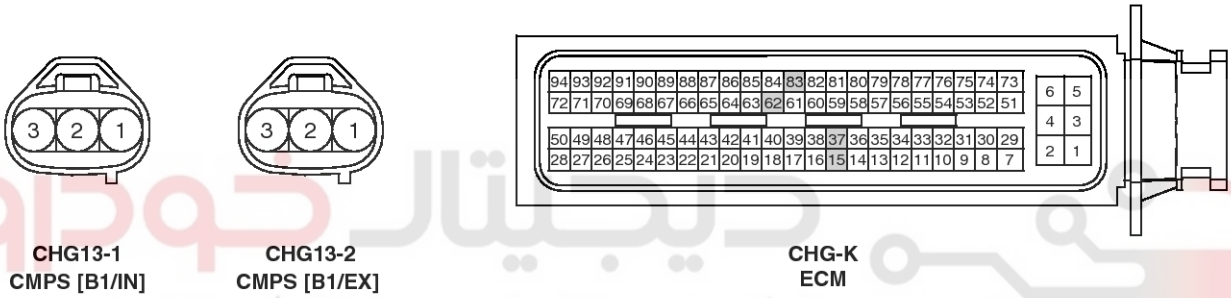
CMPS [B1/IN] (CHG13-1)

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

STFFL1010L

Inspection

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

Specification: Refer to “Wave Form”

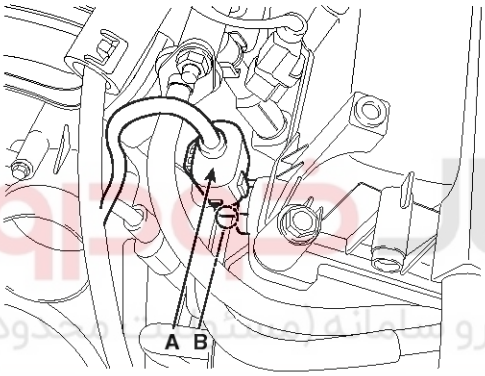
Removal

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]

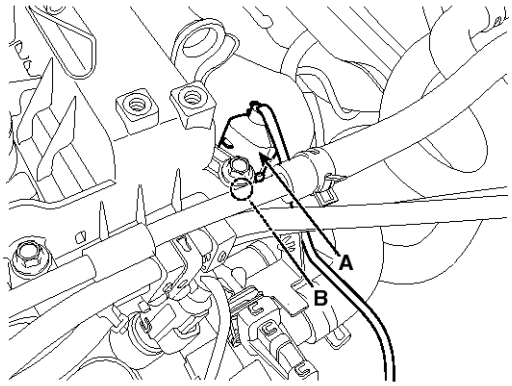
1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Disconnect the camshaft position sensor connector (A).
3. Remove the installation bolt (B), and then remove the sensor.



SXMF19142D

[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.



STFFL1011L

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.

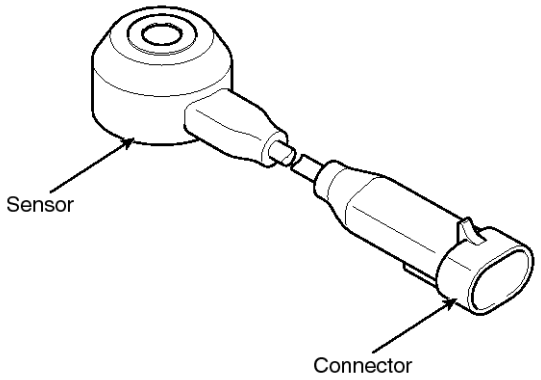
Camshaft position sensor installation bolt:
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)

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.



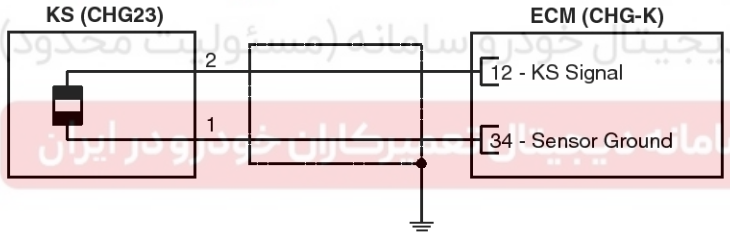
EGRF251A

Specification

Item	Specification
Capacitance (pF)	850 ~ 1,150

Circuit Diagram

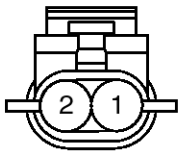
[Circuit Diagram]



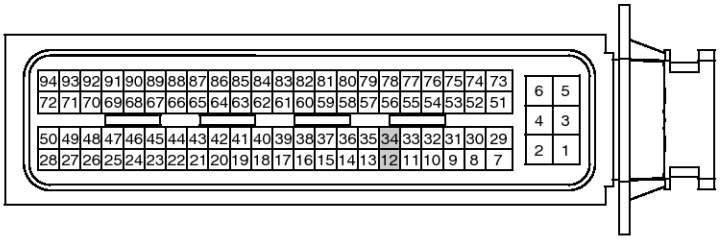
[Connection Information]

Terminal	Connected to	Function
1	ECM CHG-K (34)	KS Signal
2	ECM CHG-K (12)	Sensor Ground

[Harness Connector]



CHG23
Knock Sensor

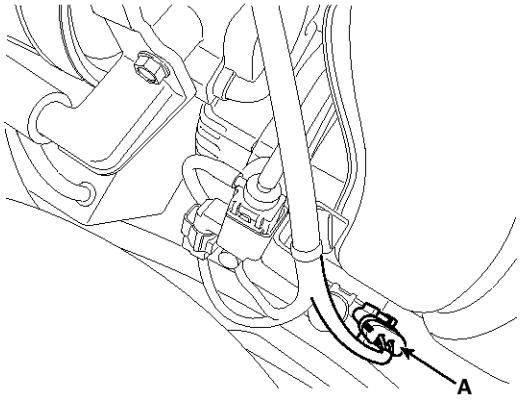


CHG-K
ECM

STFFL1012L

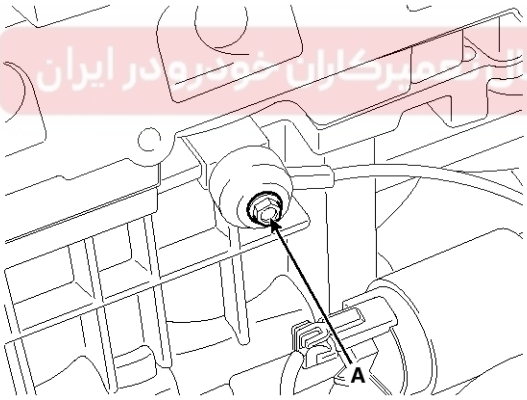
Removal

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.

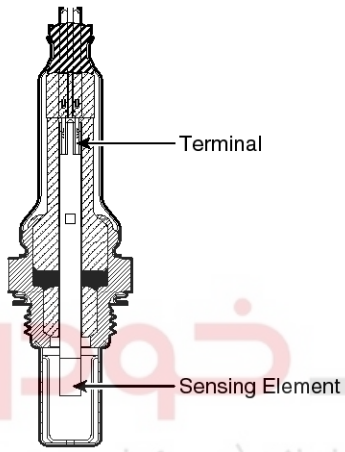
Knock sensor installation bolt:
18.6 ~ 23.5 N.m (1.9 ~ 2.4 kgf.m, 13.7 ~ 17.4 lb-ft)

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

[Except Euro 5]

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

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

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

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

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

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

[Euro 5 only]

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

Item	Specification
Heater Resistance (Ω)	2.5 ~ 4.0 [20℃(68°F)]

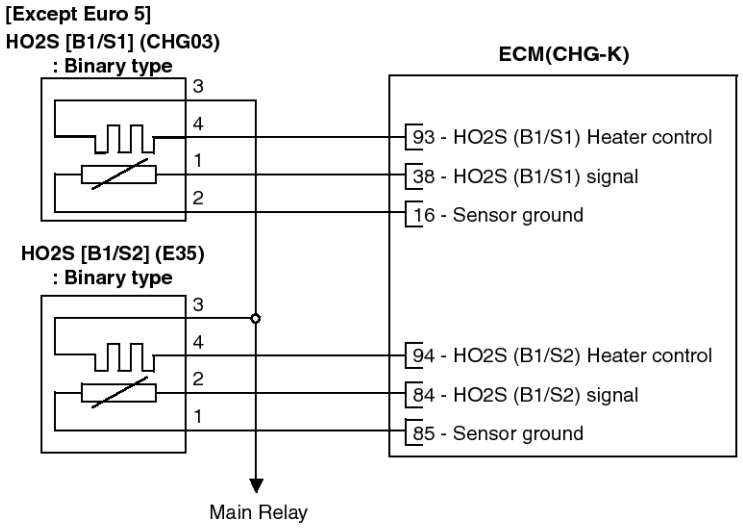
HO2S [Bank 1/Sensor 2] (Binary type)

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

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

Circuit Diagram

[Circuit Diagram]



[Connection Information]

HO2S [B1/S1] (CHG03)

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] (E35)

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]

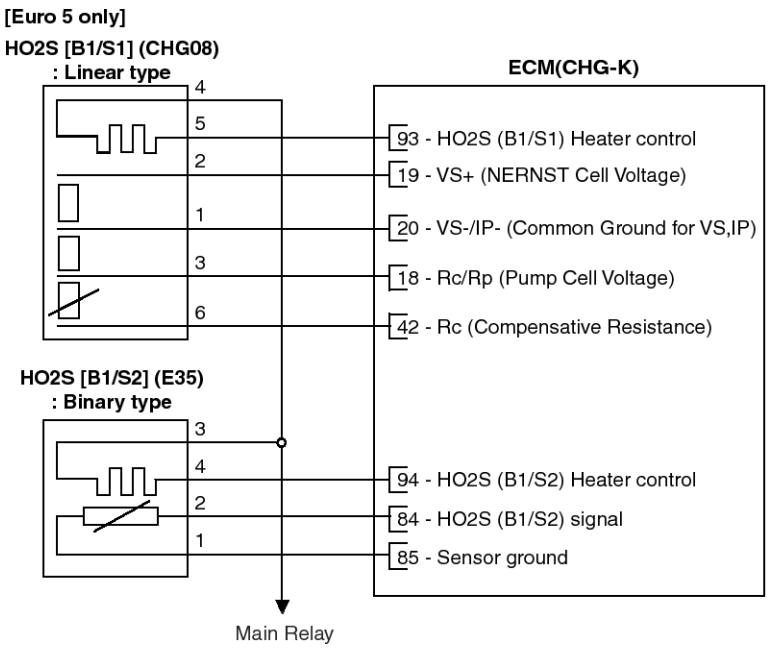
CHG03
HO2S [B1/S1]

E35
HO2S [B1/S2]

CHG-K
ECM

STFFL1013L

[Circuit Diagram]



[Connection Information]

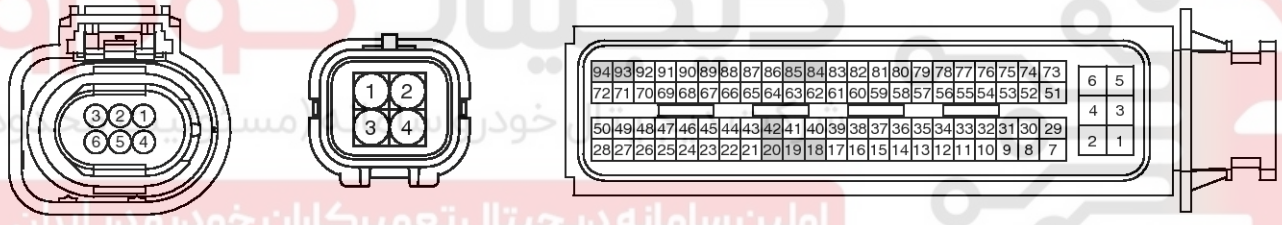
HO2S [B1/S1] (CHG08)

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] (E35)

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]



STFFL1014L

Inspection

1. Turn the ignition switch OFF.
2. Disconnect the HO2S connector.
3. Measure resistance between the HO2S terminals 4 and 5 [B1/S1] (Euro 5 only).

   Measure resistance between the HO2S terminals 3 and 4 [B1/S1] (Except Euro 5).
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”

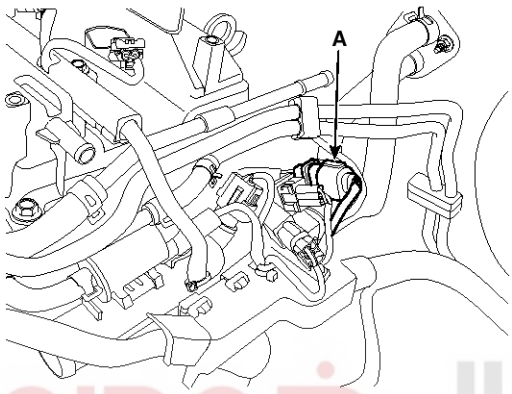
Removal

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

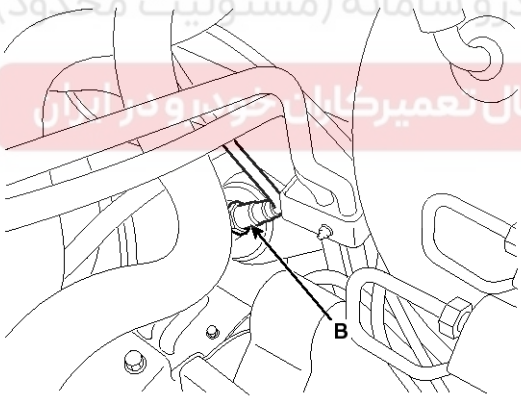
NOTICE

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

[Bank 1 / Sensor 1]

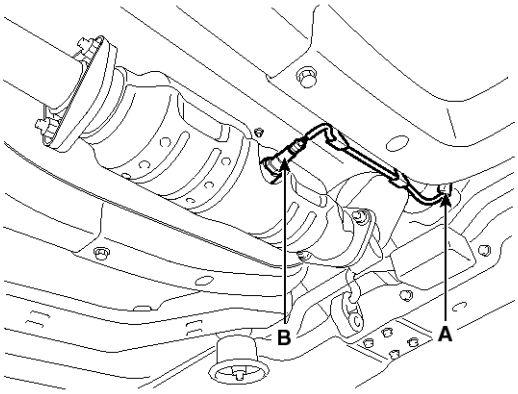


SYFFL0004D



SYFFL0131D

[Bank 1 / Sensor 2]



SYFFL0141D

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).**

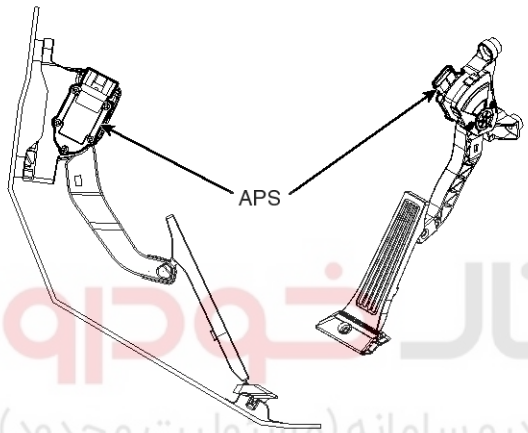
1. Installation is reverse of removal.

Heated oxygen sensor installation:
35 ~ 45 N.m (3.6 ~ 4.6 kgf.m, 25.8 ~ 33.2 lb-ft)

Accelerator Position Sensor (APS)

Description

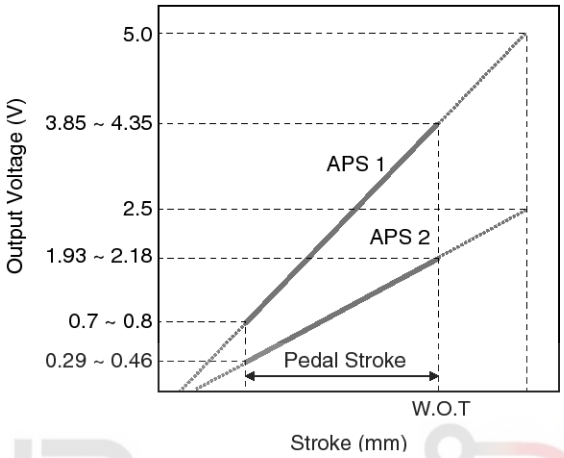
Accelerator Position Sensor (APS) is installed on the accelerator pedal module and detects the rotation angle of the accelerator pedal. The APS is one of the most important sensors in engine control system, so it consists of the two sensors which adapt individual sensor power and ground line. The second 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.



STFFL1007D

Specification

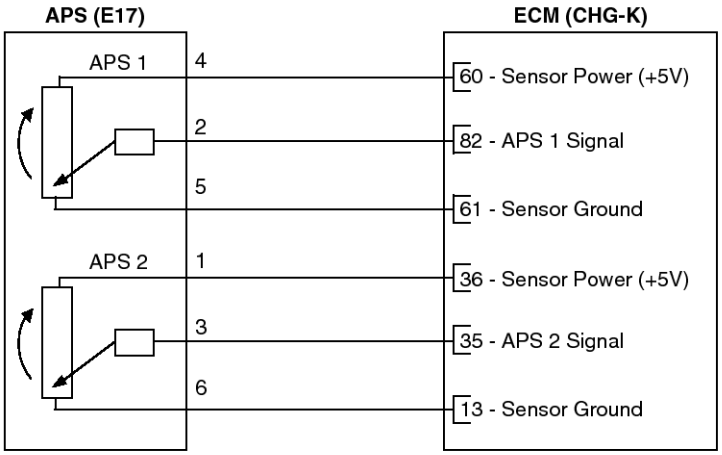
Accelerator Position	Output Voltage (V) [Vref = 5V]	
	APS1	APS2
C.T	0.7 ~ 0.8	0.29 ~ 0.46
W.O.T	3.85 ~ 4.35	1.93 ~ 2.18



SXMF10143L

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]

E17
APS

CHG-K
ECM

STFFL1015L

Inspection

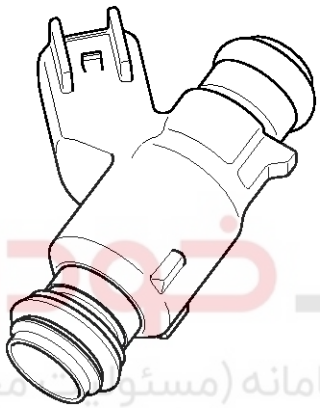
1. Connect the GDS on the Data Link Connector (DLC).
2. Turn the ignition switch ON.
3. Measure the output voltage of the APS 1 and 2 at C.T and W.O.T.

Specification: Refer to “Specification”

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.



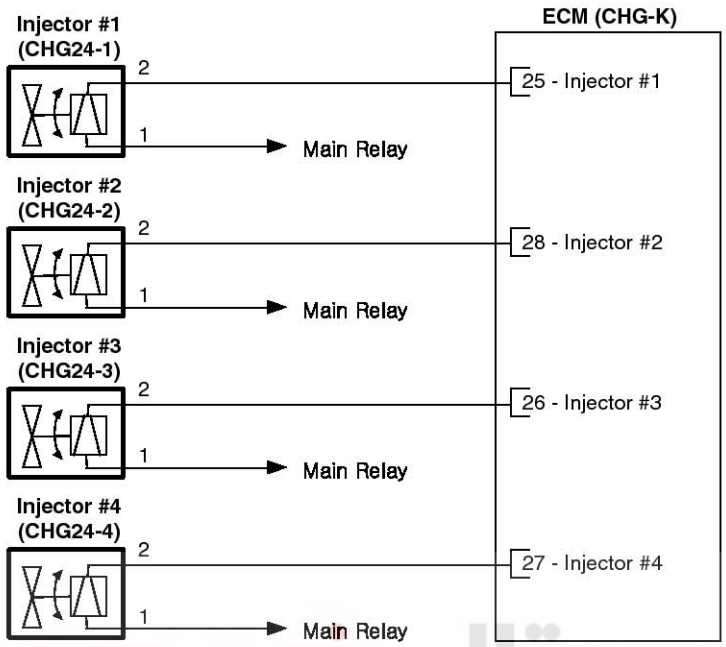
KFCF1026

Specification

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

Circuit Diagram

[Circuit Diagram]



[Connection Information]

Injector #1 (CHG24-1)

Terminal	Connected to	Function
1	Main Relay	Battery Power (B+)
2	ECM CHG-K (25)	Injector #1 Control

Injector #2 (CHG24-2)

Terminal	Connected to	Function
1	Main Relay	Battery Power (B+)
2	ECM CHG-K (28)	Injector #2 Control

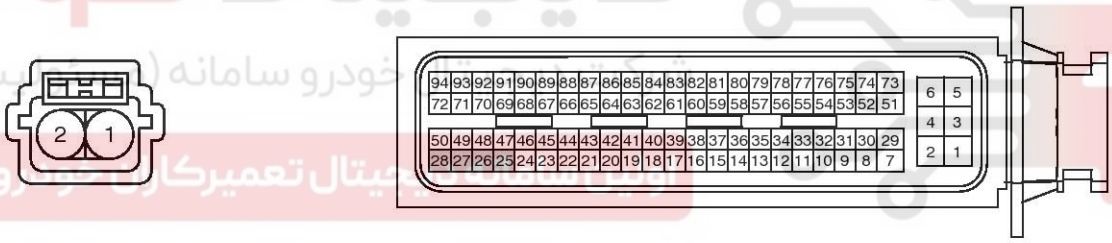
Injector #3 (CHG24-3)

Terminal	Connected to	Function
1	Main Relay	Battery Power (B+)
2	ECM CHG-K (26)	Injector #3 Control

Injector #4 (CHG24-4)

Terminal	Connected to	Function
1	Main Relay	Battery Power (B+)
2	ECM CHG-K (27)	Injector #4 Control

[Harness Connector]



CHG24-1,2,3,4
INJECTOR #1,2,3,4

CHG-K
ECM

STFFL1016L

Inspection

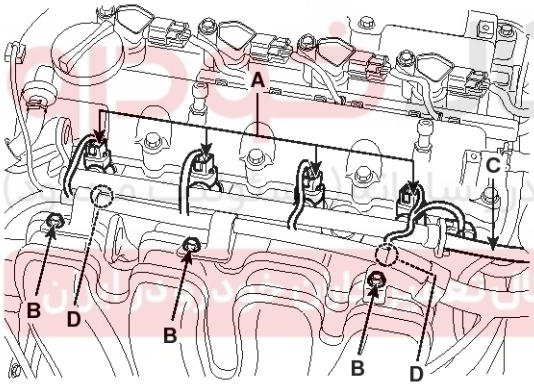
1. Turn the ignition switch OFF.
2. Disconnect the injector connector.
3. Measure resistance between the injector terminals 1 and 2.
4. Check that the resistance is within the specification.

Specification: Refer to “Specification”

Removal

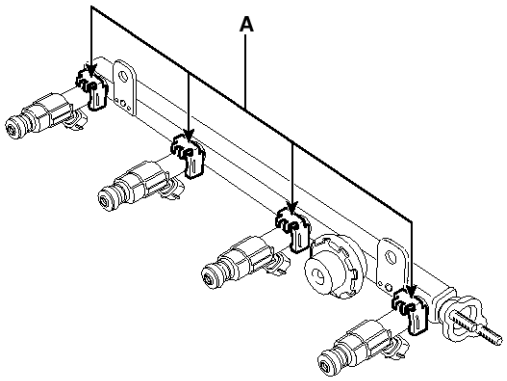
1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Release the residual pressure in fuel line (Refer to “Release Residual Pressure in Fuel Line” in this group).

   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.
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.**

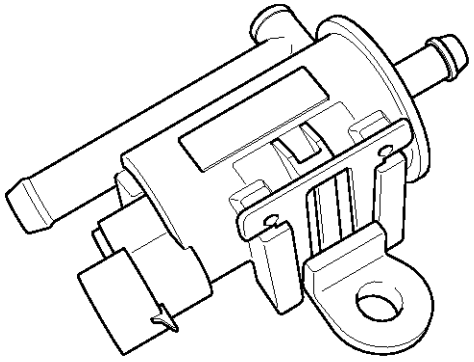
1. Installation is reverse of removal.

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)

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.



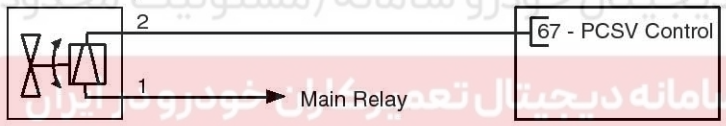
KFCF1028

Specification

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

Circuit Diagram

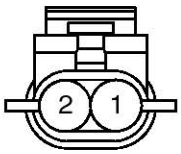
[Circuit Diagram]



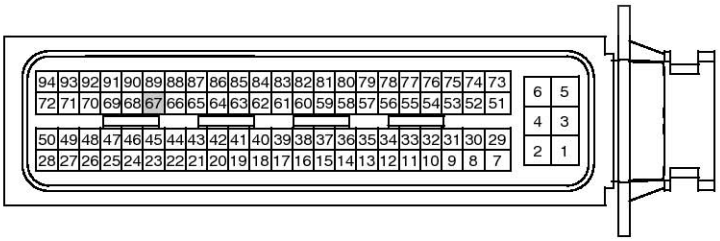
[Connection Information]

Terminal	Connected to	Function
1	Main Relay	Battery Power (B+)
2	ECM CHG-K (67)	PCSV Control

[Harness Connector]



CHG21
PCSV



CHG-K
ECM

STFFL1017L

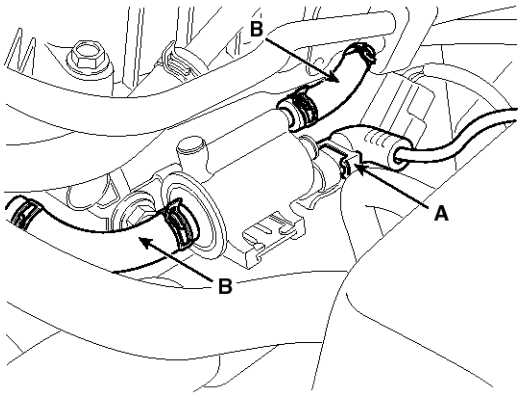
Inspection

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”

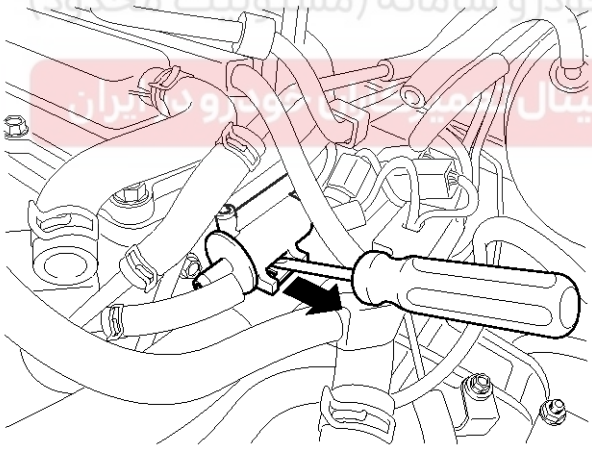
Removal

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.



STFF11006D

4. Remove the valve in the direction of arrow after pressing the center part of the PCSV support bracket with the (-) driver.



STFF11130D

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)

CVVT Oil Control Valve (OCV)

Description

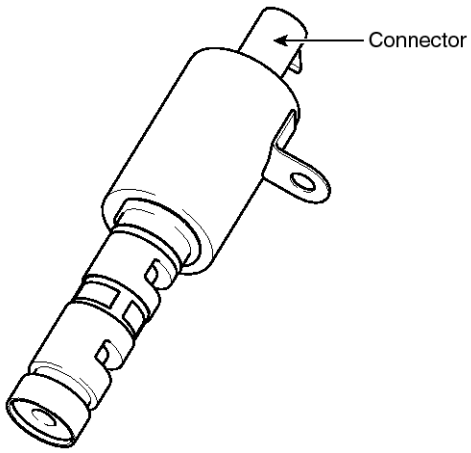
Continuous Variable Valve Timing (CVVT) system advances or retards the valve timing of the intake and exhaust valve in accordance with the ECM control signal which is calculated by the engine speed and load.

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.



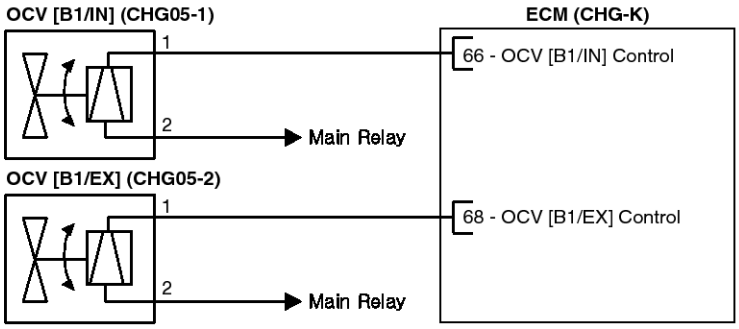
SBKFL9183L

Specification

Item	Specification
Coil Resistance (Ω)	6.9 ~ 7.9 [20℃(68°F)]

Circuit Diagram

[Circuit Diagram]



[Connection Information]

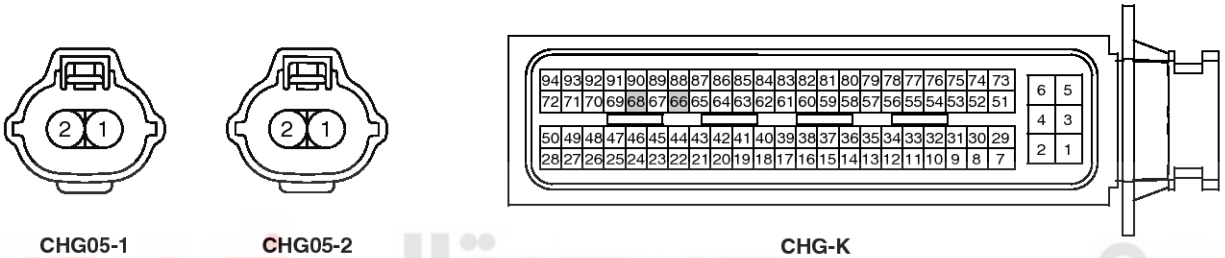
OCV [B1/IN] (CHG05-1)

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

STFFL1018L

Inspection

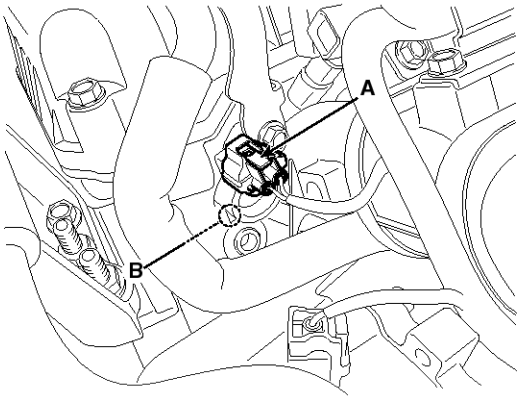
1. Turn the ignition switch OFF.
2. Disconnect the OCV connector.
3. Measure resistance between the OCV terminals 1 and 2.
4. Check that the resistance is within the specification.

Specification: Refer to “Specification”

Removal

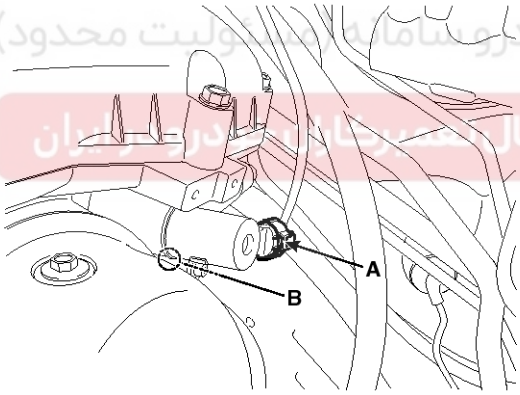
1. Turn the ignition switch OFF and disconnect the battery negative (-) cable.
2. Disconnect the CVVT oil control valve connector (A).
3. Remove the installation bolt (B), and then remove the valve from the engine.

[Bank 1 / Intake]



SXMF19161D

[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.**

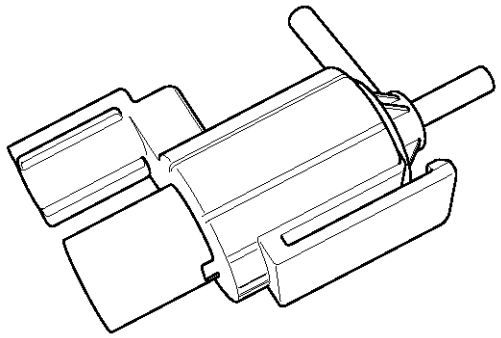
1. Installation is reverse of removal.

CVVT oil control valve installation bolt:
9.8 ~ 11.8 N.m (1.0 ~ 1.2 kgf.m, 7.2 ~ 8.7 lb-ft)

Variable Intake Solenoid (VIS) Valve

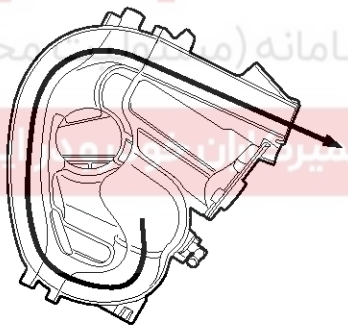
Description

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).

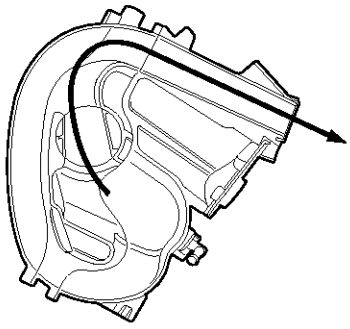


KFCF1029

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

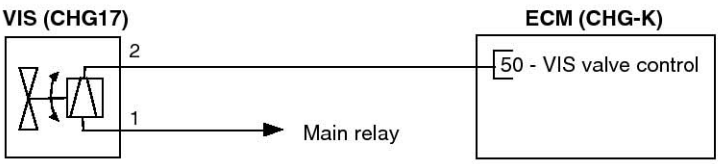
SNFFL9036N

Specification

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

Circuit Diagram

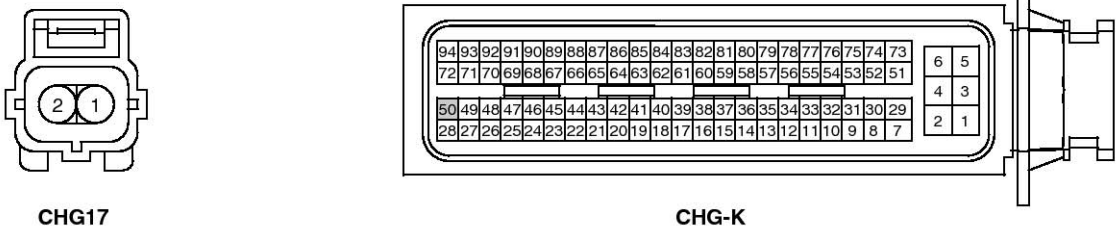
[Circuit Diagram]



[Connection Information]

Terminal	Connected to	Function
1	Main relay	Power supply (B+)
2	ECM CHG-K (50)	VIS valve control

[Harness Connector]



CHG17
VIS VALVE

CHG-K
ECM

STFFL1019L

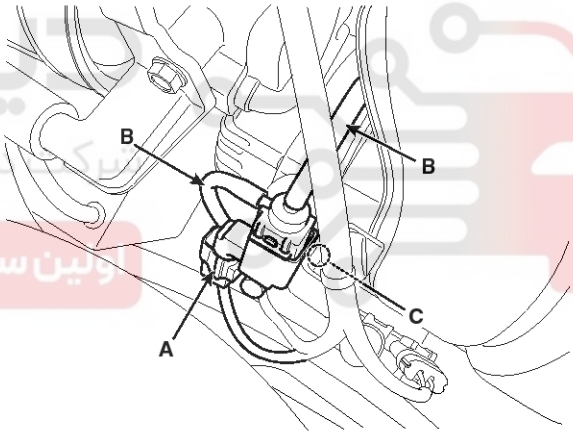
Inspection

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.**

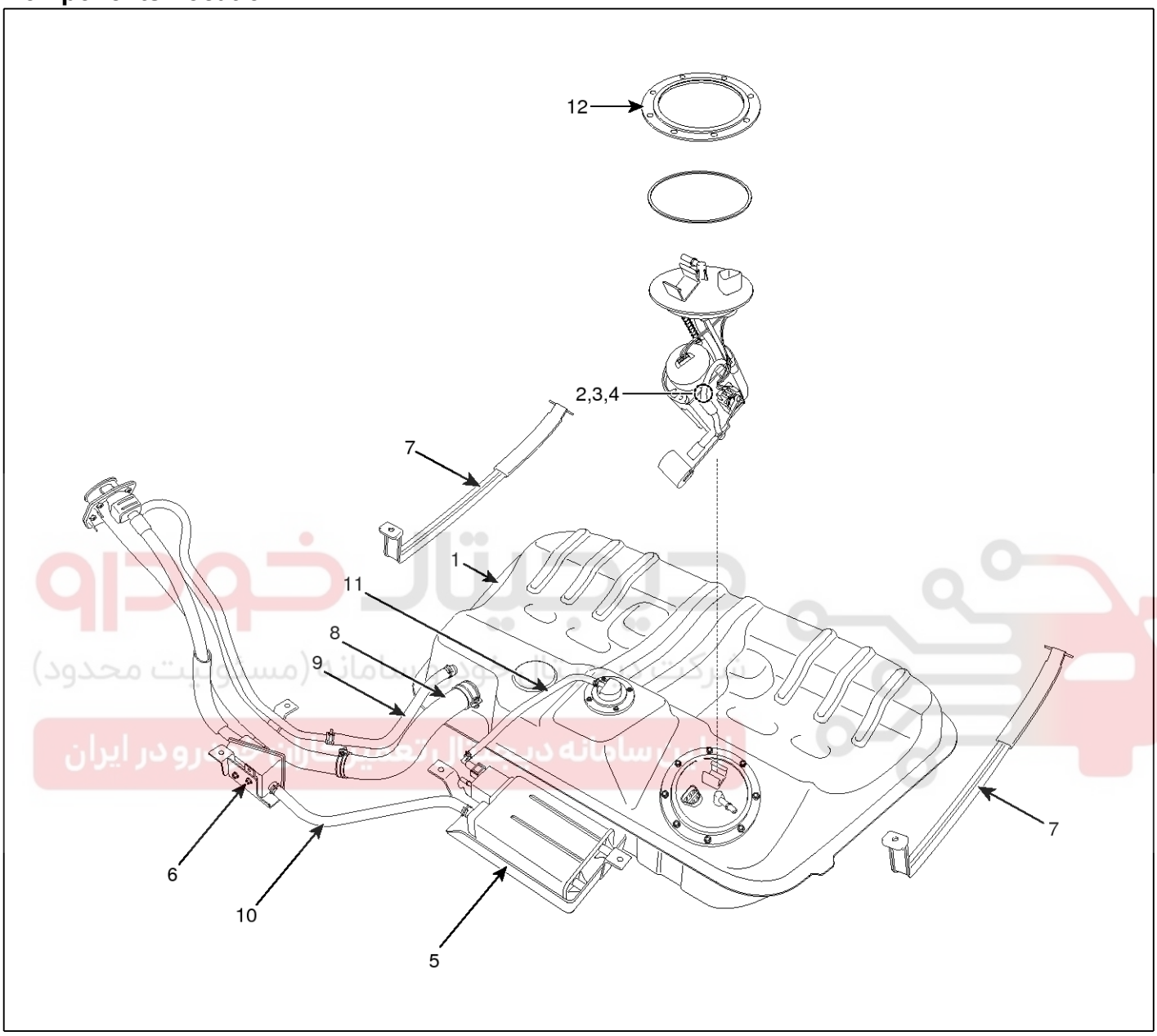
⚠CAUTION

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

1. Installation is reverse of removal.

Fuel Delivery System

Components Location



SYFFL0122L

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

Fuel Pressure Test

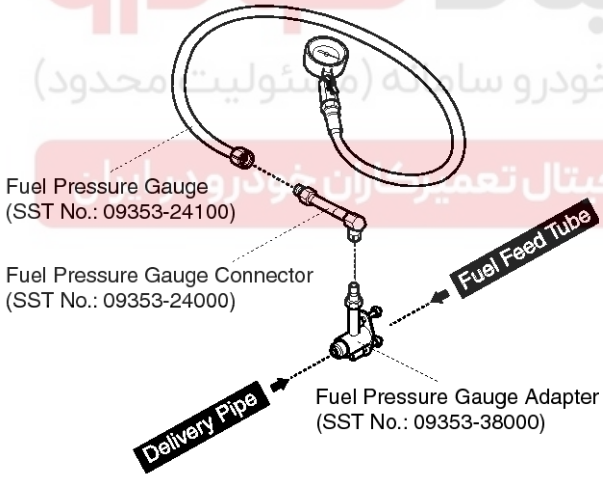
1. Release the residual pressure in fuel line (Refer to “Release Residual Pressure in Fuel Line” in this group).

   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: 343 kPa (3.50 kgf/㎠, 49.7 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.

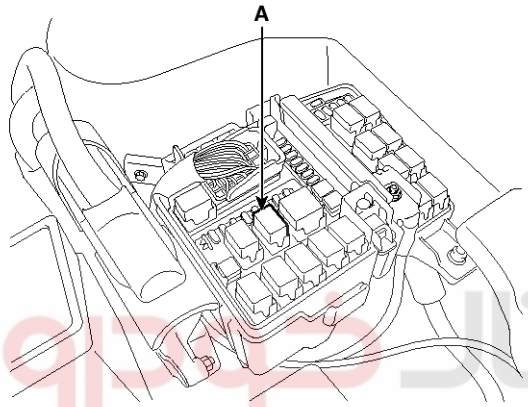
6. Test End
   1) Remove the Special Service Tool (SST) from the fuel feed tube and the delivery pipe.
   2) Connect the fuel feed tube and the delivery pipe.

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).



SYFFL0181D

⚠CAUTION

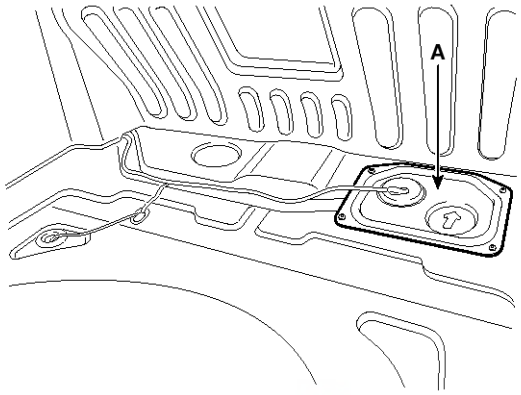
When removing the fuel pump relay, a Diagnostic Trouble Code (DTC) may occur. Delete the code with the GDS after completion of "Release Residual Pressure in Fuel Line" work.

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 Tank

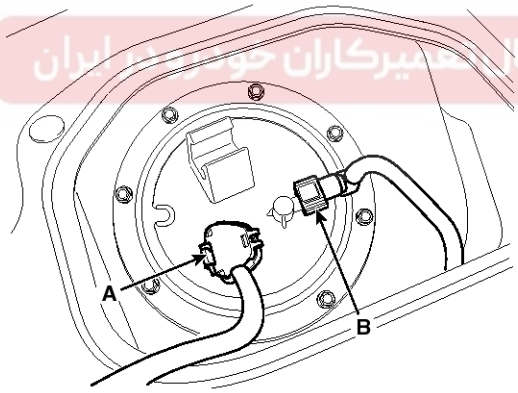
Removal

1. Release the residual pressure in fuel line (Refer to “Release Residual Pressure in Fuel Line” in this group).
2. Open the trunk and remove the floor mat.
3. Remove the fuel pump service cover (A).



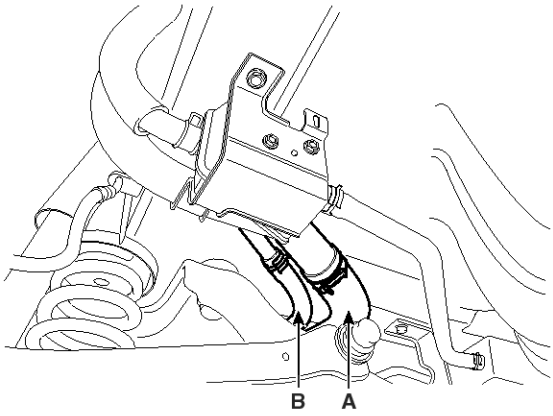
SYFFL0220D

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



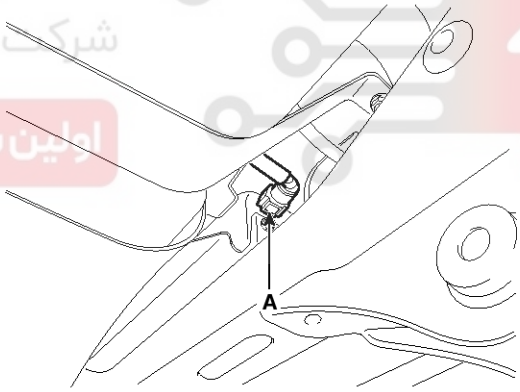
SYFFL0100L

6. Lift the vehicle and support the fuel tank with a jack.
7. Remove the center muffler assembly (Refer to “Intake And Exhaust System” in EM group).
8. Disconnect the fuel filler hose (A) and leveling hose (B).



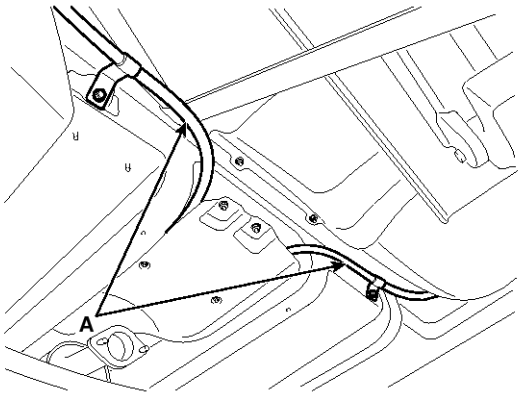
SYFFL0142L

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



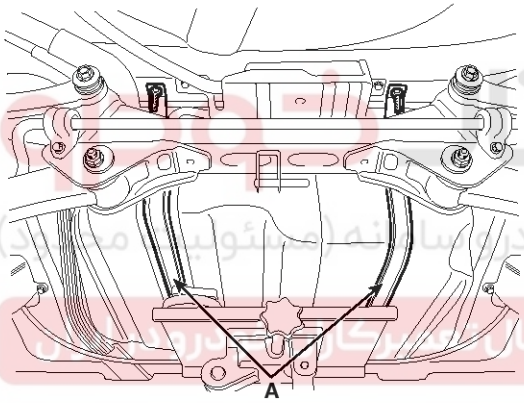
SYFFL0110L

10. Remove the brake line bracket (A).



SYFFL0120L

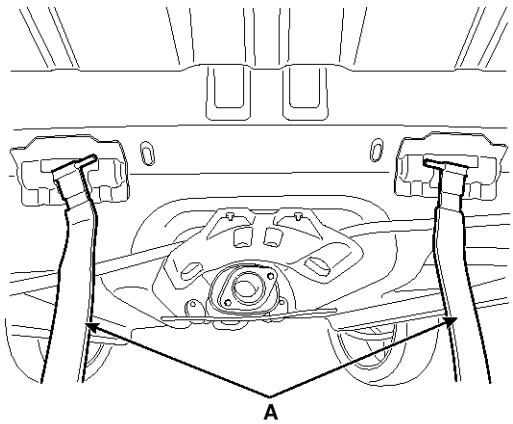
11. Remove the fuel tank from the vehicle after removing the fuel tank band (A).



SYFFL0130L

NOTICE

Remove the fuel tank band as below.



SYFFL0260D

Installation

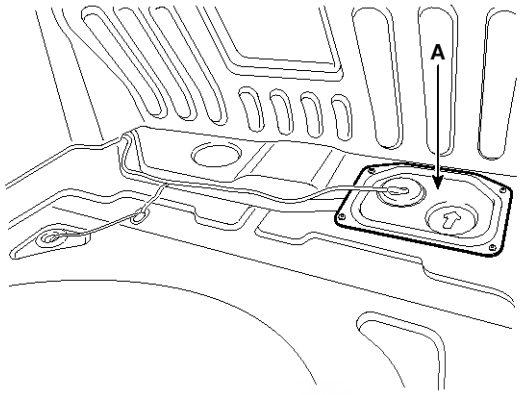
1. Installation is reverse of removal.

Fuel tank band installation nut:
39.2 ~ 54.0 N.m (4.0 ~ 5.5 kgf.m, 28.9 ~ 39.8 lb-ft)

Fuel Pump

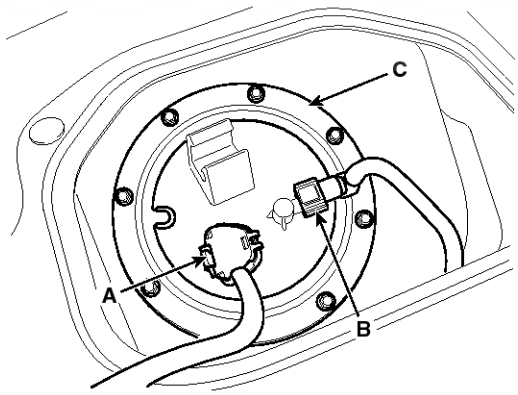
Removal

1. Release the residual pressure in fuel line (Refer to “Release Residual Pressure in Fuel Line” in this group).
2. Open the trunk and remove the floor mat.
3. Remove the fuel pump service cover (A).

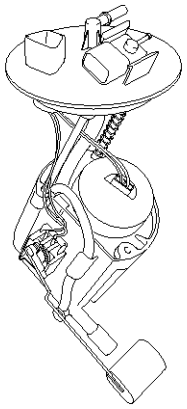


SYFFL0220D

4. Disconnect the fuel pump connector (A).
5. Disconnect the fuel feed tube quick connector (B).
6. Remove the plate cover (C) after removing the installation bolt, and then remove the fuel pump from the fuel tank.



SYFFL0101L



SYFFL0123D

Installation

1. Installation is reverse of removal.

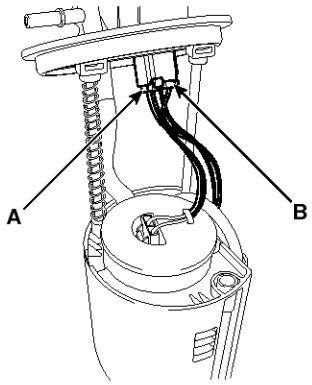
Fuel pump plate cover installation bolt:
2.0 ~ 2.9 N.m (0.2 ~ 0.3 kgf.m, 1.4 ~ 2.2 lb-ft)

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

Fuel Filter

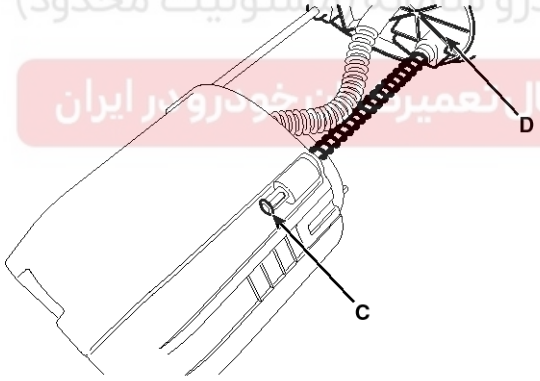
Replacement

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).



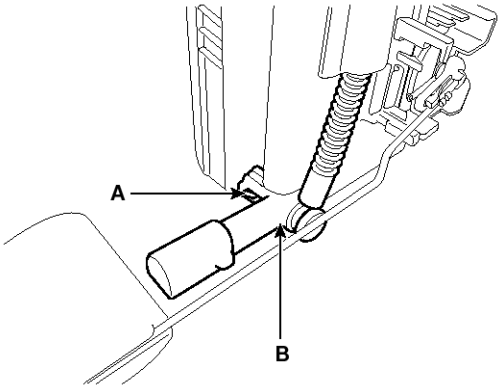
SYFFL0280D

3. Remove the cushion pipe fixing clip (C), and then separate the head assembly (D).



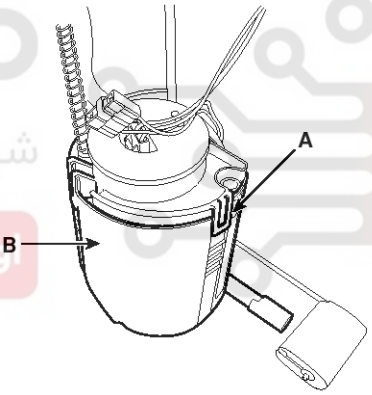
SYFFL0290D

4. Remove the return nozzle (B) after releasing the fixing hook (A).



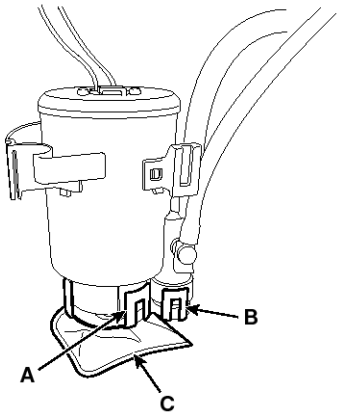
SYFFL0310D

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



SYFFL0300D

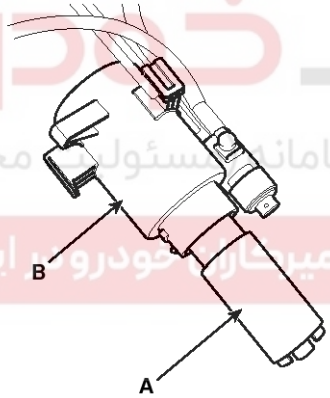
6. Remove the pre-filter (C) after releasing the fixing hooks (A,B).



SYFFL0320D

⚠CAUTION
Be careful of O-ring.

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



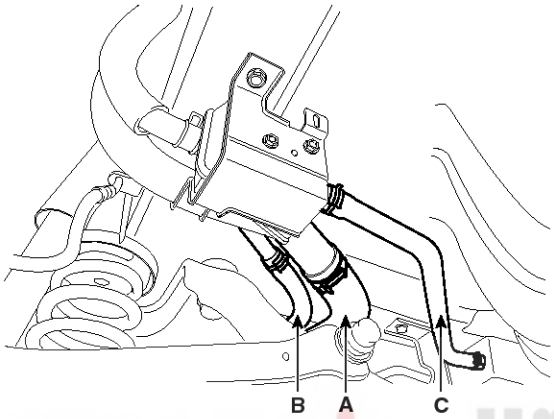
SYFFL0330D

8. Replace new fuel filter.

Filler-Neck Assembly

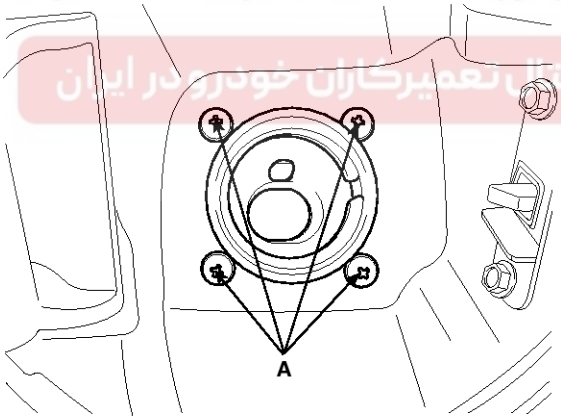
Removal

1. Lift the vehicle.
2. Disconnect the fuel filler hose (A) and the leveling hose (B).
3. Disconnect the ventilation hose (C) from the fuel tank air filter.



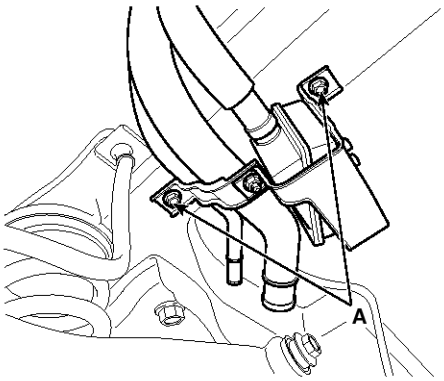
SYFFL0141L

4. Open the fuel filler door and then remove the filler-neck installation screw (A).



SYFFL0024D

5. Remove the rear-LH wheel, tire, and the inner wheel house.
6. Remove the filler-neck assembly from the vehicle after removing the bracket installation bolt (A).



SYFFL0270D

Installation

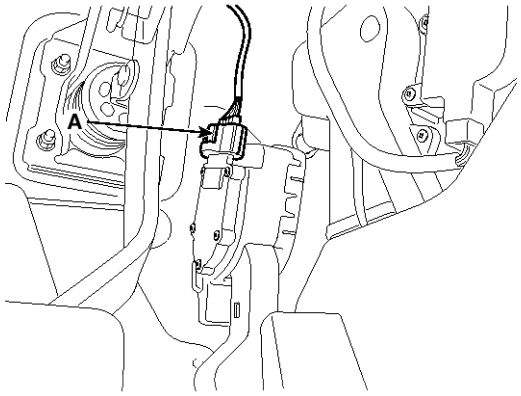
1. Installation is reverse of removal.

Filler-neck assembly bracket installation bolt :
3.9 ~ 5.9 N.m (0.4 ~ 0.6 kgf.m, 2.9 ~ 4.3 lb-ft)

Accelerator Pedal

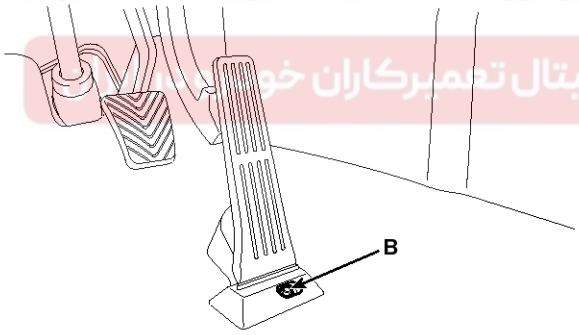
Removal

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

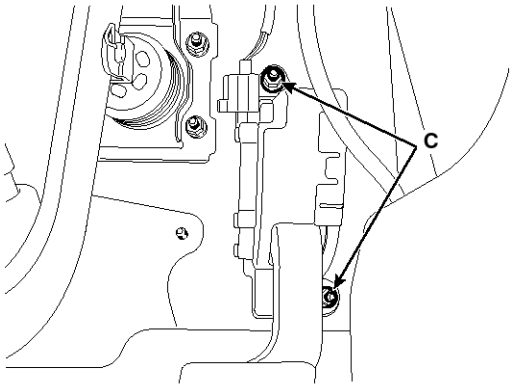


SLMF10409D

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



SXMFL9265D



SLMF10240D

Installation

1. Installation is reverse of removal.

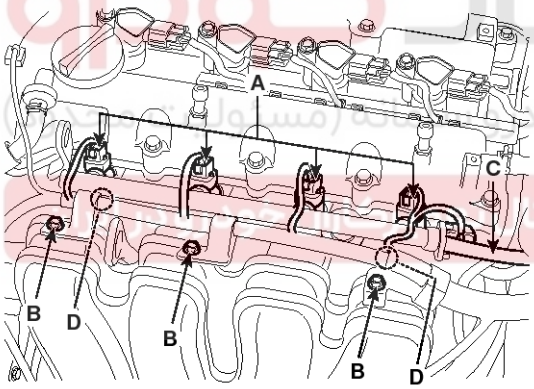
Accelerator pedal module installation bolt:
8.8 ~ 13.7 N.m (0.9 ~ 1.4 kgf.m, 6.5 ~ 10.1 lb-ft)
Accelerator pedal module installation nut:
9.8 ~ 14.7 N.m (1.0 ~ 1.5 kgf.m, 7.2 ~ 10.9 lb-ft)

Delivery Pipe

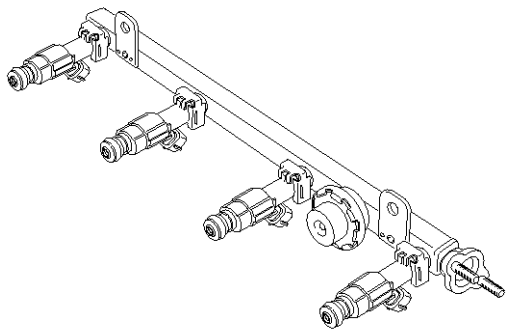
Removal

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)