General Information

Specification

Ignition System

Iestm		Specification
Ignition coil	Primary resistance	0.715 ± 15% Ω
	Secondary resistance	-
Spark plugs	NGK	ILFR5B11
	Plugs Gap	1.0 ~ 1.1 mm (0.0394 ~ 0.0433 in)

Starting System

Items			Specification
Starter	Rated voltage		12 V, 1.2 kW
	No. of pinion teeth		8
	No-load characteristics	Voltage	11.5 V
		Ampere	90A, MAX
		Speed	2,600 rpm, MIN

Charging System

Items		Specification
Generator	Type	Battery voltage sensing
	Rate voltage	13.5 V, 130A
	Speed in use	1,000 ~ 18,000 rpm
	Voltage regulator	I.C Reg built-in type
	Regulator setting voltage	14.2 ~ 14.8V
Battery	Type	54 - 26 GL
	Cold cranking amperage [at -18˚C(-0.4˚F)]	600 A
	Reserve capacity	110 min
	Specific gravity [at 20˚C(68˚F)]	1.280 ± 0.01

NOTICE

- *COLD CRANKING AMPERAGE is the amperage a battery can deliver for 30 seconds and maintain a terminal voltage of 7.2V or greater at a specified temperature.*
- *RESERVE CAPACITY RATING is amount of time a battery can deliver 25A and maintain a minimum terminal voltage of 10.5V at 26.7˚C(80.1˚F).*

• Battery type notation: □□ - □□ □ □
① ② ③ ④

① : 5HR capacity
② : Battery length
③ : Battery width
④ : Terminal location

SGKEE8100N

Trouble Shooting

Ignition System

Symptom	Suspect area	Remedy
Engine will not start or is hard to start (Cranks OK)	Ignition lock switch	Inspect ignition lock switch, or replace as required
	Ignition coil	Inspect ignition coil, or replace as required
	Spark plugs	Inspect spark plugs, or replace as required
	Ignition wiring disconnected or broken	Repair wiring, or replace as required
Rough idle or stalls	Ignition wiring	Repair wiring, or replace as required
	Ignition coil	Inspect ignition coil, or replace as required
Engine hesitates/poor acceleration	Spark plugs and spark plug cables	Inspect spark plugs / cable, or replace as required
	Ignition wiring	Repair wiring, or replace as required
Poor mileage	Spark plugs and spark plug cables	Inspect spark plugs / cable, or replace as required

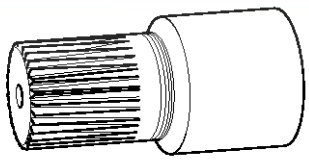
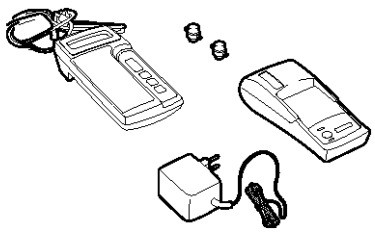
Charging System

Symptom	Suspect area	Remedy
Charging warning indicator does not light with ignition switch "ON" and engine off.	Fuse blown	Check fuses
	Light burned out	Replace light
	Wiring connection loose	Tighten loose connection
	Electronic voltage regulator	Replace voltage regulator
Charging warning indicator does not go out with engine running. (Battery requires frequent recharging)	Drive belt loose or worn	Adjust belt tension or replace belt
	Battery cable loose, corroded or worn	Inspect cable connection, repair or replace cable
	Electronic voltage regulator or alternator	Replace voltage regulator or alternator
	Wiring	Repair or replace wiring
Overcharge	Electronic voltage regulator	Replace voltage regulator
	Voltage sensing wire	Repair or replace wiring
Discharge	Drive belt loose or worn	Adjust belt tension or replace belt
	Wiring connection loose or short circuit	Inspect wiring connection, repair or replace wiring
	Electronic voltage regulator or alternator	Replace voltage regulator or alternator
	Poor grounding	Inspect ground or repair
	Worn battery	Replace battery

Starting System

Symptom	Suspect area	Remedy
Engine will not crank	Battery charge low	Charge or replace battery
	Battery cables loose, corroded or worn out	Repair or replace cables
	Transaxle range switch (Vehicle with automatic transaxle only)	Refer to TR group-automatic transaxle
	Fuse blown	Replace fuse
	Starter motor faulty	Replace
	Ignition switch faulty	Replace
Engine cranks slowly	Battery charge low	Charge or replace battery
	Battery cables loose, corroded or worn out	Repair or replace cables
	Starter motor faulty	Replace
Starter keeps running	Starter motor	Replace
	Ignition switch	Replace
Starter spins but engine will not crank	Short in wiring	Repair wiring
	Pinion gear teeth broken or starter motor	Replace
	Ring gear teeth broken	Replace fly wheel or torque converter

Special Service Tools

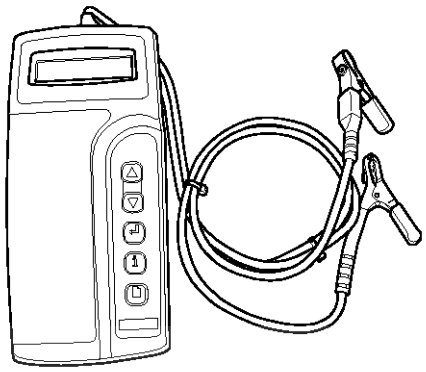
Tool (Number and name)	Illustration	Use
Alternator pulley remover wrench		Removal and installation of alternator pulley
Micro-570 Battery checker		- Check the battery condition - Chdck the charging and starting (Using with Thermal Printer_182-003A)

The Micro 570 Analyzer

The Micro 570 Analyzer provides the ability to test the charging and starting systems, including the battery, starter and alternator.

⚠CAUTION

Because of the possibility of personal injury, always use extreme caution and appropriate eye protection when working with batteries.



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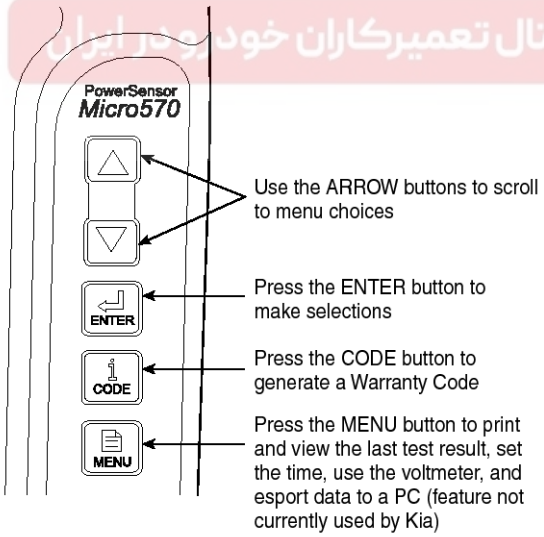
Keypad

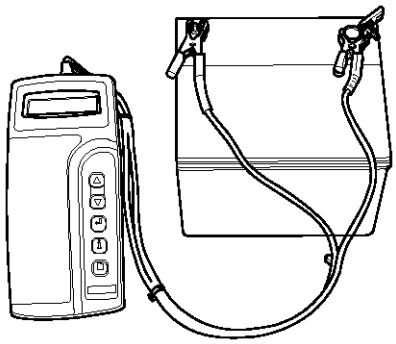
The Micro 570 button on the key pad provide the following functions :



LBGE012A

Battery Test Procedure

1. Connect the tester to the battery.
   - Red clamp to battery positive (+) terminal.
   - Black clamp to battery negative (-) terminal.

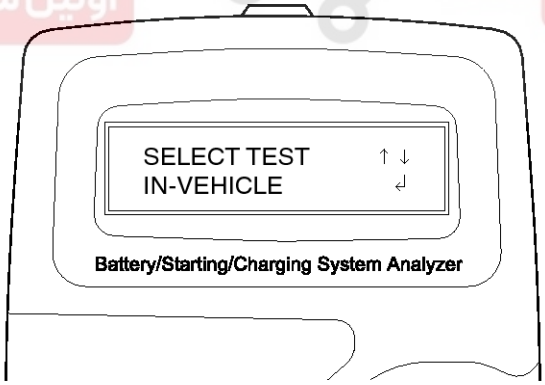


EBKD001C

⚠CAUTION

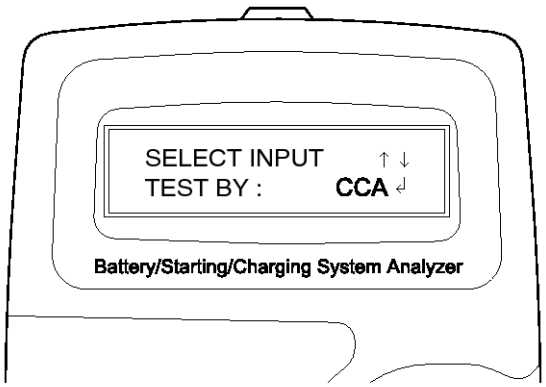
Connect clamps securely. If "CHECK CONNECTION" message is displayed on the screen, reconnect clamps securely.

2. The tester will ask if the battery is connected "IN-VEHICLE" or "OUT-OF-VEHICLE". Make your selection by pressing the arrow buttons; then press ENTER.



SXMEE9129D

3. Select CCA and press the ENTER button.

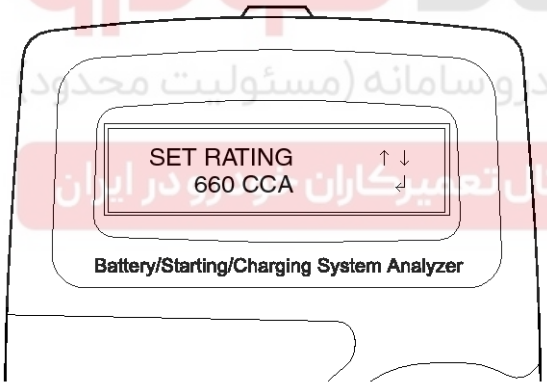


SXMEE9130D

NOTICE

CCA : Cold cranking amps, is an SAE specification for cranking batteried at -0.4˚F (-18˚C).

4. Set the CCA value displayed on the screen to the CCA value marked on the battery label by pressing up and down buttons and press ENTER.

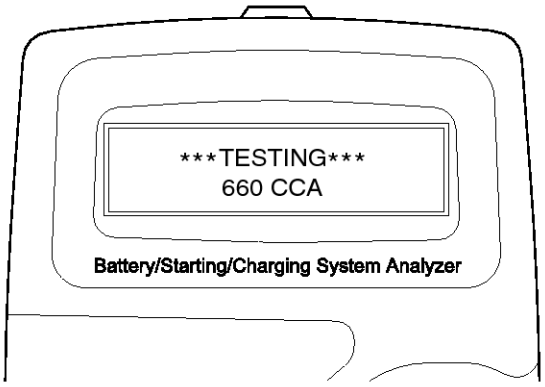


EBKD001F

NOTICE

The battery ratings(CCA) displayed on the tester must be identical to the ratings marked on battery label.

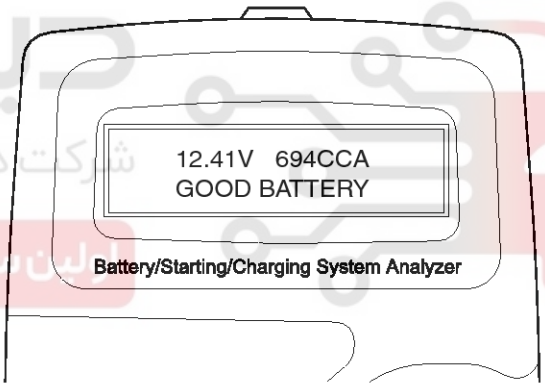
5. The tester will conduct battery test.



SXMEE9131D

6. The tester displays battery test results including voltage and battery ratings.

   Refer to the following table and take the appropriate action as recommended by the Micro 570.



SXMEE9132D

Battery Test Results

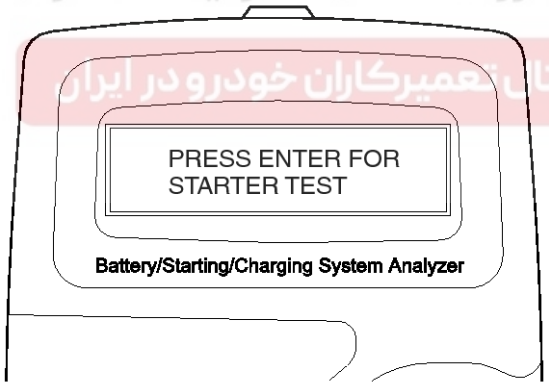
Result On Printer	Remedy
GOOD BATTERY	No action is required.
GOOD RECHARGE	Battery is in a good state. Recharge the battery and use.
CHARGE & RETEST	Battery is not charged properly. - Charge and test the battery again. (Failure to charge the battery fully may read incorrect measurement value.)
REPLACE BATTERY	Replace battery and recheck the charging system. - Improper connection between battery and vehicle cables may cause "REPLACE BATTERY", retest the battery after removing cables and connecting the tester to the battery terminal directly prior to replacing the battery.
BAD CELL-REPLACE	Charge and retest the battery. - If the Micro 570 recommends "REPLACE BATTERY", replace the battery and recheck the charging system.

WARNING

Whenever filing a claim for battery, the print out of the battery test results must be attached.

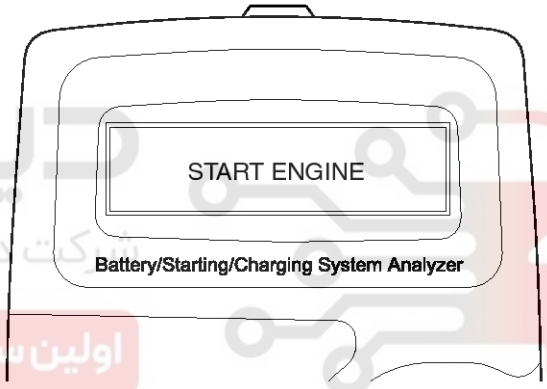
Starter Test Procedure

7. After the battery test, press ENTER immediately for the starter test.



EBKD001H

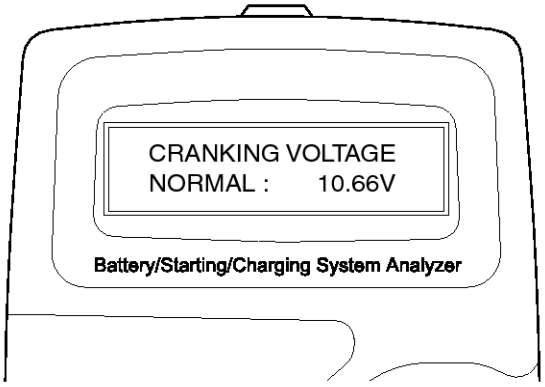
8. Start the engine.



EBKD001I

9. Cranking voltage and starter test results will be displayed on the screen.

   Refer to the following table and take the appropriate action as recommended by the Micro 570.



SXMEE9133D

Starter Test Results

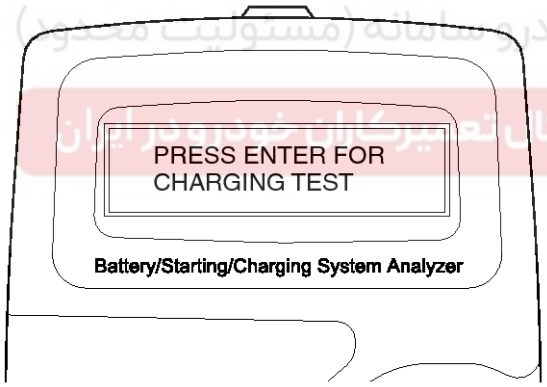
Result On Printer	Remedy
CRANKING VOLTAGE NORM-AL	System shows a normal starter draw.
CRANKING VOLTAGE LOW	Cranking voltage is lower than normal level. - Check starter.
CHARGE BATTERY	The state of battery charge is too low to test. - Charge the battery and retest.
REPLACE BATTERY	Replace battery. - If the vehicle is not started though the battery condition of "GOOD BATTERY" is di-splayed, check wiring for open circuit, battery cable connection, starter and repair or replace as necessary. - If the engine does crank, check fuel system.

NOTICE

When testing the vehicle with old diesel engines, the test result will not be favorable if the glow plug is not heated. Conduct the test after warming up the engine for 5 minutes.

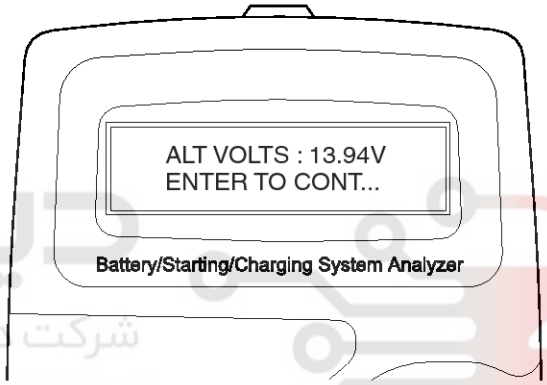
Charging System Test Procedure

10. Press ENTER to begin charging system test.



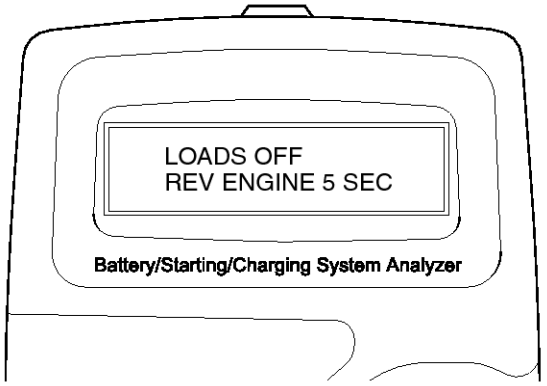
EBKD001K

11. The tester displays the actual voltage of alternator. Press ENTER to continue.

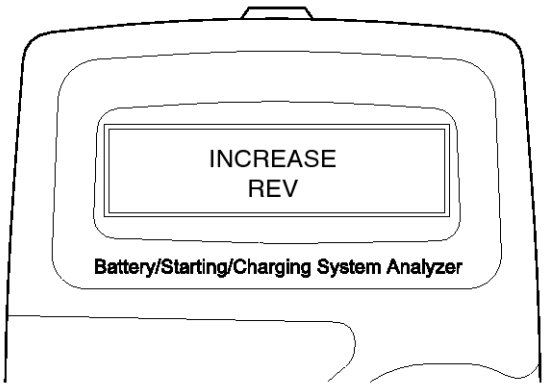


EBKD001L

12. Turn off all electrical load and rev engine for 5 seconds with pressing the accelerator pedal. (Follow the instructions on the screen)



EBKD001M



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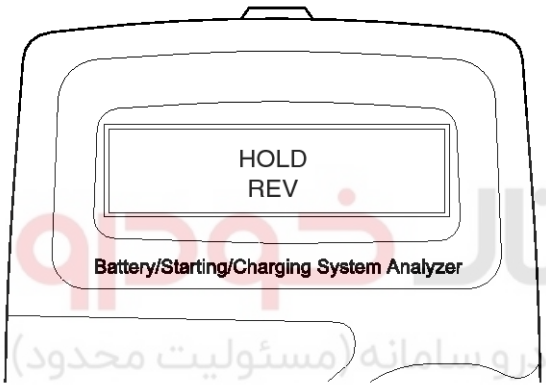
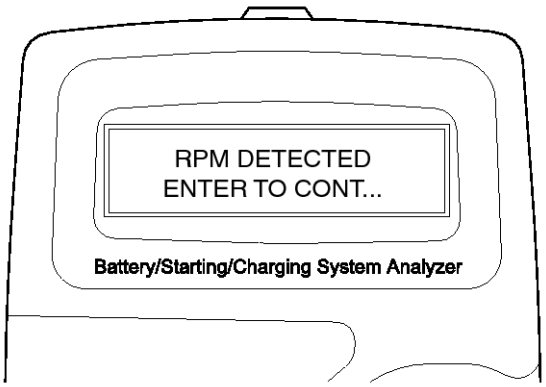


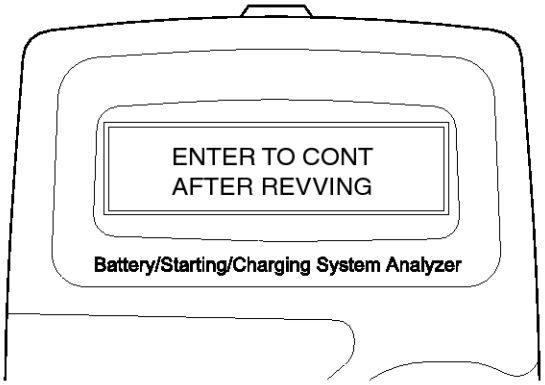
SXMEE9135D

13. The message that engine RPM is detected will be displayed on the screen. Press ENTER to continue.



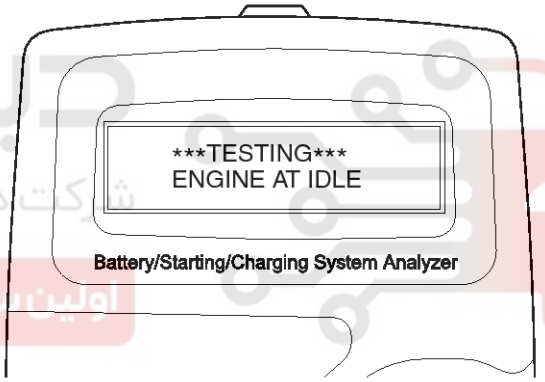
SXMEE9136D

14. If the engine RPM is not detected, press ENTER after revving engine.

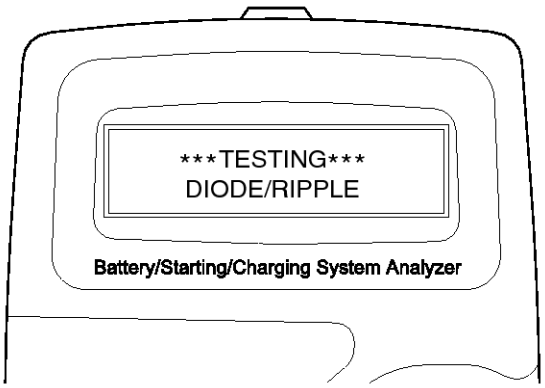


SXMEE9137D

15. The tester will conduct charging system test during loads off.

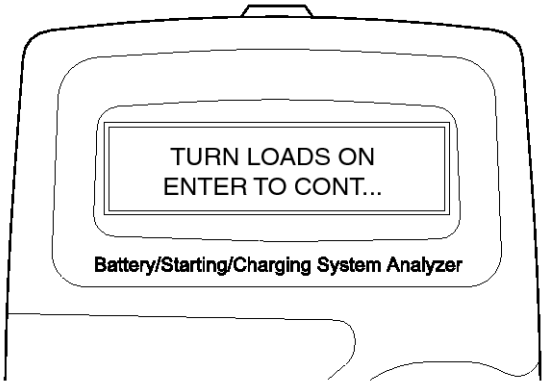


EBKD001O



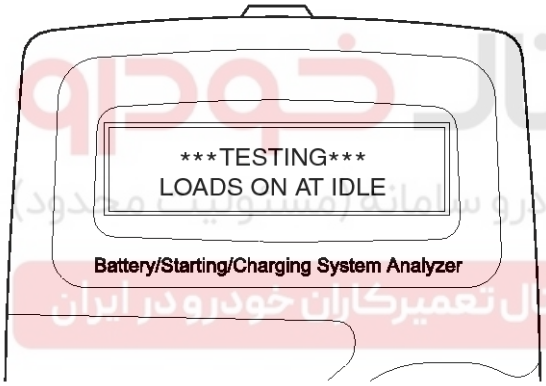
SXMEE9138D

16. Turn on electrical loads (air conditioner, lamps, audio and etc). Press ENTER to continue.



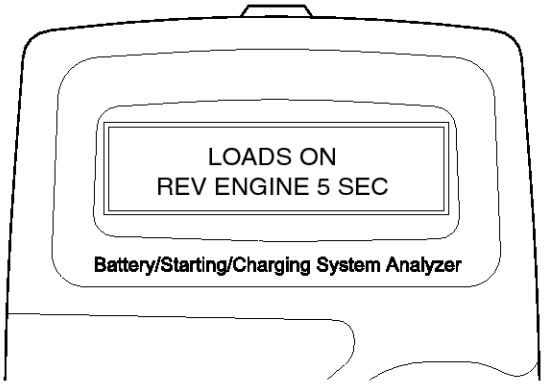
SXMEE9139D

17. The tester will conduct charging system test during loads on.

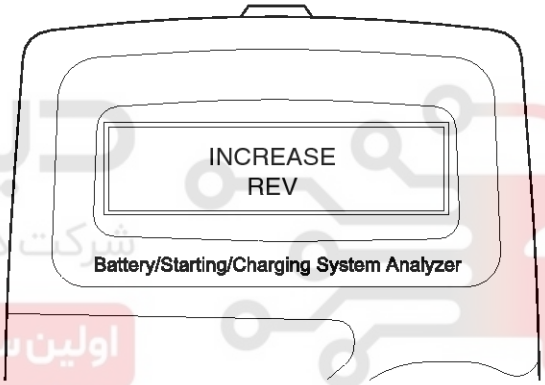


SXMEE9140D

18. Rev engine for 5 seconds with pressing the accelerator pedal. (Follow the instructions on the screen)



SXMEE9141D



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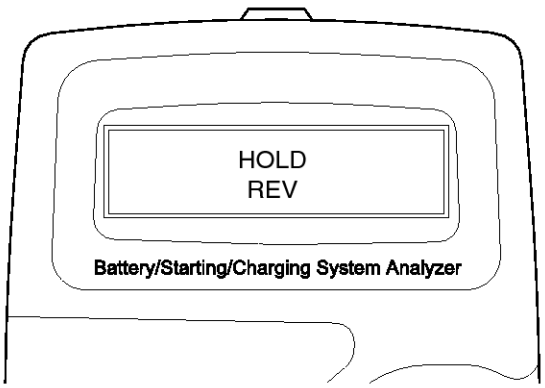
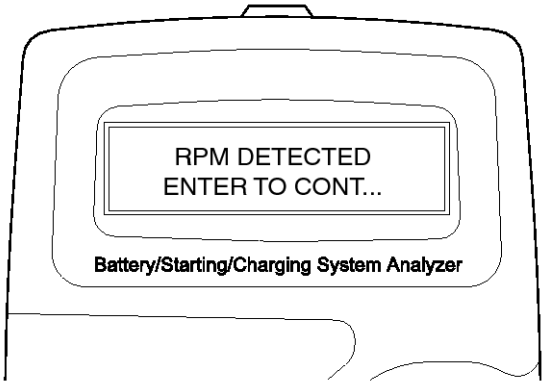


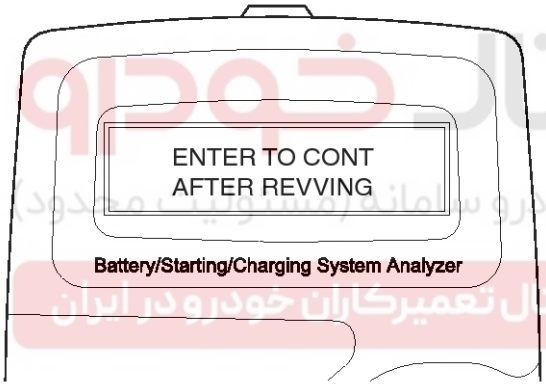
SXMEE9143D

19. The message that engine RPM is detected will be displayed on the screen. Press ENTER to continue.



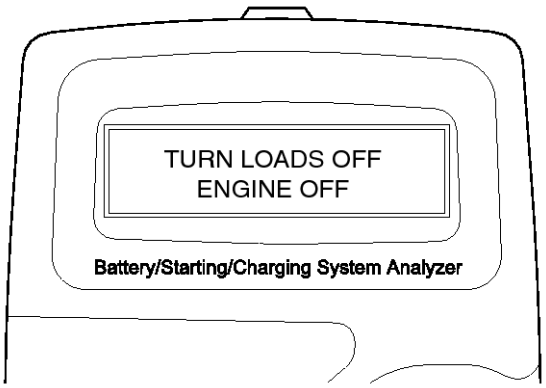
SXMEE9144D

20. If the engine RPM is not detected, press ENTER after revving engine.



SXMEE9145D

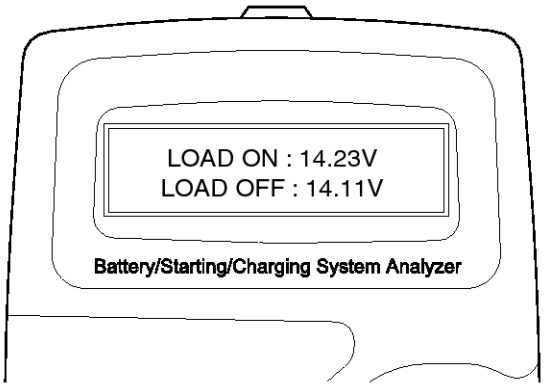
21. Turn off electrical loads (air conditioner, lamps, audio and etc). Turn the engine off.



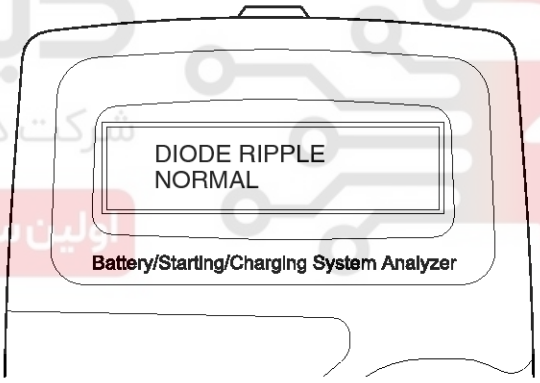
SXMEE9146D

22. Charging voltage and charging system test results will be displayed on the screen.

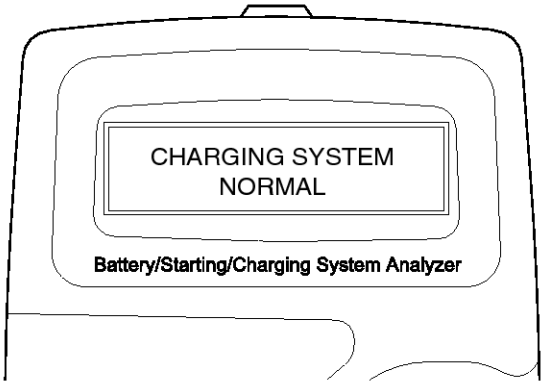
Shut off engine end disconnect the tester clamps from the battery. Refer to the following table and take the appropriate action as recommended by the Micro 570.



SXMEE9147D



EBKD001P



SXMEE9148D

Charging System Test Results

Result On Printer	Remedy
CHARGING SYSTEM NORMAL / DIODE RIPPLE NORMAL	Charging system is normal.
NO CHARGING VOLTAGE	Alternator does not supply charging current to battery. - Check belts, connection between alternator and battery and replace belts or cable or alternator as necessary.
LOW CHARGING VOLTAGE	Alternator does not supply charging current to battery and electrical load to system fully. - Check belts and alternator and replace as necessary.
HIGH CHARGING VOLTAGE	The voltage from alternator to battery is higher than normal limit during voltage regulating. - Check connection and ground and replace regulator as necessary. - Check electrolyte level in the battery.
EXCESS RIPPLE DETECTED	One or more diodes in the alternator is not functioning properly. - Check alternator mounting and belts and replace as necessary.

Ignition System

Description

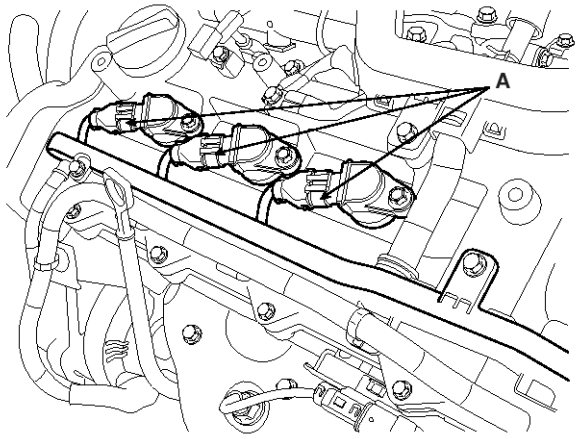
Ignition timing is controlled by the electronic control ignition timing system. The standard reference ignition timing data for the engine operating conditions are preprogrammed in the memory of the ECM (Engine Control Module).

The engine operating conditions (speed, load, warm-up condition, etc.) are detected by the various sensors. Based on these sensor signals and the ignition timing data, signals to interrupt the primary current are sent to the ECM. The ignition coil is activated, and timing is controlled.

Removal

Ignition Coil

1. Remove the engine cover.
2. Remove the ignition coil (A).



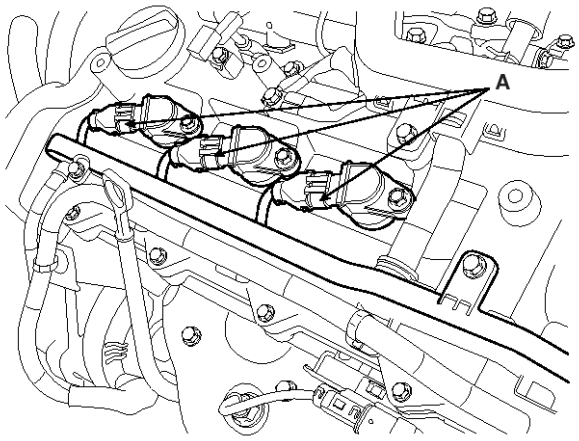
KCBF156A

3. Remove the ignition coil.
4. Installation is the reverse of removal.

Replacement

Spark Plug

1. Remove the ignition coil connector(A).



KCBF156A

2. Remove the ignition coil.
3. Using a spark plug socket, remove the spark plug.

⚠CAUTION

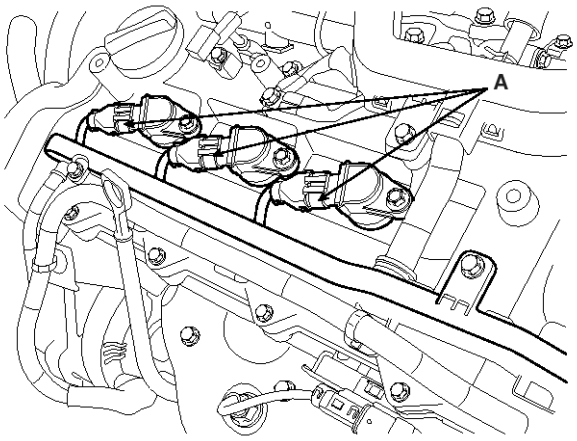
Be careful that no contaminants enter through the spark plug holes

4. When replacing the spark plug, always use the long reach type spark plug.
   1) Color Marking (Tip)
      - [2.7L]
        Unleaded : Yellow Marking
        Leaded : Green Marking
   2) Length(Tip-Tip / PT Length)
      - [2.7L]
      - 83.2mm/ 26.5mm
      - Others: The length is different from the specification above.
   3) Part ID
      - [U2.7]
        L nleaded : ILFR5B11
        Leaded : LFR5A

On-vehicle Inspection

Spark Test

1. Remove the ignition coil connector(A).



KCBF156A

NOTICE

Disconnect the iguition coil connector while pulling up tre connector lock.

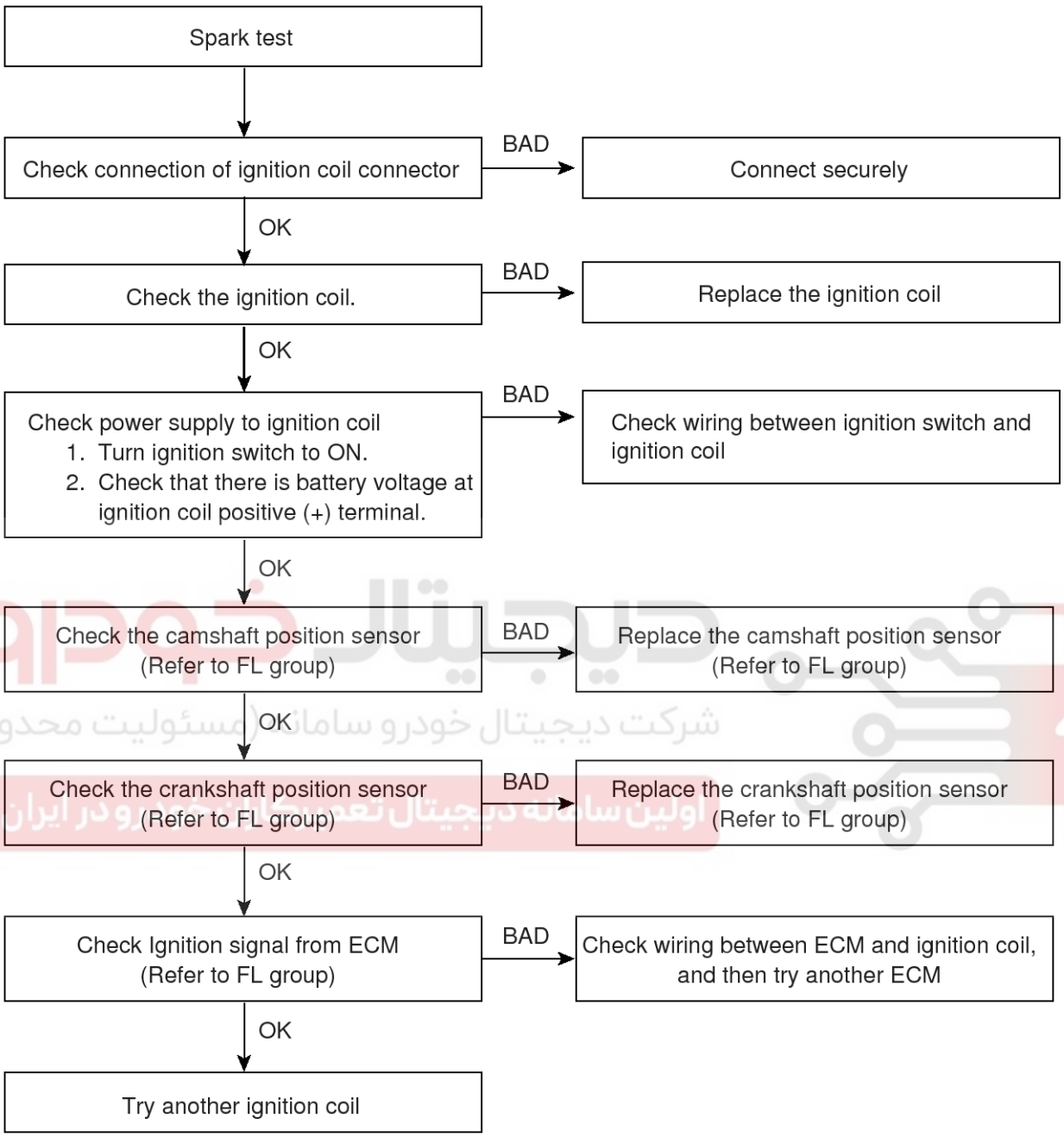
2. Remove the ignition coil.
3. Using a spark plug socket, remove the spark plug.
4. Install an appropriate test device.
5. Check is spark occurs while engine is being cranked.

NOTICE

To prevent fuel being injected from injectors while the engine is being cranked, remove the fuel pump(A) relay from the fuse box.

Crank the engine for no more than 5 ~ 10 seconds.

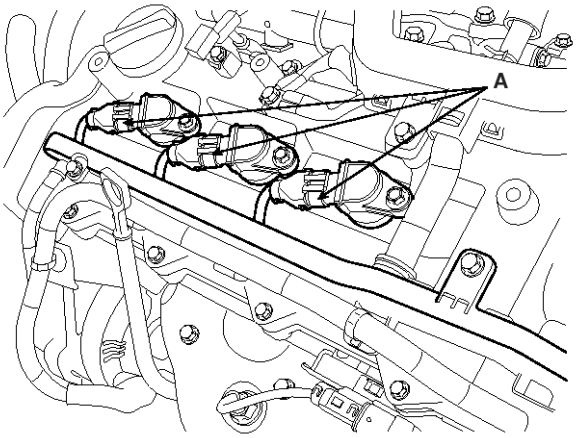
6. Inspect all the spark plugs.
7. Using a spark plug socket, install the spark plug.
8. Install the ignition coil.
9. Reconnect the ignition coil connector.



EBRF001A

Inspect Spark Plug

1. Remove the ignition coil connector(A).

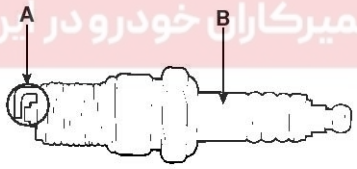


KCBF156A

2. Remove the ignition coil.
3. Using a spark plug socket, remove the spark plug.

⚠CAUTION
Be careful that no contaminates enter through the spark plug holes.

4. Inspect the electrodes (A) and ceramic insulator (B).



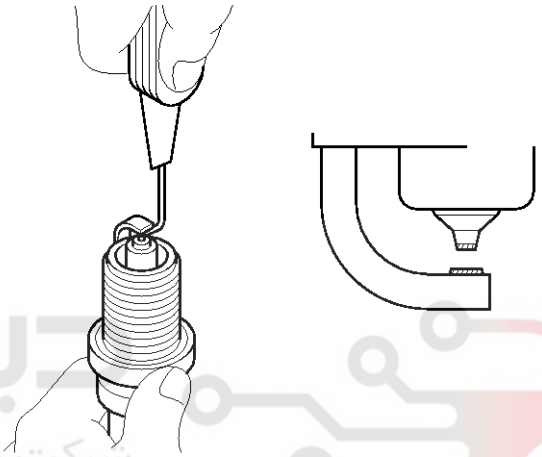
EBKD002K

Inspection Of Electrodes

Condition	Dark deposits	White deposits
Description	- Fuel mixture too rich - Low air intake	- Fuel mixture too lean - Advanced ignition timing - Insufficient plug tightening torque

5. Check the electrode gap (A).

Standard : 1.0 ~ 1.1 mm (0.0394 ~ 0.0433 in.)

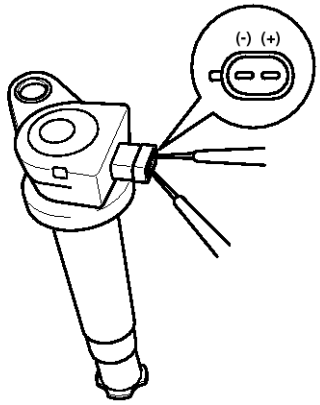


EBKE002L

Inspect Ignition Coil

1. Measure the primary coil resistance between terminals (+) and (-).

Standard : 0.715 ± 15%Ω



ABGE004A

NOTICE

Mesure the resistance between the terminals No.1 and No.3.

Charging System

Description

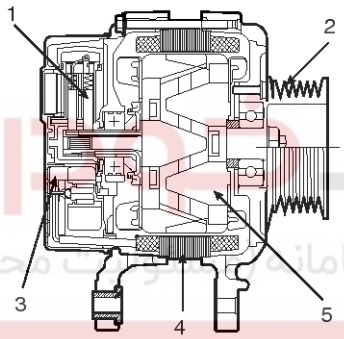
The charging system included a battery, an generator with a built-in regulator, and the charging indicator light and wire.

The generator has built-in diodes, each rectifying AC current to DC current.

Therefore, DC current appears at generator "B" terminal.

In addition, the charging voltage of this generator is regulated by the battery voltage detection system.

The generator is regulated by the battery voltage detection system. The main components of the generator are the rotor, stator, rectifier, capacitor brushes, bearings and V-ribbed belt pulley. The brush holder contains a built-in electronic voltage regulator.



SMGE19100N

1. Brush
2. Drive belt pulley
3. Rectifler
4. Stator
5. Rotor

On-vehicle Inpection

CAUTION

- **Check that the battery cables are connected to the correct terminals.**
- **Disconnect the battery cables when the battery is given a quick charge.**
- **Never disconnect the battery while the engine is running.**

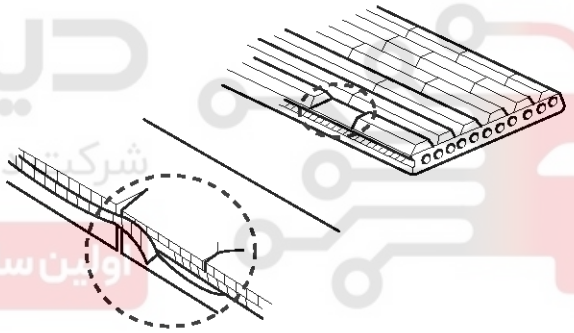
Inspect Drive Belt

Visually check the belt for excessive wear, frayed cords etc.

If any defect has been found, replace the drive belt.

NOTICE

Cracks on the rib side of a belt are considered acceptable. If the belt has chunks missing from the ribs, it should be replaced.



EBKD004B

Visually Check Generator Wiring And Listen For Abnormal Noises

1. Check that the wiring is in good condition.
2. Check that there is no abnormal noise from the generator while the engine is running.

Check Discharge Warning Light Circuit

1. Warm up the engine and then turn it off.
2. Turn off all accessories.
3. Turn the ignition switch "ON". Check that the discharge warning light is lit.
4. Start the engine. Check that the light is lit.

   If the light does not go off as specified, troubleshoot the discharge light circuit.

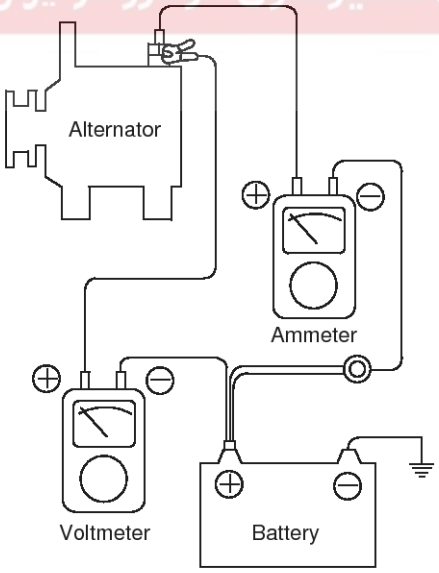
Inspect Charging System

Voltage Drop Test Of Alternator Output Wire

This test determines whether or not the wiring between the generator "B" terminal and the battery (+) terminal is good by the voltage drop method.

Preparation

1. Turn the ignition switch to "OFF".
2. Disconnect the output wire from the generator "B" terminal. Connect the (+) lead wire of ammeter to the "B" terminal of generator and the (-) lead wire of ammeter to the output wire. Connect the (+) lead wire of voltmeter to the "B" terminal of generator and the (-) lead wire of voltmeter to the (+) terminal of battery.



BBGE002A

Test

1. Start the engine.
2. Turn on the headlamps and blower motor, and set the engine speed until the ammeter indicates 20A.

   And then, read the voltmeter at this time.

Result

1. The voltmeter may indicate the standard value.

Standard value: 0.2V max

2. If the value of the voltmeter is higher than expected (above 0.2V max.), poor wiring is suspected. In this case check the wiring from the generator "B" terminal to the battery (+) terminal. Check for loose connections, color change due to an over-heated harness, etc. Correct them before testing again.
3. Upon completion of the test, set the engine speed at idle.

   Turn off the headlamps, blower motor and the ignition switch.

Output Current Test

This test determines whether or not the generator gives an output current that is equivalent to the normal output.

Preparation

1. Prior to the test, check the following items and correct as necessary.

   Check the battery installed in the vehicle to ensure that it is good condition. The battery checking method is described in the section "Battery".

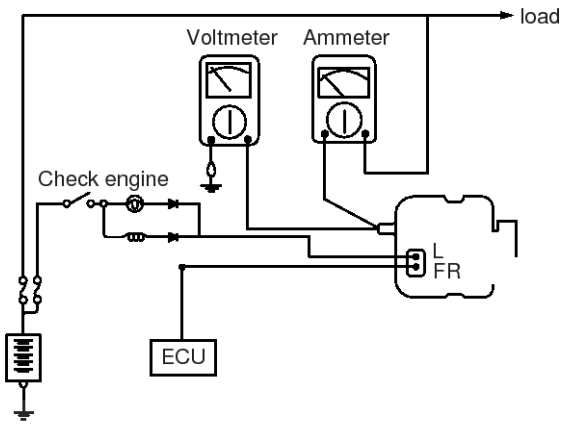
   The battery that is used to test the output current should be one that has been partially discharged. With a fully charged battery, the test may not be conducted correctly due to an insufficient load.

   Check the tension of the generator drive belt. The belt tension check method is described in the section "Inspect drive belt".
2. Turn off the ignition switch.
3. Disconnect the battery ground cable.
4. Disconnect the generator output wire from the generator "B" terminal.
5. Connect a DC ammeter (0 to 150A) in series between the "B" terminal and the disconnected output wire. Be sure to connect the (-) lead wire of the ammeter to the disconnected output wire.

NOTICE

Tighten each connection securely, as a heavy current will flow. Do not rely on clips.

6. Connect a voltmeter (0 to 20V) between the "B" terminal and ground. Connect the (+) lead wire to the generator "B" terminal and (-) lead wire to a good ground.
7. Attach an engine tachometer and connect the battery ground cable.
8. Leave the engine hood open.



EBRF020A

Test

1. Check to see that the voltmeter reads as the same value as the battery voltage. If the voltmeter reads 0V, and the open circuit in the wire between generator "B" terminal and battery (+) terminal or poor grounding is suspected.
2. Start the engine and turn on the headlamps.
3. Set the headlamps to high beam and the heater blower switch to HIGH, quickly increase the engine speed to 2,500 rpm and read the maximum output current value indicated by the ammeter.

NOTICE

After the engine start up, the charging current quickly drops.

Therefore, the above operation must be done quickly to read the maximum current value correctly.

Result

1. The ammeter reading must be higher than the limit value. If it is lower but the alternator output wire is in good condition, remove the generator from the vehicle and test it.

Limit value : 70% of the rated current

NOTICE

- *The nominal output current value is shown on the nameplate affixed to the generator body.*
- *The output current value changes with the electrical load and the temperature of the generator itself.*

  Therefore, the nominal output current may not be obtained. If such is the case, keep the headlamps on the cause discharge of the battery, or use the lights of another vehicle to increase the electrical load.

  The nominal output current may not be obtained if the temperature of the generator itself or ambient temperature is too high.

  In such a case, reduce the temperature before testing again.

2. Upon completion of the output current test, lower the engine speed to idle and turn off the ignition switch.
3. Disconnect the battery ground cable.
4. Remove the ammeter and voltmeter and the engine tachometer.
5. Connect the generator output wire to the alternator "B" terminal.
6. Connect the battery ground cable.

Regulated Voltage Test

The purpose of this test is to check that the electronic voltage regulator controls voltage correctly.

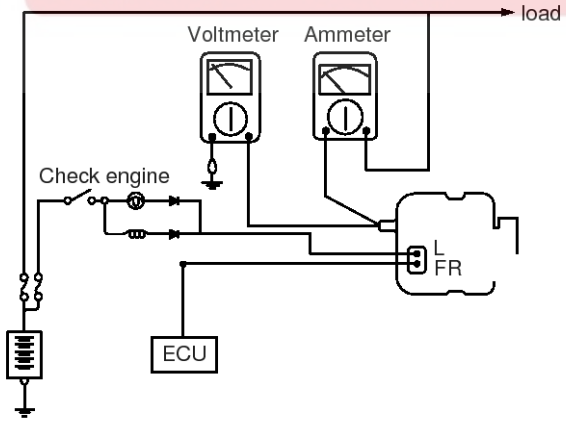
Preparation

1. Prior to the test, check the following items and correct if necessary.

   Check that the battery installed on the vehicle is fully charged. The battery checking method is described in the section "Battery".

   Check the generator drive belt tension. The belt tension check method is described in the section "Inspect drive belt".
2. Turn ignition switch to "OFF".
3. Disconnect the battery ground cable.
4. Connect a digital voltmeter between the "B" terminal of the generator and ground. Connect the (+) lead of the voltmeter to the "B" terminal of the generator. Connect the (-) lead to good ground or the battery (-) terminal.
5. Disconnect the generator output wire from the generator "B" terminal.
6. Connect a DC ammeter (0 to 150A) in series between the "B" terminal and the disconnected output wire.

   Connect the (-) lead wire of the ammeter to the disconnected output wire.
7. Attach the engine tachometer and connect the battery ground cable.



EBRF020A

Test

1. Turn on the ignition switch and check to see that the voltmeter indicates the following value.

Voltage: Battery voltage

   If it reads 0V, there is an open circuit in the wire between the generator "B" terminal and the battery and the battery (-) terminal.
2. Start the engine. Keep all lights and accessories off.
3. Run the engine at a speed of about 2,500 rpm and read the voltmeter when the generator output current drops to 10A or less

Result

1. If the voltmeter reading agrees with the value listed in the regulating voltage table below, the voltage regulator is functioning correctly. If the reading is other than the standard value, the voltage regulator or the generator is faulty.

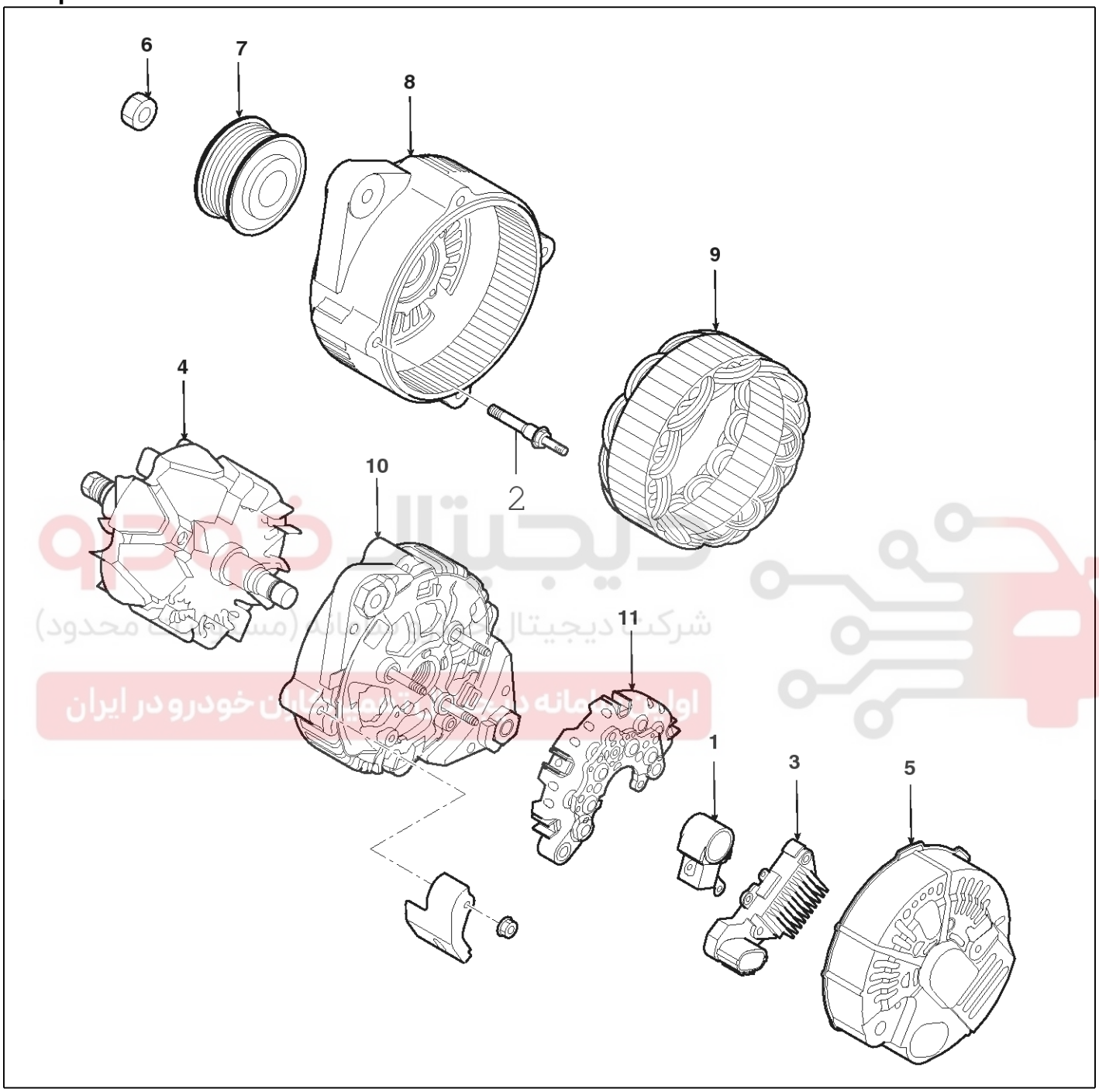
Regulating Voltage Table

Voltage regulator ambient temperature °C (°F)	Regulating voltage (V)
-20 (-4)	14.2 ~ 15.4
20 (68)	14.0 ~ 15.0
60 (140)	13.7 ~ 14.9
80 (176)	13.5 ~ 14.7

2. Upon completion of the test, reduce the engine speed to idle, and turn off the ignition switch.
3. Disconnect the battery ground cable.
4. Remove the voltmeter and ammeter and the engine tachometer.
5. Connect the generator output wire to the alternator "B" terminal.
6. Connect the battery ground cable.

Alternator

Component

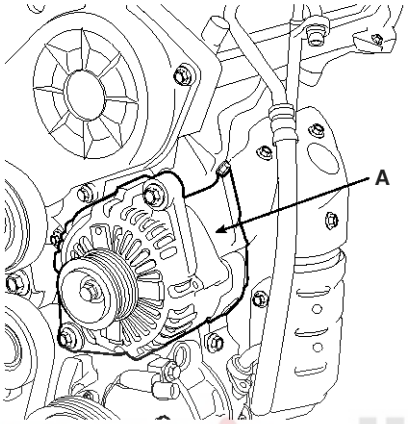


SMGE19101N

1. Generator blust
2. Bolt
3. Generator regulator assembly
4. Rotor assembly
5. Generator pump
6. Nut
7. Generator pulley
8. Generator front assembly
9. Stator
10. Generator rear bracket assembly
11. Generator rectifier assembly

Removal

1. Disconnect the battery negative terminal first, then the positive terminal.
2. Disconnect the generator connector, and remove the cable from generator "B" terminal.
3. Remove the drive belt.
4. Pull out the through bolt and then remove the generator(A).

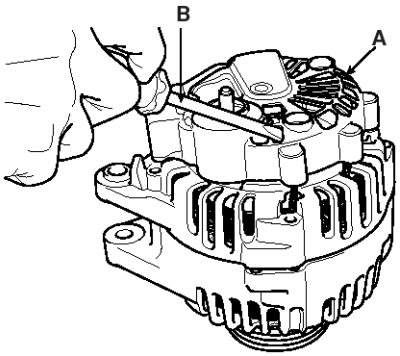


SMGEE6301L

5. Installation is the reverse of removal.

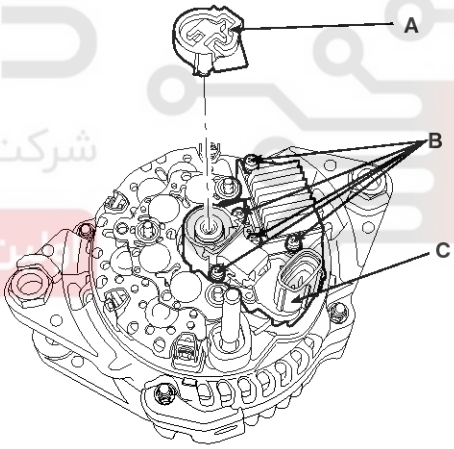
Disassembly

1. Remove the generator cover(A) using a screw driver(B).



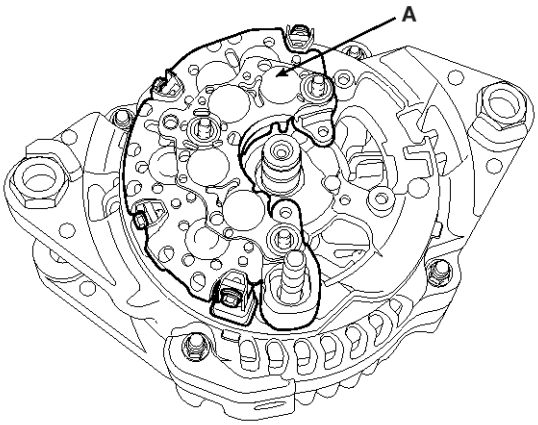
EBKD301A

2. Remove the slip ring guide(A).
3. Loosen the mounting bolts(B) and disconnect the regulator assembly(C).



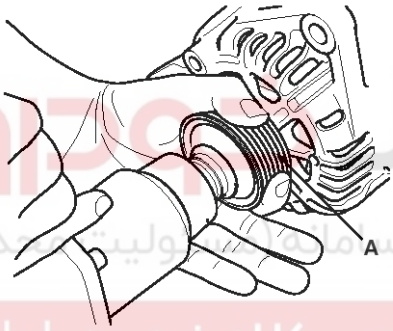
KBBF101A

4. Remove the rectifler(A) with 4 screws.



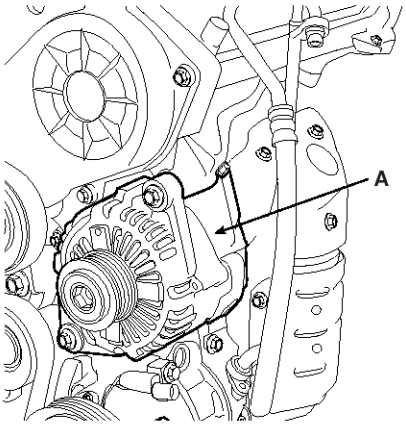
KBBF102A

5. Remove the nut, and the pulley(A).



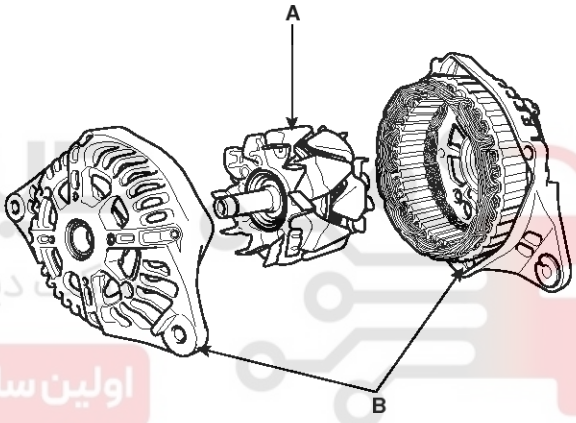
EBKD301D

6. Loosen the 4 through bolts(A).



KBBF003A

7. Disconnect the rotor(A) and cover(B).



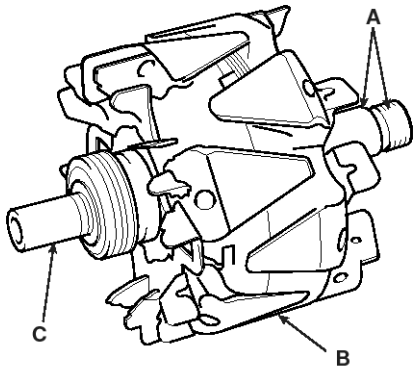
EBKD301G

8. Reassembly is the reverse order of disassembly.

Inspection

Rotor

1. Check that there is continuity between the slip rings (A).

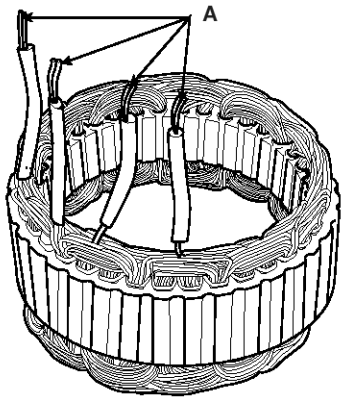


EBKD008A

2. Check that there is no continuity between the slip rings and the rotor (B) or rotor shaft (C).
3. If the rotor fails either continuity check, replace the alternator.

Stator

1. Check that there is continuity between each pair of leads (A).



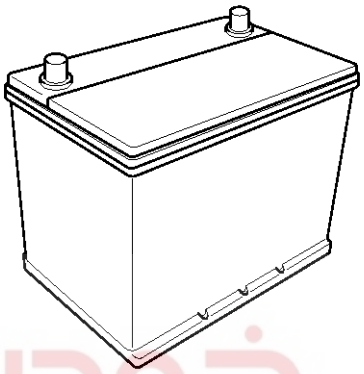
EBKD008B

2. Check that there is no continuity between each lead and the coil core.
3. If the coil fails either continuity check, replace the generator.

Battery

Description

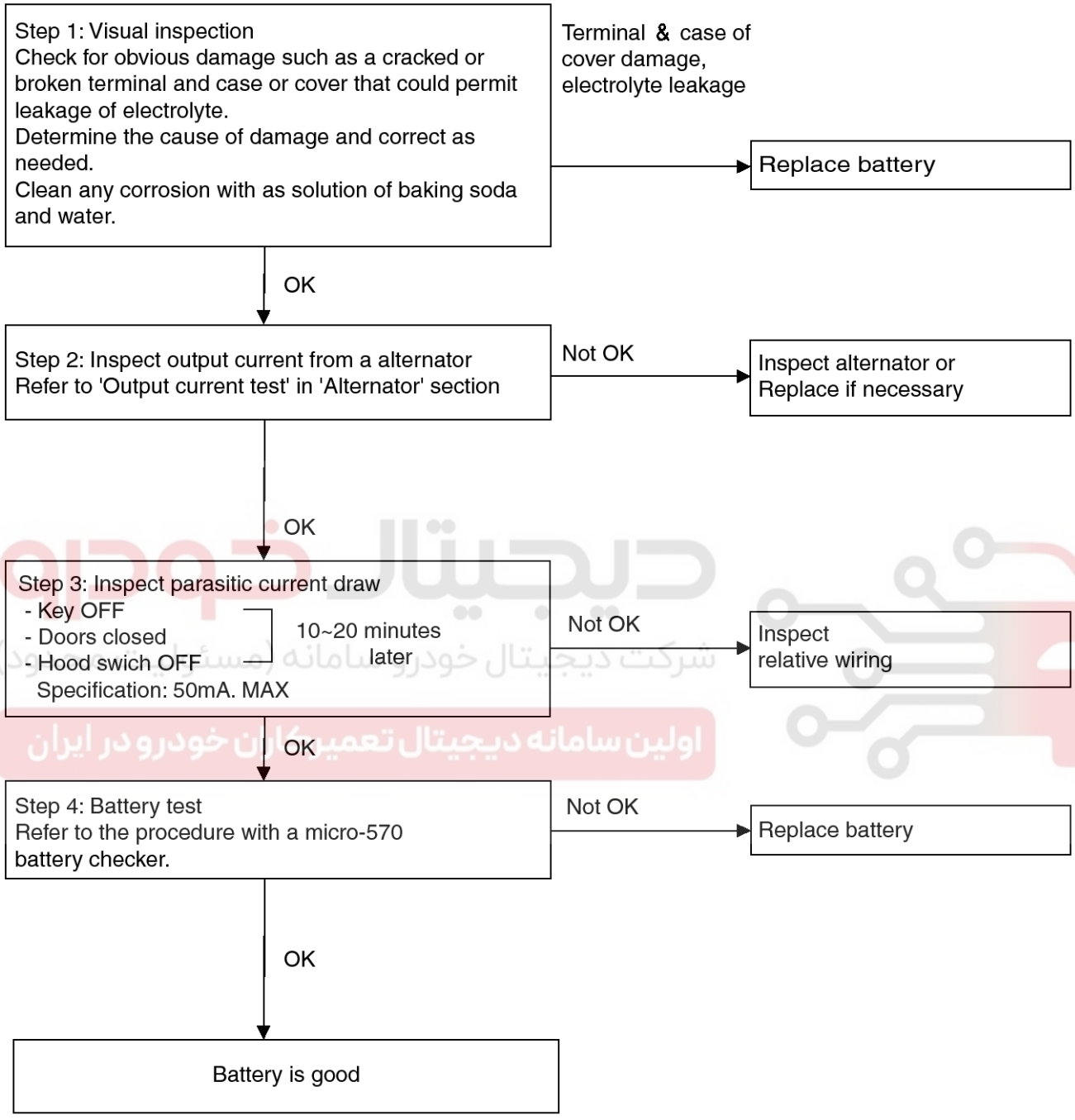
1. The maintenance-free battery is, as the name implies, totally maintenance free and has no removable battery cell caps.
2. Water never needs to be added to the maintenance-free battery.
3. The battery is completely sealed, except for small vent holes in the cover.



EBJD008A

Inspection

Battery Diagnostic Flow



SXMEE9150L

Vehicle parasitic current inspection

1. Turn the all electric devices OFF, and then turn the ignition switch OFF.
2. Close all doors except the engine hood, and then lock all doors.
   1) Disconnect the hood switch connector.
   2) Close the trunk lid.
   3) Close the doors or remove the door switches.
3. Wait a few minutes until the vehicle's electrical systems go to sleep mode.

   NOTICE

   For an accurate measurement of a vehicle parasitic current, all electriacl systems should go to sleep mode. (It takes at least one hour or at most one day.) However, an approximate vehicle parasitic current can be measured after 10~20 minutes.
4. Connect an ammeter in series between the battery (-) terminal and the ground cable, and then disconnect the clamp from the battery (-) terminal slowly.

   CAUTION

   Be careful that the lead wires of an ammeter do not come off from the battery (-) terminal and the ground cable to prevent the battery from being reset. In case the battery is reset, connect the battery cable again, and then start the engine or turn the ignition switch ON for more than 10 sec. Repeat the procedure from No. 1.

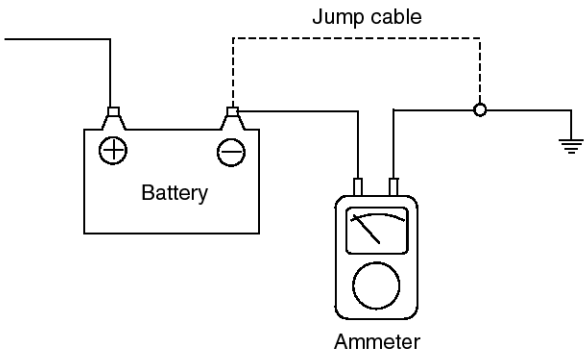
   To prevent the battery from being reset during the inspection,

   a. Connect a jump cable between the battery (-) terminal and the ground cable.

   b. Disconnect the ground cable from the battery (-) terminal.

   c. Connect an ammeter between the battery (-) terminal and the ground cable.

   d. After disconnecting the jump cable, read the current value of the ammeter.



SVQEE0002L

5. Read the current value of the ammeter.
   - If the parasitic current is over the limit value, search for abnormal circuit by removing a fuse one by one and checking the parasitic current.
   - Check the parasitic current again, and search for suspected unit by removing a unit connected with the abnormal circuit one by one.

Limit value (after 10~20 min.) : Below 50mA

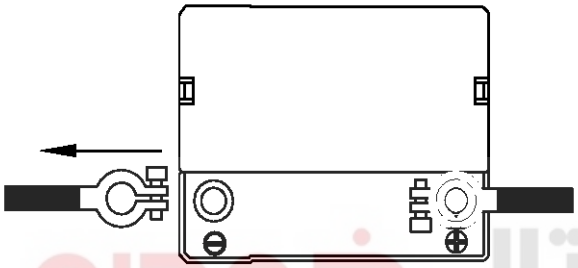
Cleaning

1. Make sure the ignition switch and all accessories are in the OFF position.
2. Disconnect the battery cables (negative first).
3. Remove the battery from the vehicle.

⚠CAUTION

Care should be taken in the event the battery case is cracked or leaking, to protect your skin from the electrolyte.

Heavy rubber gloves (not the household type) should be wore when removing the battery.



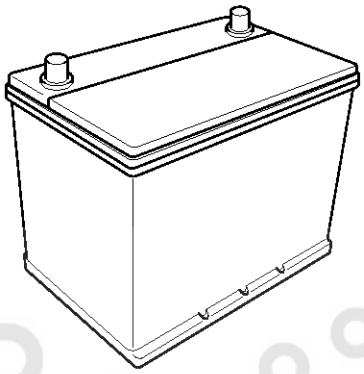
EBJD008B

4. Inspect the battery tray for damage caused by the loss of electrolyte. If acid damage is present, it will be necessary to clean the area with a solution of clean warm water and baking soda. Scrub the area with a stiff brush and wipe off with a cloth moistened with baking soda and water.
5. Clean the top of the battery with the same solution as described above.
6. Inspect the battery case and cover for cracks. If cracks are present, the battery must be replaced.
7. Clean the battery posts with a suitable battery post tool.
8. Clean the inside surface of the terminal clamps with a suitable battery cleaning tool. Replace damaged or frayed cables and broken terminal clamps.
9. Install the battery in the vehicle.
10. Connect the cable terminals to the battery post, making sure tops of the terminals are flush with the tops of the posts.
11. Tighten the terminal nuts securely.
12. Coat all connections with light mineral grease after tightening.

⚠CAUTION

When batteries are being charged, an explosive gas forms beneath the cover of each cell. Do not smoke near batteries being charged or which have recently been charged. Do not break live circuit at the terminals of batteries being charged.

A spark will occur when the circuit is broken. Keep open flames away form battery.



EBJD008A

Starting System

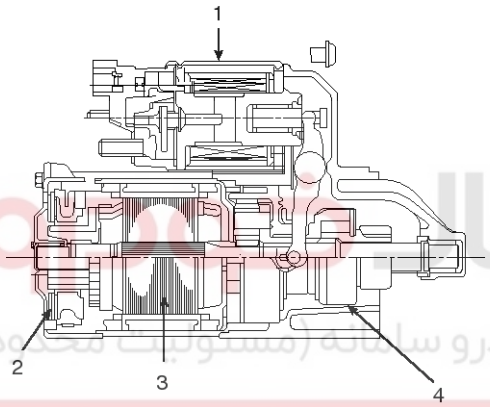
Description

The starting system includes the battery, starter, solenoid switch, ignition switch, inhibitor switch (A/T), ignition lock switch, connection wires and the battery cable.

When the ignition key is turned to the start position, current flows and energizes the starter motor's solenoid coil.

The solenoid plunger and clutch shift lever are activated, and the clutch pinion engages the ring gear.

The contacts close and the starter motor cranks. In order to prevent damage caused by excessive rotation of the starter armature when the engine starts, the clutch pinion gear overruns.



SMGE19102N

1. Solenoid
2. Brush assembly
3. Armature
4. Overrun clutch

Troubleshooting

Starter Circuit

NOTICE

The battery must be in good condition and fully charged.

1. Remove the fuel pump relay(A) from the fuse box.
2. With the shift lever in N or P (A/T) or clutch pedal pressed (M/T), turn the ignition switch to "START"

   If the starter normally cranks the engine, starting system is OK. If the starter will not crank the engine at all, go to next step.

   If it won't disengage from the ring gear when you release key, check for the following until you find the cause.

   - Solenoid plunger and switch malfunction.
   - Dirty pinion gear or damaged overrunning clutch.
3. Check the battery condition. Check electrical connections at the battery, battery negative cable connected to the body, engine ground cables, and the starter for looseness and corrosion. Then try starting the engine again.

   If the starter cranks normally the engine, repairing the loose connection repaired the problem. The starting system is now OK.

   If the starter still does not crank the engine, go to next step.
4. Disconnect the connector from the S-terminal of solenoid. Connect a jumper wire from the B-terminal of solenoid to the S-terminal of solenoid.

   If the starter cranks the engine, go to next step.

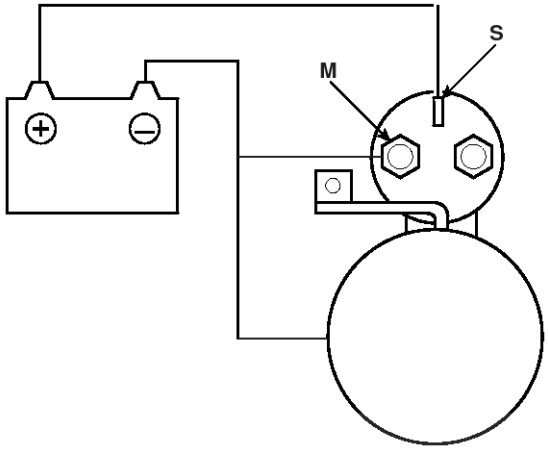
   If the starter still does not crank the engine, remove the starter, and repair or replace as necessary.

5. Check the following items in the order listed until you find the open circuit.

   - Check the wire and connectors between the driver's under-dash fuse/relay box and the ignition switch, and between the driver's under-dash fuse/relay box and the starter.
   - Check the ignition switch (Refer to BE group - ignition system)
   - Check the transaxle range switch connector or ignition lock switch connector.
   - Inspect the starter relay.

Stater Solenoid Test

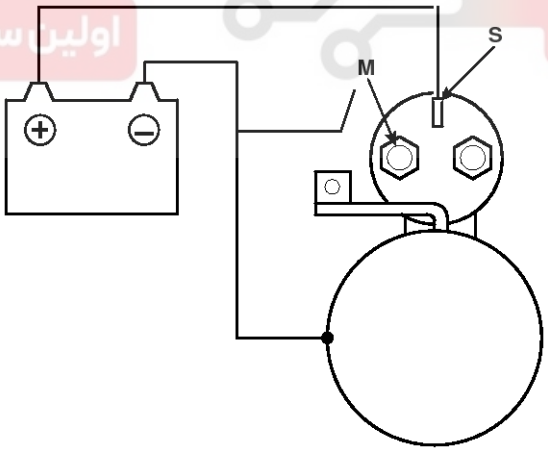
1. Disconnect the field coil wire from the M-terminal of solenoid switch.
2. Connect the battery as shown. If the starter pinion pops out, it is working properly. To avoid damaging the starter, do not leave the battery connected for more than 10 seconds.



KBSE203D

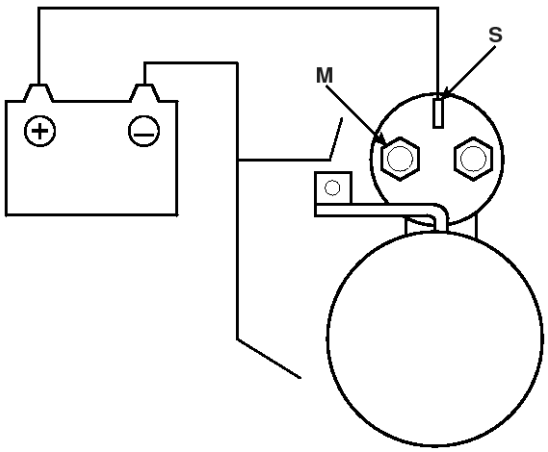
3. Disconnect the battery from the M terminal.

   If the pinion does not retract, the hold-in coil is working properly. To avoid damaging the starter, do not leave the battery connected for more than 10 seconds.



KBSE203E

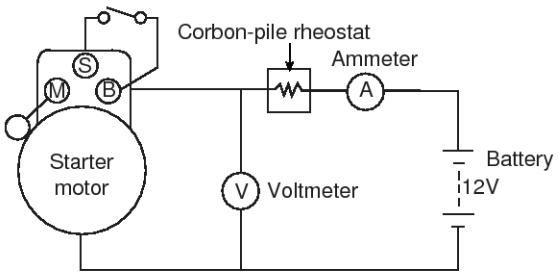
4. Disconnect the battery also from the body. If the pinion retracts immediately, it is working properly. To avoid damaging the starter, do not leave the battery connected for more than 10 seconds.



KBSE203F

Free Running Test

1. Place the starter motor in a vise equipped with soft jaws and connect a fully-charged 12-volt battery to starter motor as follows.
2. Connect a test ammeter (100-ampere scale) and carbon pile rheostats shown is the illustration.
3. Connect a voltmeter (15-volt scale) across starter motor.

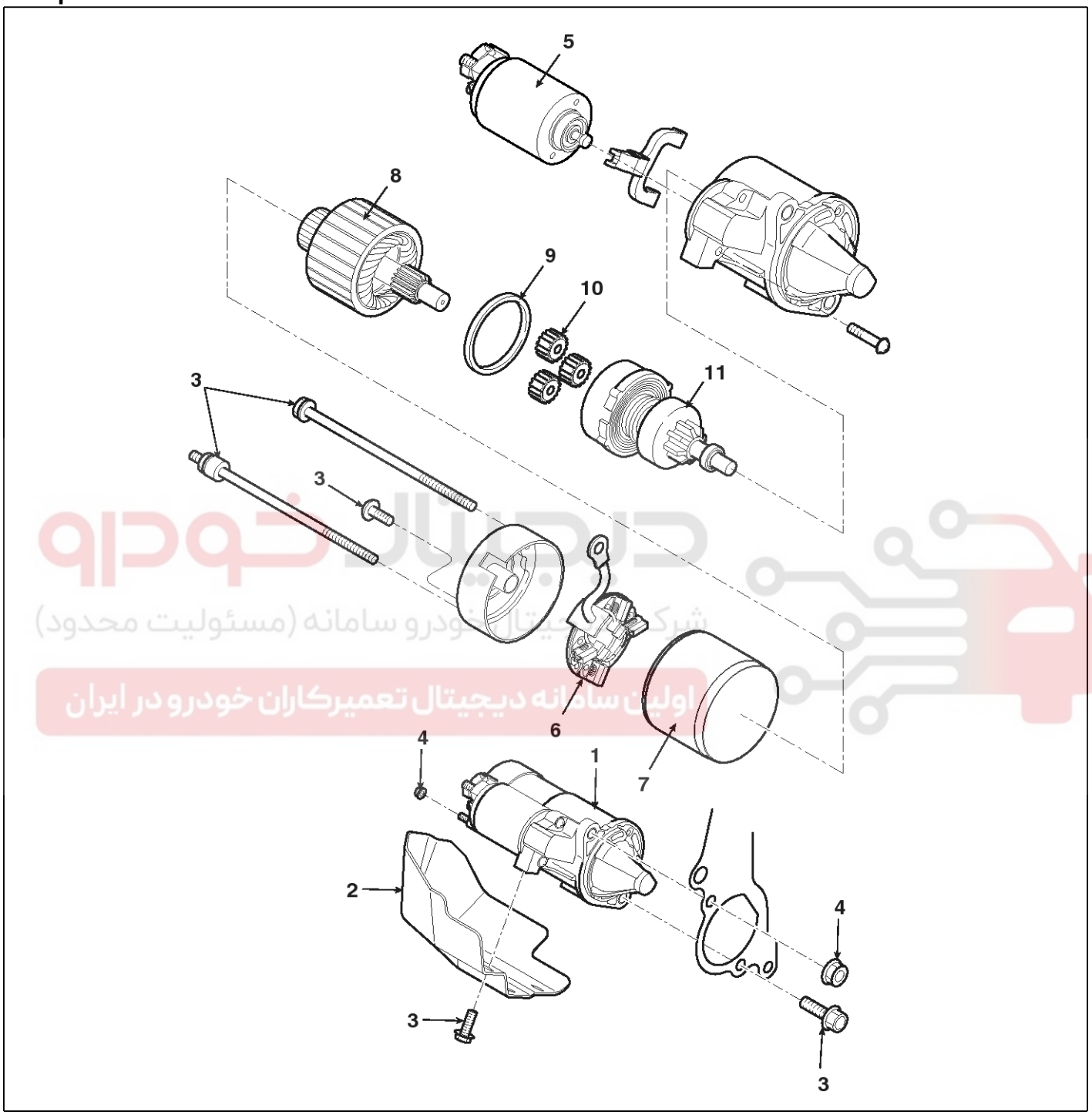


BBGE005A

4. Rotate carbon pile to the off position.
5. Connect the battery cable from battery's negative post to the starter motor body.
6. Adjust until battery voltage shown on the voltmeter reads 11volts.
7. Confirm that the maximum amperage is within the specifications and that the starter motor turns smoothly and freely.

Starter

Component

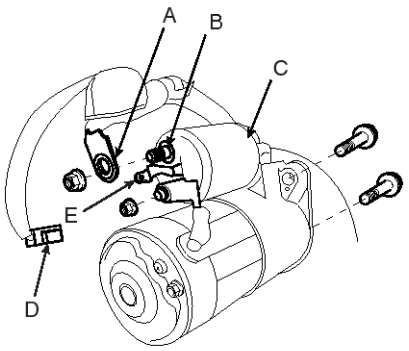


SMGE19103N

1. Starter assembly
2. Starter cover
3. Bolt
4. Nut
5. Magnet switch assembly
6. Brush holder assembly
7. Yoke
8. Armature
9. Parking
10. Planet gear
11. Overruning olutch

Removal

1. Disconnect the battery negative cable.
2. Disconnect the starter cable (A) from the B terminal (B) on the solenoid (C), then disconnect the connector (D) from the S terminal (E).

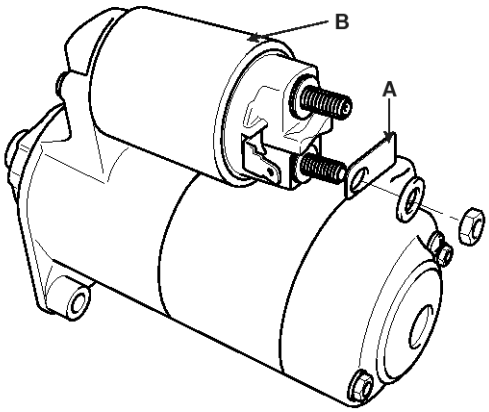


ABGE024A

3. Remove the 2 bolts holding the starter, then remove the starter.
4. Installation is the reverse of removal.
5. Connect the battery negative cable to the battery.

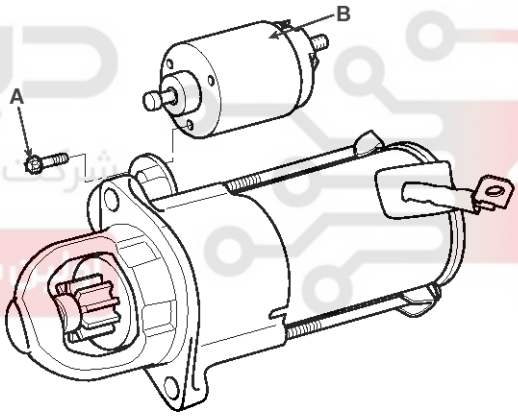
Disassembly

1. Disconnect the M-terminal (A) on the magnet switch assembly (B).



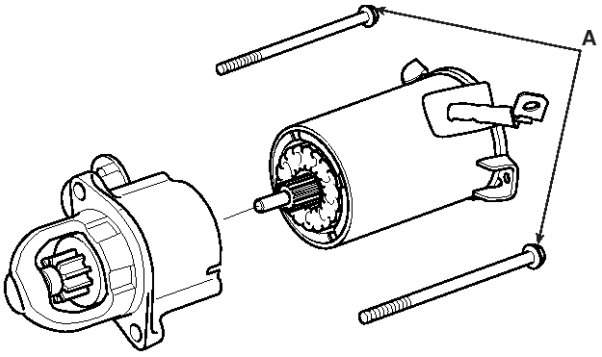
EBKD011C

2. After loosening the 3 screws (A), detach the magnet switch assembly (B).



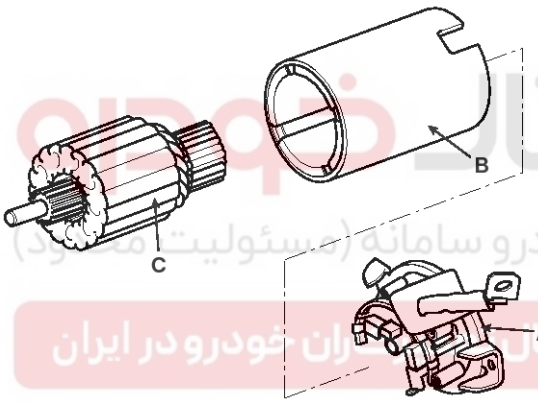
KBRF010A

3. Loosen the through bolts (A).



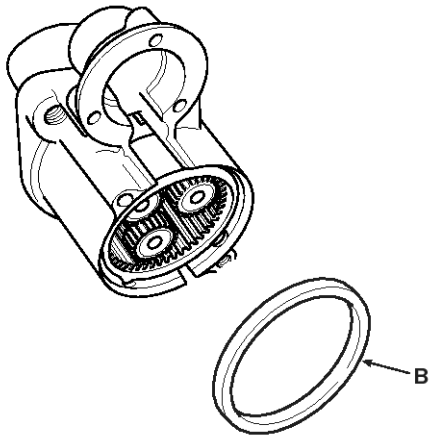
KBRF011A

4. Remove the brush holder assembly (A), yoke (b) and armature (C).



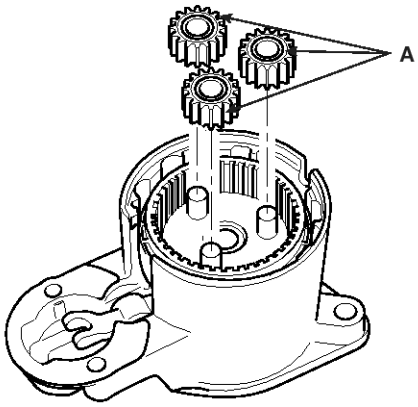
KBRF012A

5. Remove the and packing (B).



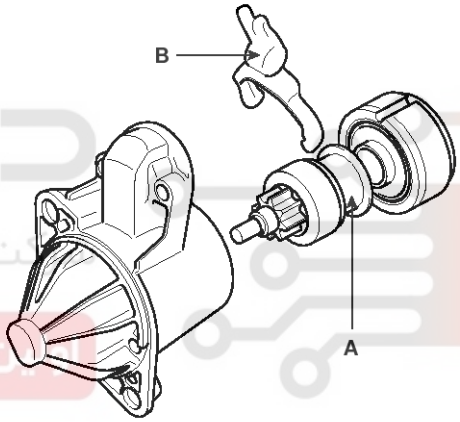
SMGEE6305L

6. Disconnect the planet gear (A).



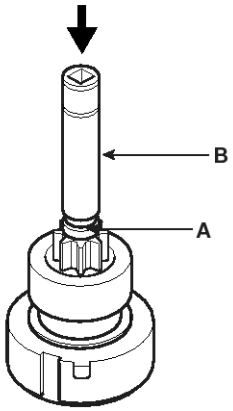
EBKD011I

7. Disconnect the planet shaft assembly (A) and lever (B).



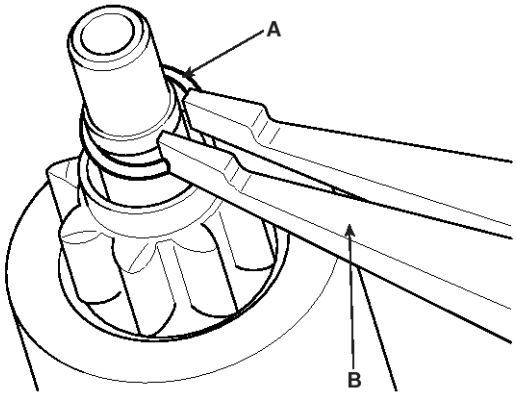
EBKD011J

8. Press the stop ring (A) using a socket (B).



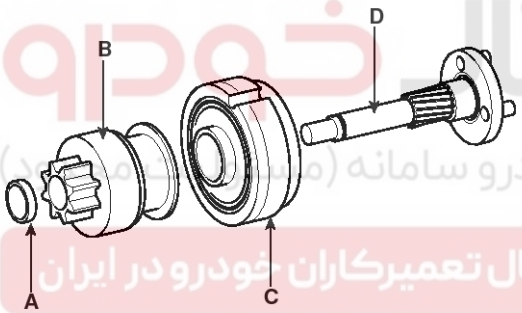
EBKD011K

9. After removing the stopper (A) using stopper pliers (B).



EBKD011L

10. Disconnect the stop ring (A), overrunning clutch (B), internal gear (C) and planet shaft (D).

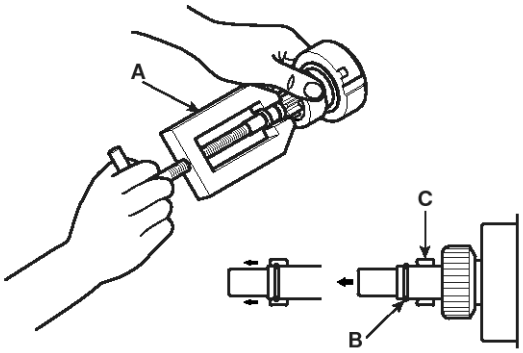


EBKD011M

11. Reassembly is the reverse of disassembly.

NOTICE

Using a suitable pulling tool (A), pull the overrunning clutch stop ring (B) over the stopper (C).

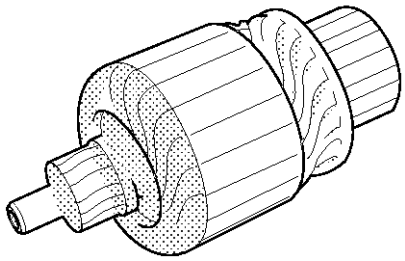


EBKD011O

Inspection

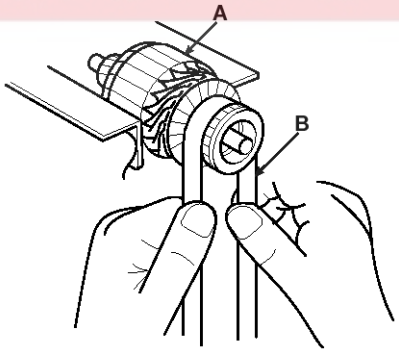
Armature

1. Remove the starter.
2. Disassemble the starter as shown at the beginning of this procedure.
3. Inspect the armature for wear or damage from contact with the permanent magnet. If there is wear or damage, replace the armature.



EBKD012A

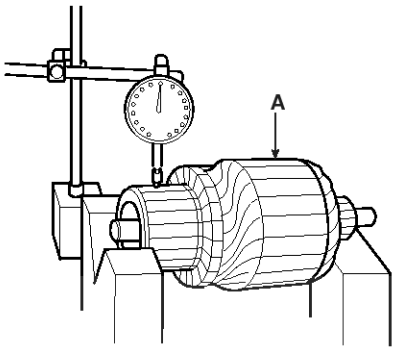
4. Check the commutator (A) surface. If the surface is dirty or burnt, resurface with emery cloth or a lathe within the following specifications, or recondition with #500 or #600 sandpaper (B).



EBKD012B

5. Measure the commutator (A) runout.
   - If the commutator runout is within the service limit, check the commutator for carbon dust or brass chips between the segments.
   - If the commutator run out is not within the service limit, replace the armature.

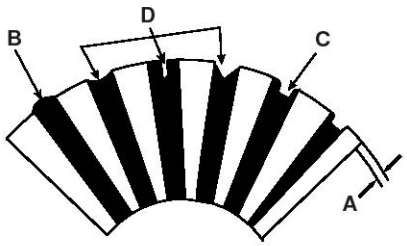
Commutator runout
Standard (New): 0.02mm (0.0008in.) max
Service limit: 0.05mm (0.0020in.)



EBKD012D

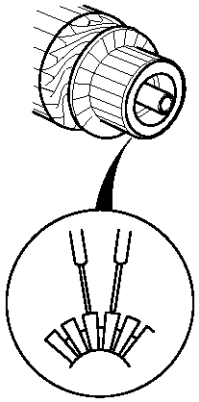
6. Check the mica depth (A). If the mica is too high (B), undercut the mica with a hacksaw blade to the proper depth. Cut away all the mica (C) between the commutator segments. The undercut should not be too shallow, too narrow, or v-shaped (D).

Commutator mica depth
Standard (New) : 0.5 mm (0.0197 in.)
Limit : 0.2mm (0.0079 in.)



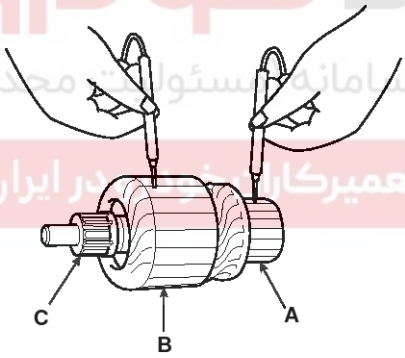
EBKD012E

7. Check for continuity between the segments of the commutator. If an open circuit exists between any segments, replace the armature.



EBKD012F

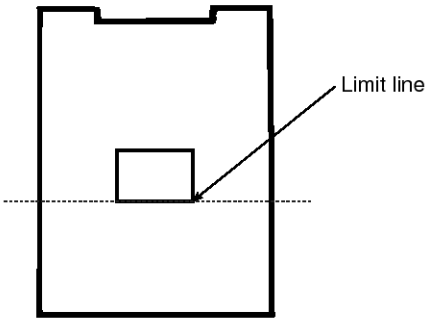
8. Check with an ohmmeter that no continuity exists between the commutator (A) and armature coil core (B), and between the commutator and armature shaft (C). If continuity exists, replace the armature.



EBKD012G

Starter Brush

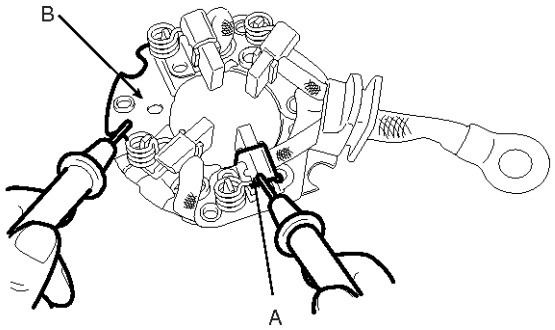
Brushes that are worm out, or oil-soaked, should be replaced.



EBRF022A

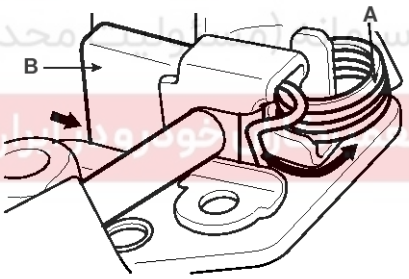
Starter Brush Holder

1. Check that there is no continuity between the (+) brush holder (A) and (-) brush holder (B). If there is no continuity, replace the brush holder assembly.



EBBD330A

2. Pry back each brush spring (A) with a screwdriver, then position the brush (B) about halfway out of its holder, and release the spring to hold it there.

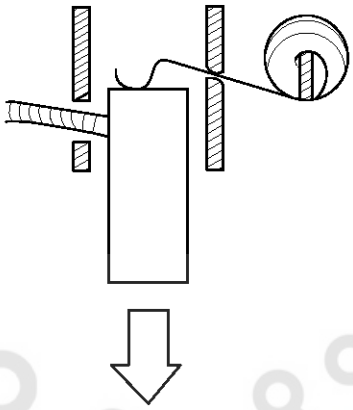


EBKD012K

3. Install the armature in the housing, and install the brush holder. Next, pry back each brush spring again, and push the brush down until it seats against the commutator, then release the spring against the end of the brush.

NOTICE

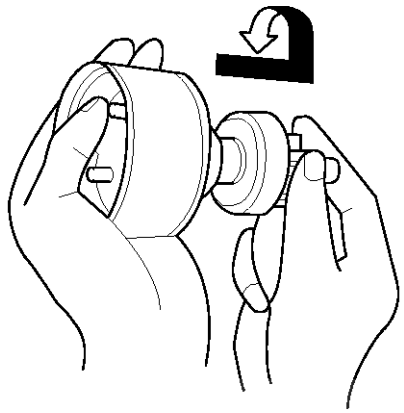
To seat new brushes, slip a strip of #500 or #600 sandpaper, with the grit side up, between the commutator and each brush, and smoothly rotate the armature. The contact surface of the brushes will be sanded to the same contour as the commutator.



EBKD012I

Overrunning Clutch

1. Slide the overrunning clutch along the shaft.
   Replace it if does not slide smoothly.
2. Rotate the overrunning clutch both ways.
   Does it lock in one direction and rotate smoothly in reverse? If it does not lock in either direction of it locks in both directions, replace it.



EBKD012J

3. If the starter drive gear is worn or damaged, replace the overrunning clutch assembly. (the gear is not available separately).
   Check the condition of the flywheel or torque converter ring gear if the starter drive gear teeth are damaged.

Cleaning

1. Do not immerse parts in cleaning solvent. Immersing the yoke assembly and/or armature will damage the insulation. Wipe these parts with a cloth only.
2. Do not immerse the drive unit in cleaning solvent. The overrun clutch is pre-lubricated at the factory and solvent will wash lubrication from the clutch.
3. The drive unit may be cleaned with a brush moistened with cleaning solvent and wiped dry with a cloth.

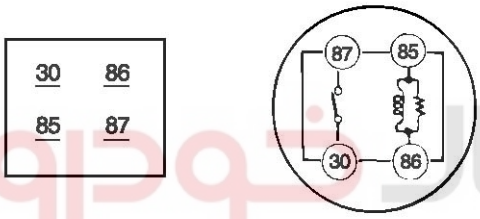
Starter Relay

Inspection

1. Remove the fuse box cover.
2. Remove the starter relay.
3. Using an ohmmeter, check that there is continuity between each terminal.

Terminal	Continuity
30 - 87	NO
85 - 86	YES

4. Apply 12V to terminal 85 and ground to terminal 86.
   Check for continuity between terminals 30 and 87.

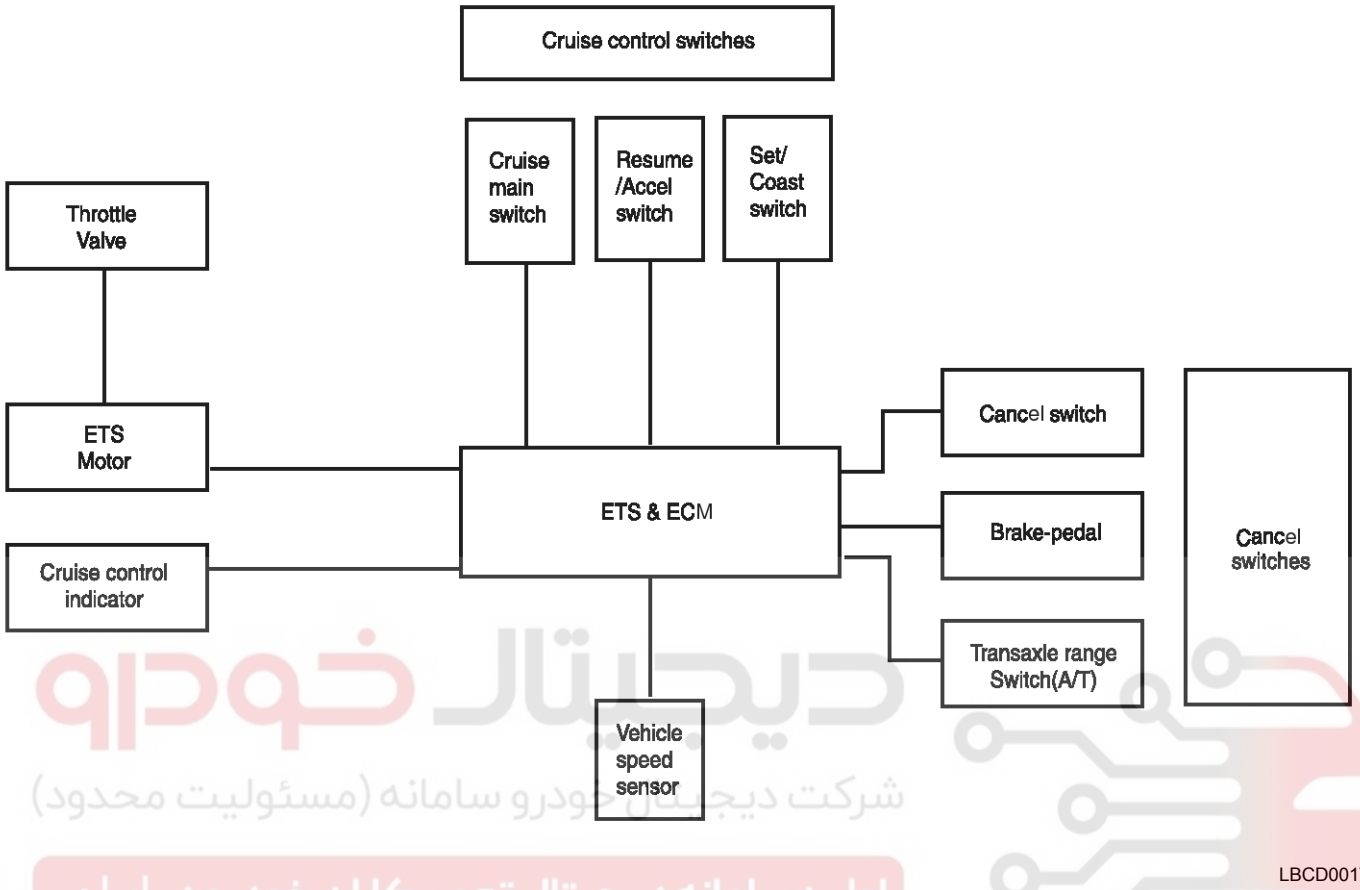


LDAD510B

5. If there is no continuity, replace the starter relay.
6. Install the starter relay.
7. Install the fuse box cover.

Cruise Control System

System Block Diagram



Component Parts And Function Outline

Component part		Function
Vehicle-speed sensor		Converts vehicle speed to pulse.
Engine control module (ECM)		Receives signals from sensor and control switches;
Cruise control indicator		Illuminate when CRUISE main switch is ON (Built into cluster)
Cruise Control switches	CRUISE main switch	Switch for automatic speed control power supply.
	Resume/Accel switch	Controls automatic speed control functions by Resume/Accel switch (Set/Coast switch)
	Set/Coast switch	
Cancel switch	Cancel switch	Sends cancel signals to ECM
	Brake-pedal switch	
	Transaxle range switch (A/T) Clutch switch (M/T)	
ETS motor		Regulates the throttle valve to the set opening by ECM.

* ETS : Electronic Throttle System

Cruise Control

Cruise control system is engaged by the "ON. OFF" main switch located on right of steering wheel column. The system has the capability to cruise, coast, resume speed, and accelerate, and raise "tap-up" or lower "tap-down" set speed.

It also has a safety interrupt, engaged upon depressing brake or shifting select lever.

The ECM is the control module for this system

The main components of cruise control system are mode control switches, transaxle range switch, brake switch, vehicle speed sensor, ECM and ETS motor that connect throttle body.

The ECM contains a low speed limit which will prevent system engagement below a minimum speed of 40km/h (25mph).

The operation of the controller is controlled by mode control switches located on steering wheel.

Transaxle range switch and brake switch are provided to disengage the cruise control system. The switches are on brake pedal bracket and transaxle. When the brake pedal is depressed or select lever shifted, the cruise control system is electrically disengaged and the throttle is returned to the idle position.

Cruise main switch

Cruise control system is engaged by pressing the "ON. OFF" push button. Releasing the "ON.OFF" push button release throttle, clears cruise memory speed, and puts vehicle in a non-cruise mode.

Coast/Set switch

COAST.SET switch located on right of steering wheel column has two positions - "Normal" and "Depressed". The set position - With COAST.SET switch depressed and then released the cruise speed will be set at the speed the vehicle was going when COAST.SET switch was released. The coast position - With COAST.SET switch fully depressed, driver can lower cruise speed. To decrease cruise speed, COAST.SET switch is held in, disengaging cruise control system. When vehicle has slowed to required cruise speed, releasing COAST.SET switch will re-engage speed at new selected speed.

The tap down - To lower vehicle speed, cruise must be engaged and operating. Tap down is done by quickly pressing and releasing COAST.SET switch. Do not hold COAST.SET switch in depressed position.

Tap down is a function in which cruise speed car be decreased by 1mph (1.6km/h)

Resume/Accel switch

RES.ACCEL switch located on right of steering wheel column has two positions - "Normal" and "Depressed".

The resume position - With RES.ACCEL switch depressed and then release, this switch also returns cruise control operation to last speed (Which is temporarily disengaged by Cancel switch or Brake pedal), setting when momentarily operating RES.ACCEL switch by constant acceleration.

The accel position - With RES.ACCEL switch depressed and held in, disengaging cruise control system, when vehicle has accelerated to required cruise speed, releasing RES.ACCEL switch will re-engage speed at new selected speed.

The tap up - To increase vehicle speed, the cruise must be engaged and operating.

Tap up is done by quickly pressing and releasing RES.ACCEL switch less than 0.5 second. Do not hold RES.ACCEL switch in depressed position. Tap up is a function in which cruise speed can be increased by 1mph (1.6km/h).

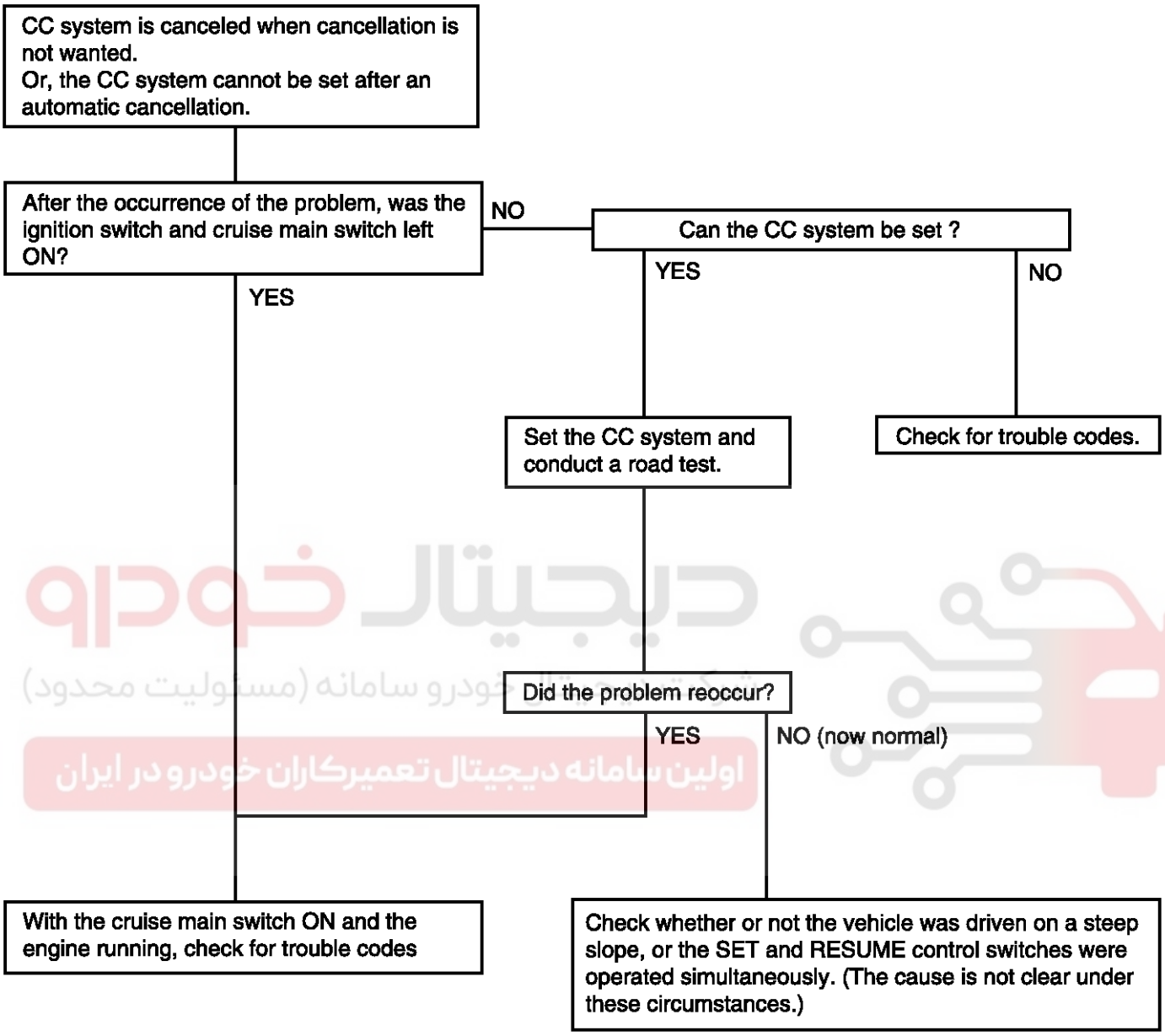
Cancel switch

Cruise control system is temporarily disengaged by pressing "CANCEL" switch.

Cruise speed canceled by this switch will be recovered by RES.ACCEL switch

Trouble Symptom Charts

Trouble Symptom 1



CC : Cruise Control
ECU : Engine Control Unit

EBRF023A

Trouble Symptom 2

Trouble symptom	Probable cause	Remedy
The set vehicle speed varies greatly upward or downward "Surging" (repeated alternating acceleration and deceleration) occurs after setting	Malfunction of the vehicle speed sensor circuit	Repair the vehicle speed sensor system, or replace the part
	Malfunction of ECM	Replace the ECM

Trouble Symptom 3

Trouble symptom	Probable cause	Remedy
The CC system is not canceled when the brake pedal is depressed	Damaged or disconnected wiring of the brake pedal switch	Repair the harness or replace the brake pedal switch
	Malfunction of the ECM	Replace the ECM

Trouble Symptom 4

Trouble symptom	Probable cause	Remedy
The CC system is not canceled when the shift lever is moved to the "N" position (It is canceled, however, when the brake pedal is depressed	Damaged or disconnected wiring of inhibitor switch input circuit	Repair the harness or repair or replace the inhibitor switch
	Improper adjustment of inhibitor switch	
	Malfunction of the ECM	Replace the ECM

Trouble Symptom 5

Trouble symptom	Probable cause	Remedy
Cannot decelerate (coast) by using the SET switch	Temporary damaged or disconnected wiring of SET switch input circuit	Repair the harness or replace the SET switch
	Malfunction of the ECM	Replace the ECM

Trouble Symptom 6

Trouble symptom	Probable cause	Remedy
Cannot accelerate or resume speed by using the RESUME switch	Damaged or disconnected wiring, or short circuit, or RESUME switch input circuit	Repair the harness or replace the RESUME switch
	Malfunction of the ECM	Replace the ECM

Trouble Symptom 7

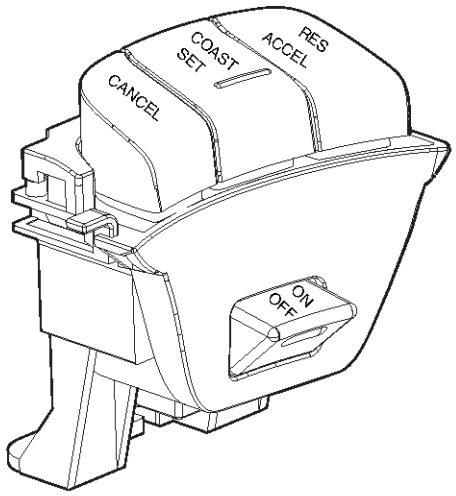
Trouble symptom	Probable cause	Remedy
CC system can be set while driving at a vehicle speed of less than 40km/h (25mph), or there is no automatic cancellation at that speed	Malfunction of the vehicle-speed sensor circuit	Repair the vehicle speed sensor system, or replace the part
	Malfunction of the ECM	Replace the ECM

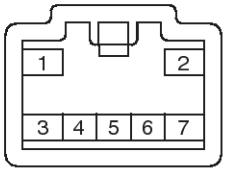
Trouble Symptom 8

Trouble symptom	Probable cause	Remedy
The cruise main switch indicator lamp does not illuminate (But CC system is normal)	Damaged or disconnected bulb of cruise main switch indicator lamp	Repair the harness or replace the part.
	Harness damaged or disconnected	

Cruise Control Switch

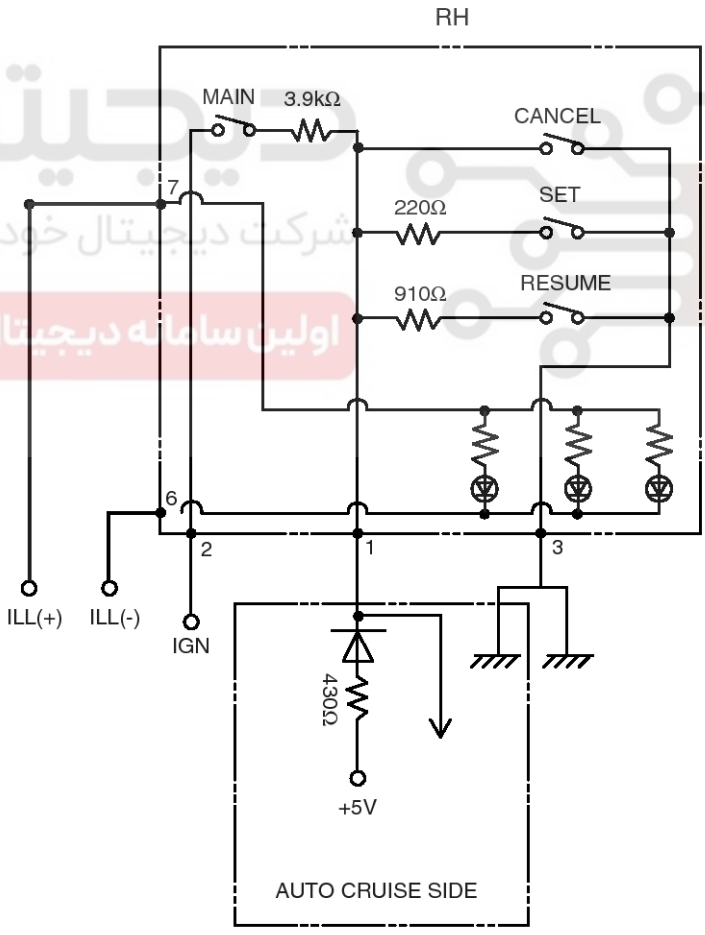
Circuit Diagram





RH CONNECTOR

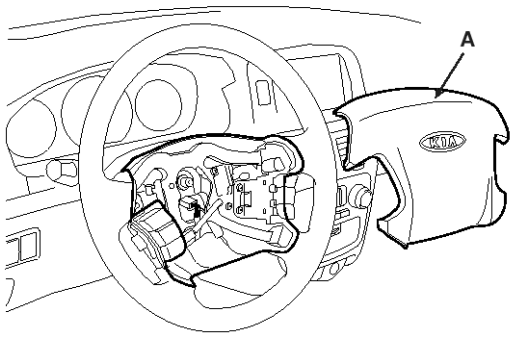
NO	CONNECTOR
1	CRUSIE SW(SIG IN)
2	CRUSIE MAIN SW(IGN)
3	CRUSIE SW(SIG OUT)
4	–
5	–
6	ILL(-)
7	ILL(+)



LBCD001R-1

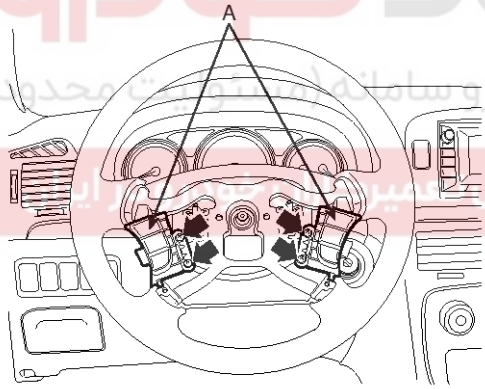
Removal

1. Disconnect the battery (-) terminal.
2. Remove the driver side air bag module(A). (Refer to RT GR.)



SMGEE6059L

3. Disconnect the cruise control switch connector and then remove the cruise control switch(A) with two screws.



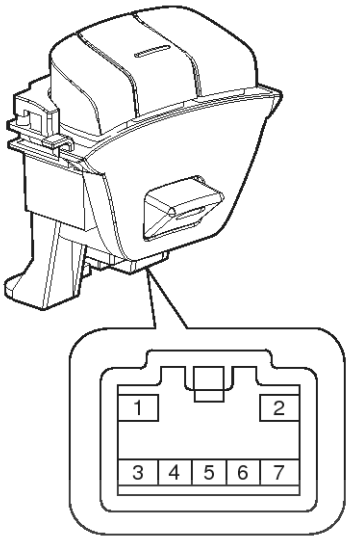
KTRE024A

4. Installation is the reverse of removal.

Inspection

Measuring Resistance

1. Disconnect the cruise control switch connector from the control switch.



KTRE024B

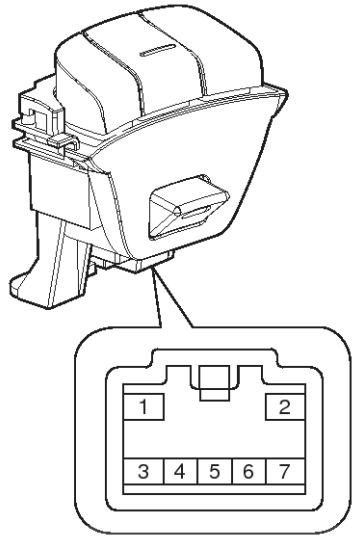
2. Measure resistance between terminals on the control switch when each function switch is ON (switch is depressed).

Function switch	Terminal	Resistance
Cruise Main	RH 1-2	3.9kΩ ± 1%
Cancel	RH 1-3	0Ω ± 1%
Set/Coast	RH 1-3	220Ω ± 1%
Resume/Accel	RH 1-3	910Ω ± 1%

3. If not within specification, replace switch.

Measuring Voltage

1. Connect the cruise control switch connector to the control switch.



KTRE024B

2. Measure voltage between terminals on the harness side connector when each function switch is ON (switch is depressed).

Function switch	Terminal	Voltage
Cruise Main	RH 1-2	-
Cancel	RH 1-3	0.0V ± 0.22V
Set/Coast	RH 1-3	1.5V ± 0.22V
Resume/Accel	RH 1-3	3.0V ± 0.22V

3. If not within specification, replace switch.