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General Information

SPECIFICATIONS

IGNITION SYSTEM

Items		Specification
Ignition coil	Primary resistance	0.7 ± 15 % (Ω)
	Secondary resistance	-
Spark plugs (Unleaded)	Type	ZFR5F-11
	Gap	1.0 ~ 1.1 mm (0.0394 ~ 0.0433in.)
Spark plugs (leaded)	Type	ZFR5F
	Gap	0.9 ~ 1.0 mm (0.30354 ~ 0.0394in)

STARTING SYSTEM

Items			Specification
Starter	Rated voltage		12.V, 0.9 kW
	No. of pinion teeth		8
	No-load characteristic-s	Voltage	11.5V
		Ampere	60 MAX
		Speed	5.500 rpm, MIN
	Commutator diameter	Standard	32.9 ~ 33.1 mm (1.29 53 ~ 1.3031in.)
	Under cut depth	Standard	0.5 ~ 1.0 mm (0.0197 ~ 0.0394in)
		Limit	0.2 mm (0.0079in)

CHARGING SYSTEM

Items		Specification
Alternator	Type	Battery voltage sensing
	Rate voltage	13.5 V, 90A
	Speed in use	1,000 ~ 18,000 rpm
	Voltage regulator	IC Regulator built-in type
	Regulator setting voltage	14.55 ± 0.2 V
	Temperature compensation	-7 ± 3 mV / ˚C
Battery	Type	MF 45AH
	Cold cranking amperage [at -18˚C(-0.4˚F)]	410 A
	Reserve capacity	80 min
	Specific gravity [at 20˚C(68˚F)]	1.280 ± 0.01

⚠CAUTION

- **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**

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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).**

TROUBLESHOOTING

IGNITION SYSTEM

Symptom	Suspect area	Remedy
Engine will not start or is hard to start (Cranks OK)	Ignition lock switch Ignition coil Spark plugs Ignition wiring disconnected or broken Spark plugs cable	Inspect ignition lock switch, or replace as required Inspect ignition coil, or replace as required Inspect spark plugs, or replace as required Repair wiring, or replace as required Inspect cable, or replace as required
Rough idle or stalls	Ignition wiring Ignition coil Spark plugs cable	Repair wiring, or replace as required Inspect ignition coil, or replace as required Inspect cable, or replace as required
Engine hesitates / poor acceleration	Spark plugs and spark plug cables Ignition wiring	Inspect spark plugs / cable, or replace as required 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 Light burned out Wiring connection loose Electronic voltage regulator	Check fuses Replace light Tighten loose connection Replace voltage regulator
Charging warning indicator does not go out with engine running. (Battery requires frequent recharging)	Drive belt loose or worn Battery cable loose, corroded or worn Electronic voltage regulator or alternator Wiring	Adjust belt tension or replace belt Inspect cable connection, repair or replace cable Replace voltage regulator or alternator Repair or replace wiring
Overcharge	Electronic voltage regulator Voltage sensing wire	Replace voltage regulator Repair or replace wiring
Discharge	Drive belt loose or worn Wiring connection loose or short circuit Electronic voltage regulator or alternator Poor grounding Worn battery	Adjust belt tension or replace belt Inspect wiring connection, repair or replace wiring Replace voltage regulator or alternator Inspect ground or repair Replace battery

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STARTING SYSTEM

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

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Ignition System

DESCRITION

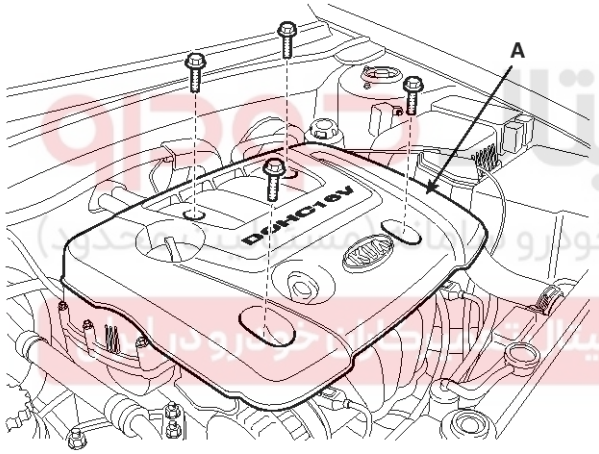
Ignition timing is controlled by the electronic control ignition timing system. The standard reference ignition timing data for the engine operating conditions are pre-programmed in the memory of the ECM (Engine Control Module).

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.

ON-VEHICLE INSPECTION

SPARK TEST

1. Remove the engine cover(A).



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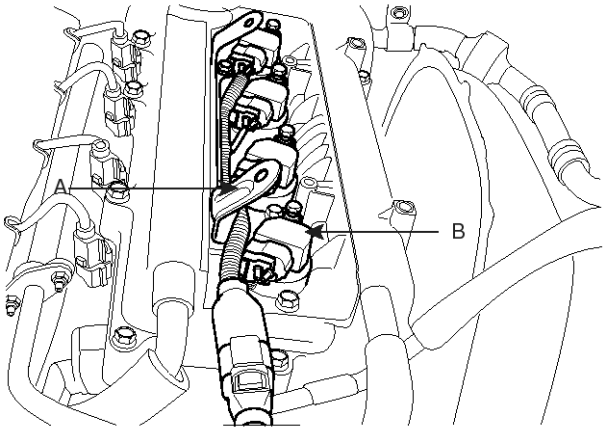
2. Remove the engine cover bracket(A) and the ignition coil(B).



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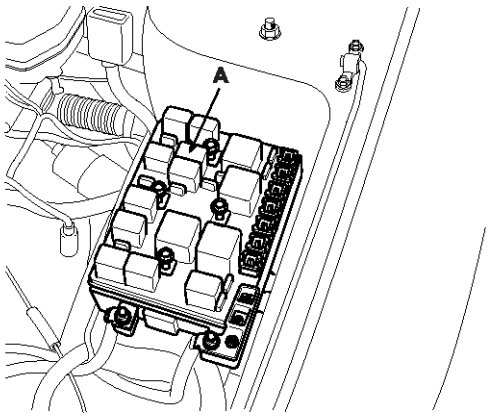
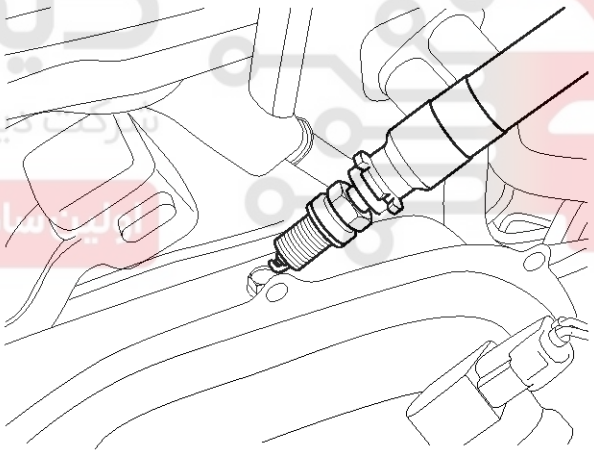
3. Remove the fuel pump relay(A) from the fuse box for fuel not to be injected while checking.



ABGE002A

4. Using a spark plug socket, remove the spark plug.
5. Install the spark plug to the ignition coil.
6. Ground the spark plug to the engine.



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7. Check if spark occurs while engine is being cranked.

NOTICE

Do not crank engine for more then 5~10 seonds.

8. Inspect all the spark plugs.
9. Using a spark plug socket, install the spark plug.
10. Install the ignition coil and the engine cover bracket.

Tightening torque :
9.8 ~11.8 Nm (1.0~1.2 kgf.m, 7.2~8.7 lb-ft)

11. Install the engine cover.

Tightening torque :
7.8 ~11.8 Nm (0.8~1.2 kgf.m, 5.8~8.7 lb-ft)

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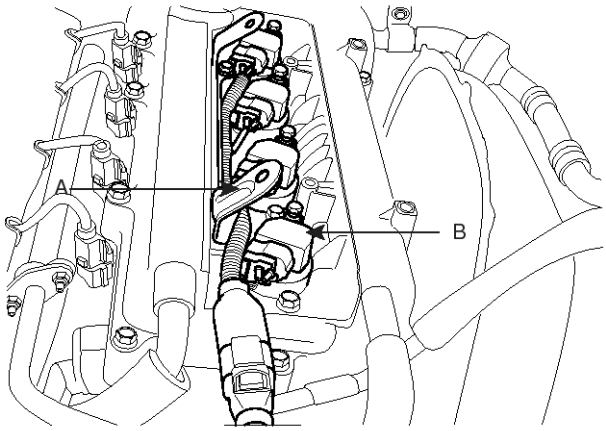
INSPECT SPARK PLUG

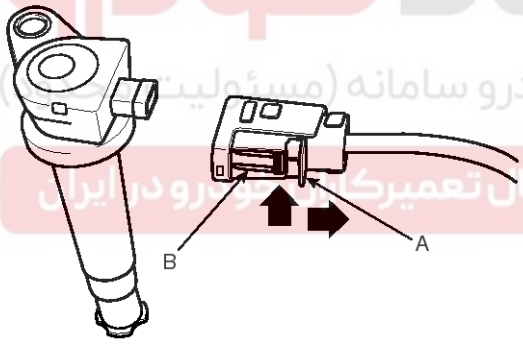
1. Remove the engine cover bracket(A) and the ignition coil(B) with bolt.



SHDEE6001D

NOTICE

When removing the ignition coil connector, pull the lock pin(A) and push the clip(B).



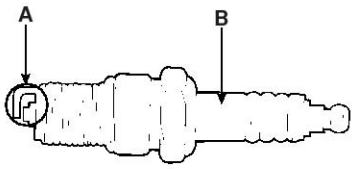
ABGE003A

2. Using a spark plug socket, remove the spark plug.

CAUTION

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

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



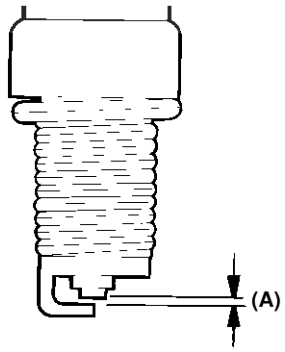
EBKD002K

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

4. Check the electrode gap (A).

Standard
Unleaded : 1.0 ~ 1.1 mm (0.0394 ~ 0.0433 in.)
Leaded: 0.9 ~ 1.0 mm (0.0354 ~ 0.0394in.)



EBKD002L

INSPECT IGNITION COIL

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

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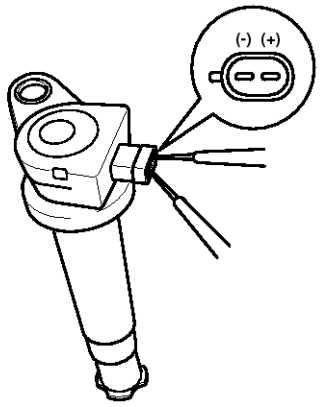

ABGE004A

Standard value: 0.75Ω ± 15%

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Charging System

DESCRIPTION

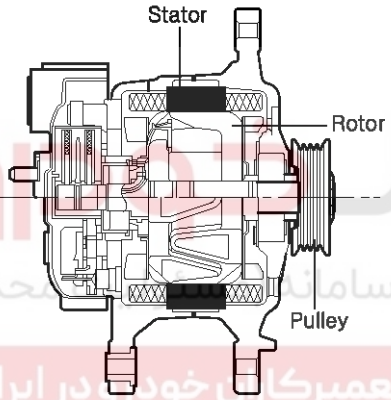
The charging system included a battery, an alternator with a built-in regulator, and the charging indicator light and wire.

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

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

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

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



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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.**

CHECK THE BATTERY TERMINALS AND FUSES

1. Check that the battery terminals are not loose or corroded.
2. Check the fuses for continuity.

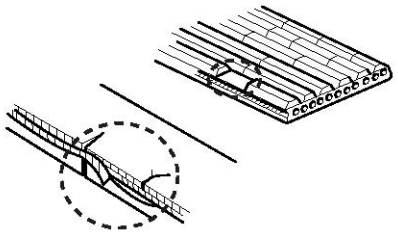
INSPECT DRIVE BELT

1. 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

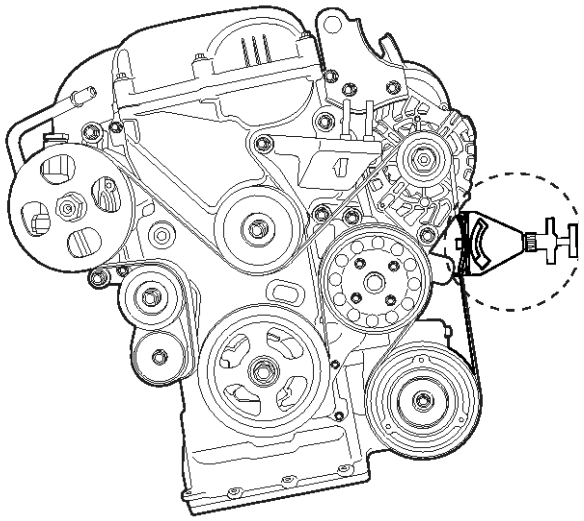
2. Measure drive belt tension and adjust it.

   Apply a force of 98N (10kgf, 22lb), and measure tension between the alternator and the water pump pulley.

TENSION

New belt	931.6 ~ 1029.7N (95-105 kgf, 209.4~231.5 lb)
Used belt	637.4 ~ 735.5mm (65~75 kgf, 143.3~165.3 lb)

If the belt tension is not as specified, adjust it.



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NOTICE

- *"New belt" refers to a belt which has been used less than 5 minutes on a running engine.*
- *"Used belt" refers to a belt which has been used on a running engine for 5 minutes or more.*
- *After installing a belt, check that it fits properly in the ribbed grooves.*
- *Check with your hand to confirm that the belt has not slipped out of the groove on the bottom of the pulley.*
- *After installing a new belt, run the engine for about 5 minutes and recheck the belt tension.*

VISUALLY CHECK ALTERNATOR 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 alternator 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.

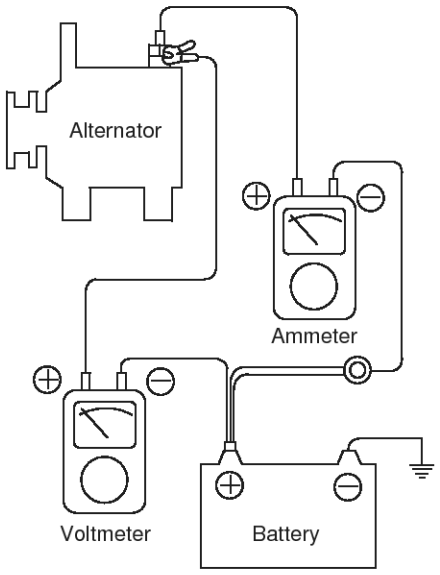
INSPECT CHARGING SYSTEM

VOLTAGE DROP TEST OF ALTERNATOR OUTPUT WIRE

This test determines whether or not the wiring between the alternator "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 alternator "B" terminal. Connect the (+) lead wire of ammeter to the "B" terminal of alternator and the (-) lead wire of ammeter to the output wire. Connect the (+) lead wire of voltmeter to the "B" terminal of alternator 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 alternator "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.

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OUTPUT CURRENT TEST

This test determines whether or not the alternator 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.

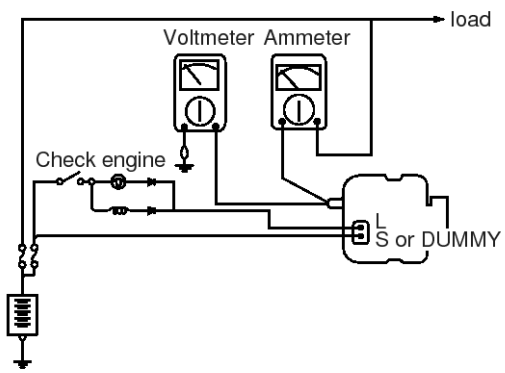
   Check the battery installed in the vehicle to ensure that it is good condition. The battery checking method is described in the section "Battery".

   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 alternator 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 alternator output wire from the alternator "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 alternator "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.



EBKD013H

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 alternator "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 alternator from the vehicle and test it.

Limit value : 50% of the rate voltage

NOTICE

- *The nominal output current value is shown on the nameplate affixed to the alternator body.*
- *The output current value changes with the electrical load and the temperature of the alternator 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 alternator 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 alternator output wire to the alternator "B" terminal.
6. Connect the battery ground cable.

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REGULATED VOLTAGE TEST

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

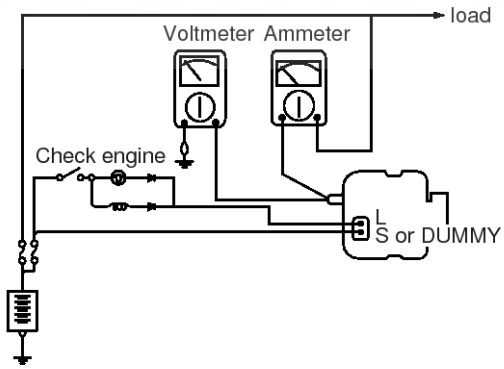
PREPARATION

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 alternator 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 alternator and ground. Connect the (+) lead of the voltmeter to the "B" terminal of the alternator. Connect the (-) lead to good ground or the battery (-) terminal.
5. Disconnect the alternator output wire from the alternator "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.



EBKD013H

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 alternator "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 alternator output current drops to 10A or less

RESULT

1. If the voltmeter reading is within 13.5 ~ 15.2V, the voltage regulator is functioning correctly. If the reading is other than the standard value, the voltage regulator or the alternator is faulty.
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 alternator output wire to the alternator "B" terminal.
6. Connect the battery ground cable.

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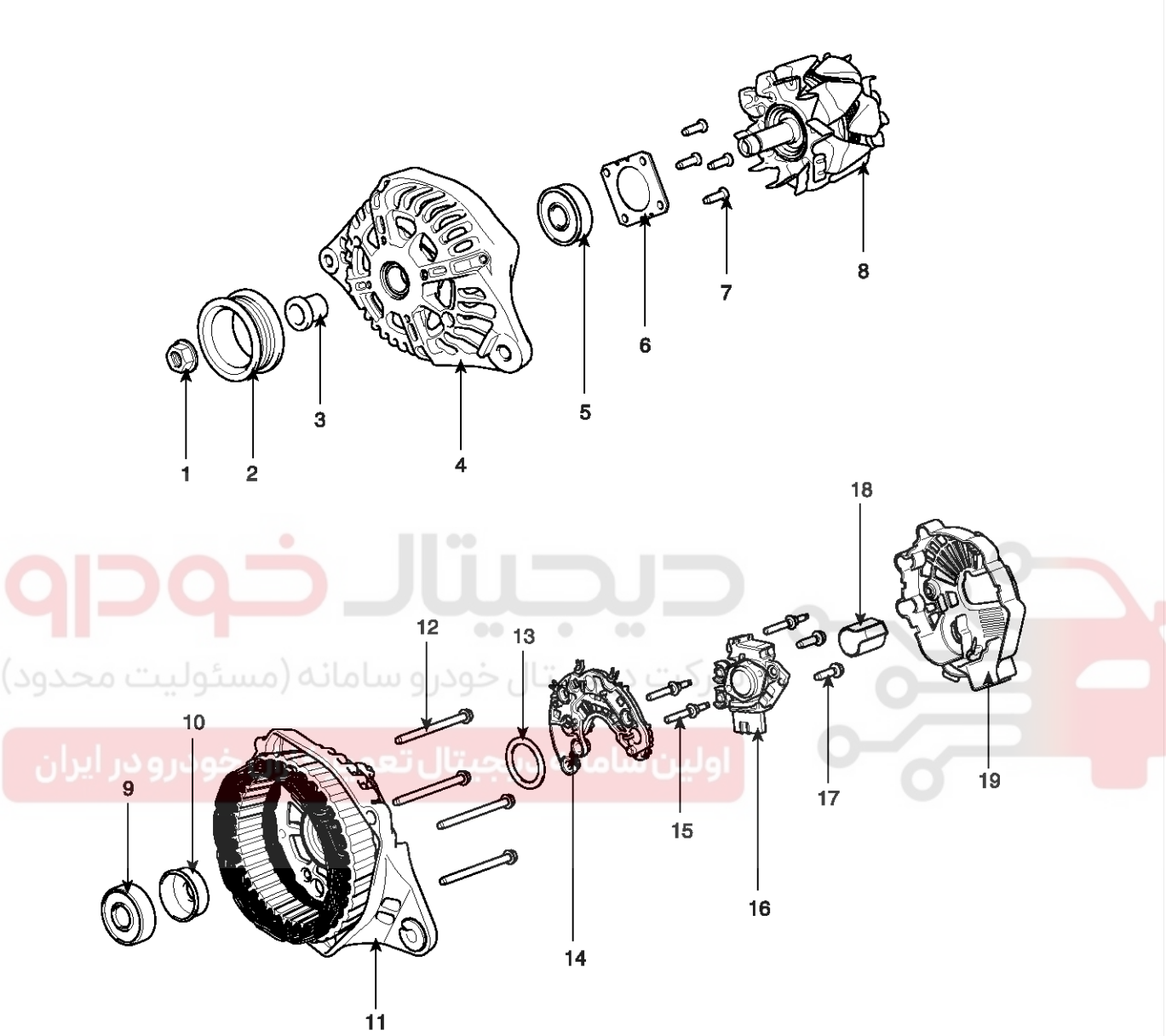
Alternator

COMPONENTS



1. Nut
2. Pulley
3. Spacer
4. Front cover assembly
5. Front bearing
6. Bearing cover
7. Bearing cover bolts
8. Rotor coil
9. Rear bearing
10. Bearing cover
11. Rear cover
12. Bolts
13. Seal
14. Rectifier assembly
15. Stud bolts
16. Brush holder assembly
17. Brush holder bolts
18. Slip ring guide
19. Cover

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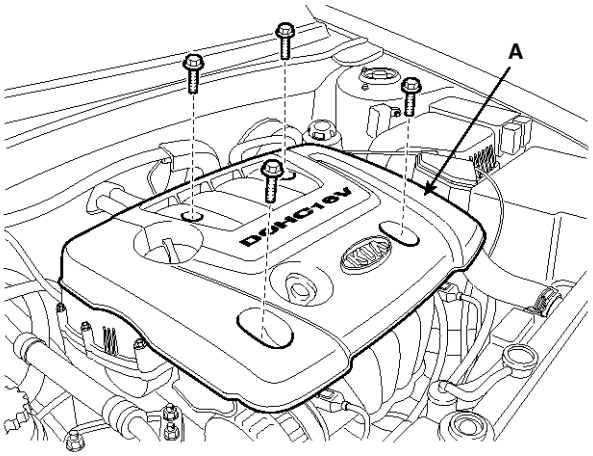
REMOVAL

1. Disconnect the battery negative terminal first, then the positive terminal.
2. Remove the engine cover(A).

Tightening torque :
7.8~11.8 Nm (0.8~1.2 kgf.m, 5.8~8.7 lb-ft)



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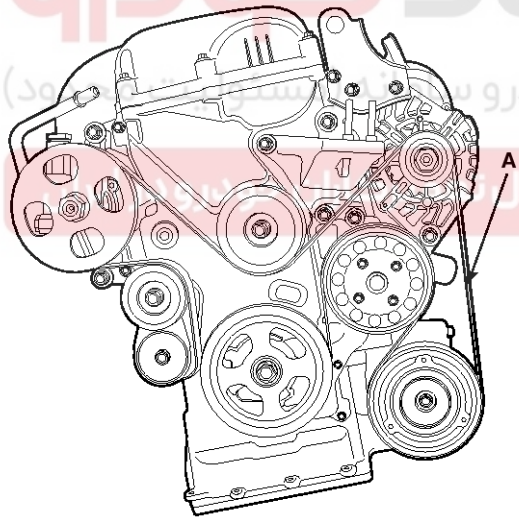
3. Remove the drive belt(A)



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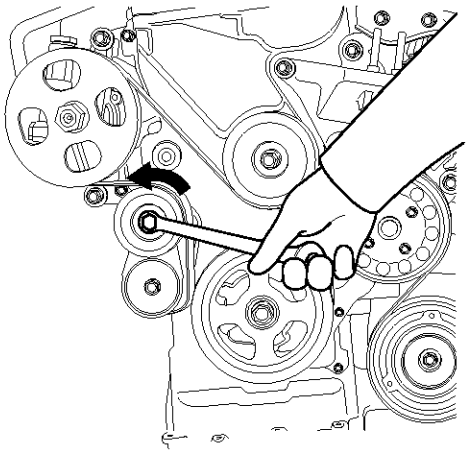
NOTICE

Remove the drive belt by turning the auto-tensioner counterclockwise.



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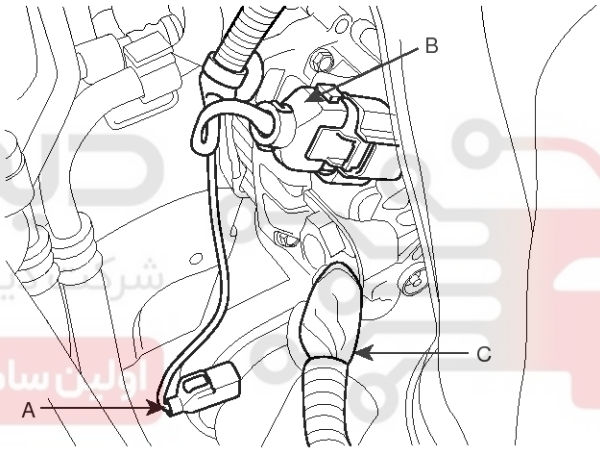
4. Disconnect the air compressor connector(A) and the alternator connector (B), and remove the cable (C) from alternator "B" terminal.



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5. Pull out the through bolt (A) and then remove the alternator.

Tightening torque :
19.6~26.5 Nm (2.0~2.7 kgf.m, 14.5~19.5 lb-ft)-12mm bolt
29.4~41.2 Nm (3.0~4.2 kgf.m, 21.7~30.4 lb-ft)-14mm bolt

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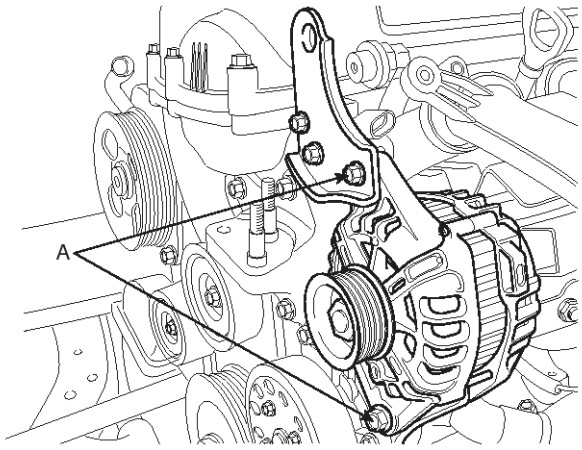

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6. Installation is the reverse order of removal.

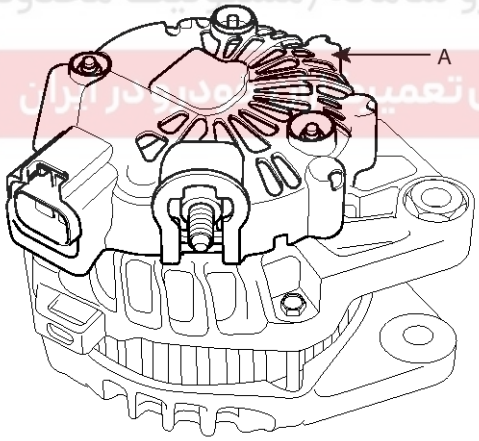
NOTICE

Install drive belt: crankshaft pulley → water pump pulley → alternator pulley → power steering pulley → auto-tensioner idle pulley.

Put the drive bolt to the idle pulley by rotating idle belt of the auto-tensioner in the counter-clockwise, release the auto-tensioner pulley slowly.

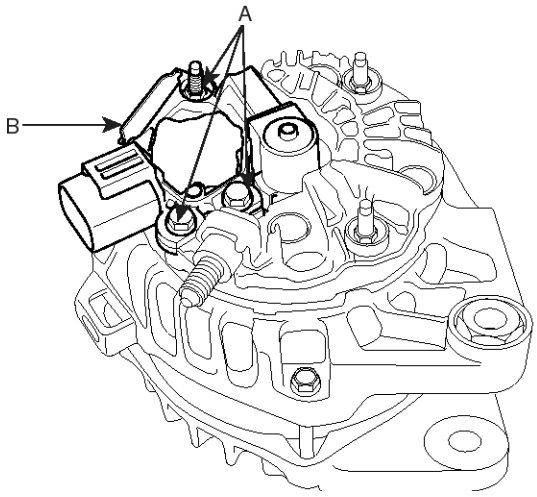
DISASSEMBLY

1. Remove the alternator cover(A).



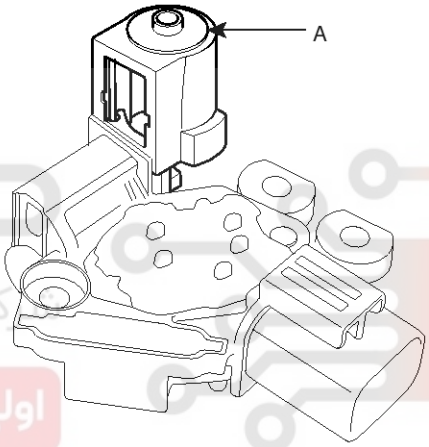
SHDEE6006D

2. Loosen the mounting bolts(A) and disconnect the brush holder assembly(B).



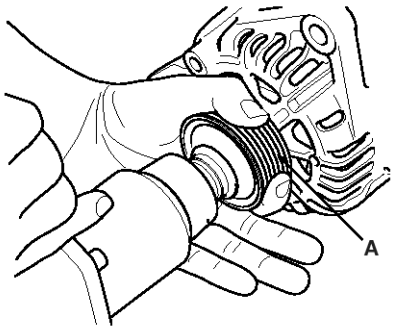
SHDEE6007D

3. Remove the slip ring guide(A).



SHDEE6008D

4. Remove the nut, pulley(A) and spacer.



EBKD301D

5. Loosen the 4 through bolts(A).

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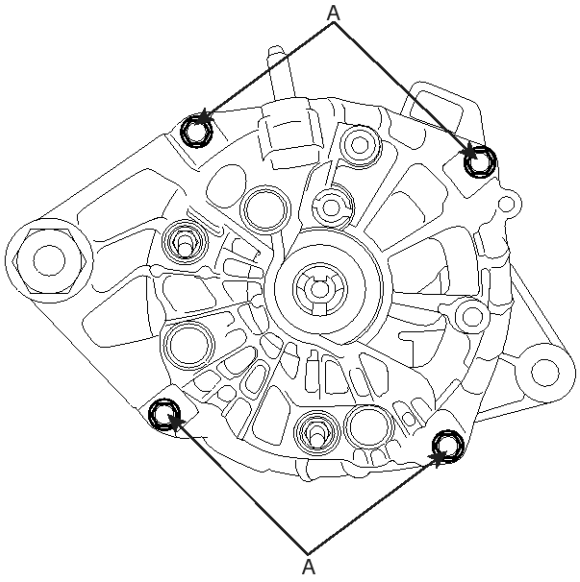
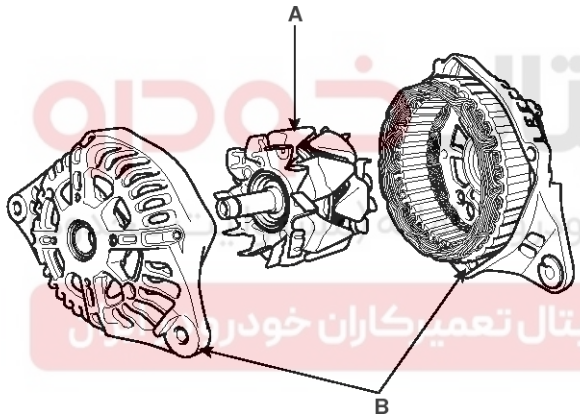


SLDEE7003L

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



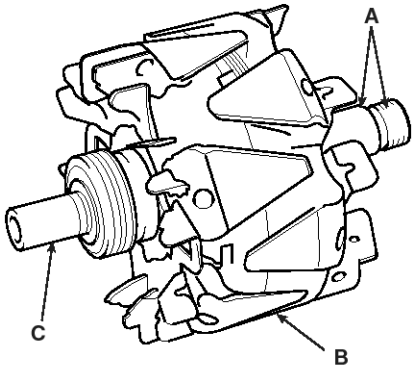
EBKD301G

7. Reassembly is the reverse of disassembly.

INSPECTION

ROTOR

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

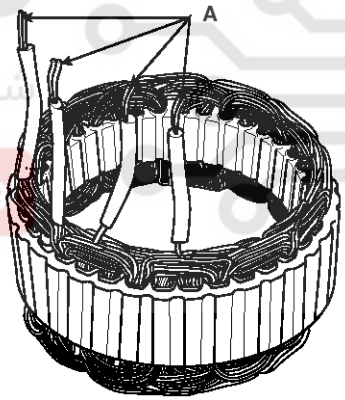


EBKD008A

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 alternator.

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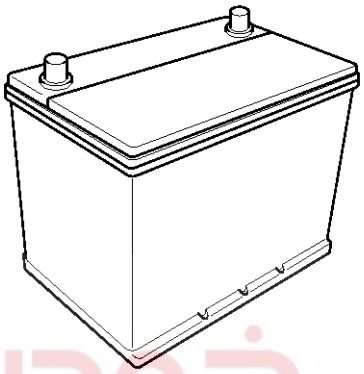
Battery

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

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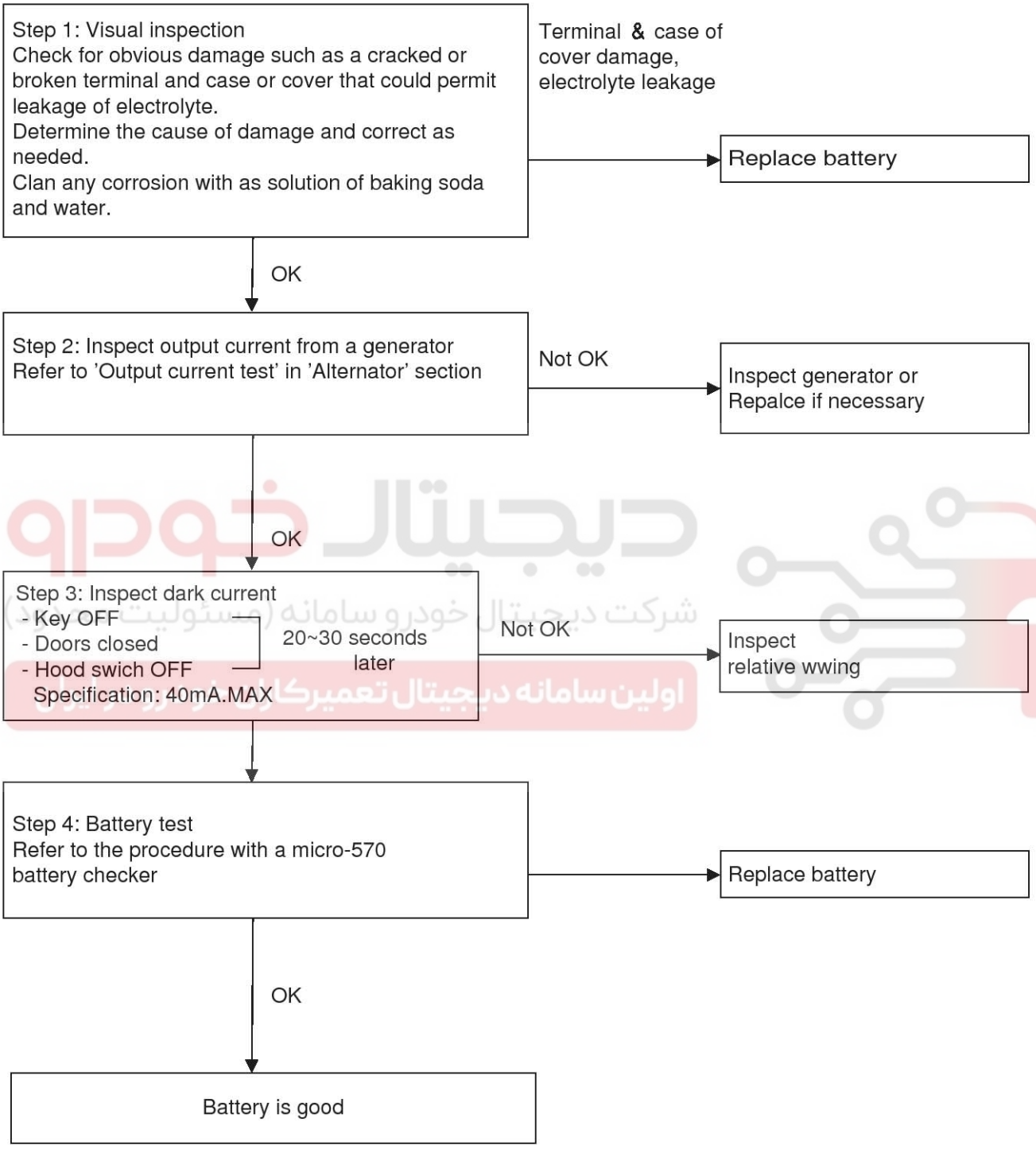
INSPECTION

BATTERY DIAGNOSTIC FLOW



SMGEE6100L

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LOAD TEST

1. Perform the following steps to complete the load test procedure for maintenance free batteries.
2. Connect the load tester clamps to the terminals and proceed with the test as follow:
   1) If the battery has been on charge, remove the surface charge by connect a 300ampere load for 15 seconds.
   2) Connect the voltmeter and apply the specified load.
   3) Read the voltage after the load has been applied for 15 seconds.
   4) Disconnect the load.
   5) Compare the voltage reading with the minimum and replace the battery if battery test voltage is below that shown in the voltage table.

Voltage	Temperature
9.6V	20˚C (68.0˚F) and above
9.5V	16˚C (60.8˚F)
9.4V	10˚C (50.0˚F)
9.3V	4˚C (39.2˚F)
9.1V	-1˚C (30.2˚F)
8.9V	-7˚C (19.4˚F)
8.7V	-12˚C (10.4˚F)
8.5V	-18˚C (-0.4˚F)

NOTICE

- *If the voltage is greater shown in the table, the battery is good.*
- *If the voltage is less than shown in the table, replace the battery.*

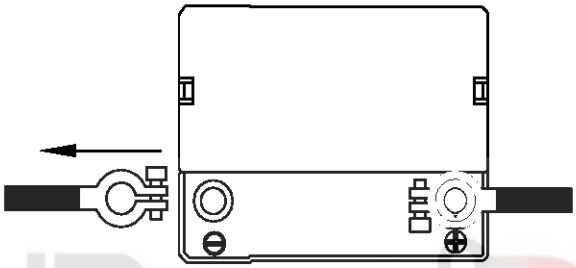
CLEANING

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.

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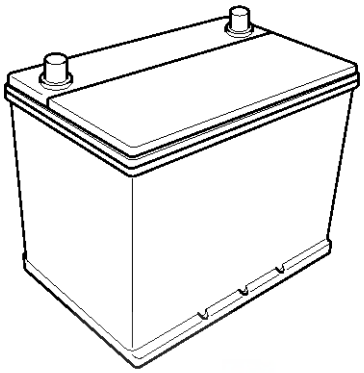
⚠CAUTION

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

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Starting System

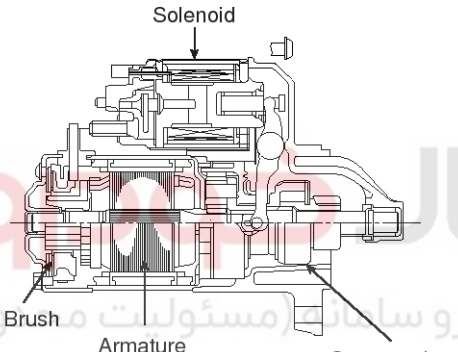
DESCRIPTION

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.



SHDEE6005L

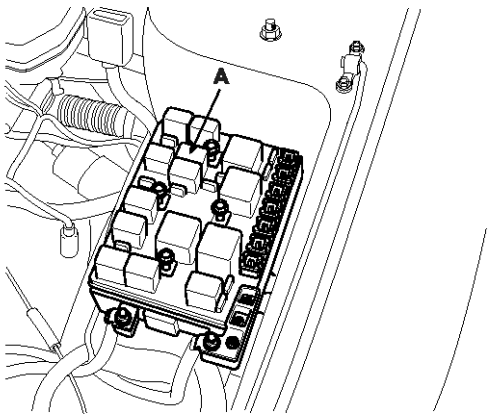
TROUBLESHOOTING

STARTER CIRCUIT

NOTICE

The battery must be in good condition and fully charged.

1. Remove the fuel pump relay(A) from the fuse box.



ABGE002A

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.

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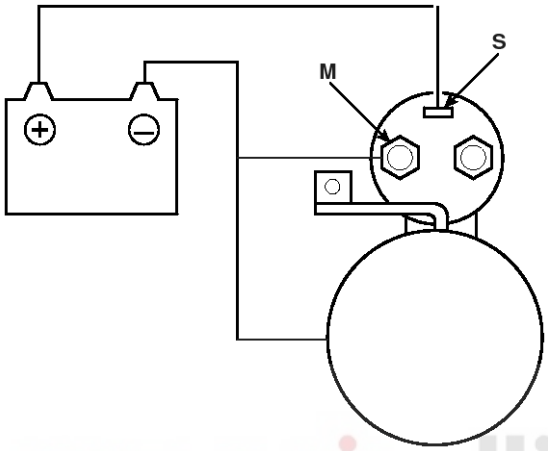
STATER SOLENOID TEST

1. Disconnect the field coil wire from the M-terminal of solenoid switch.
2. Connect the battery (+) line to the S-terminal and (-) line to the M-terminal and the stater body.

⚠CAUTION
This test must be performed quickly (in less than 10 seconds) to prevent the coil from burning.

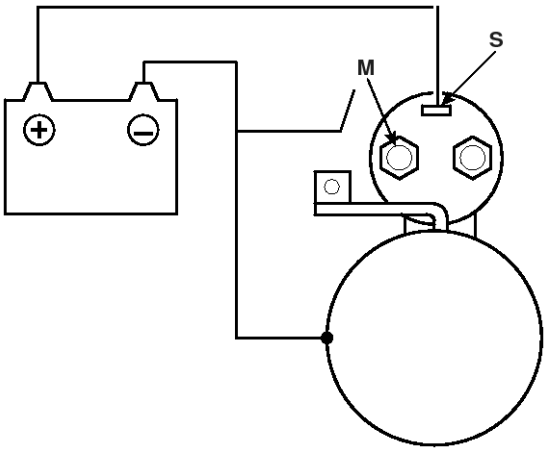


SHDEE6017D

3. Connect the field coil wire to the M-terminal.
4. If the pinion moves out, the pull-in coil of solenoid is working properly.

   If the pinion does not move, replace the magnetic switch.
5. Disconnect the (-) line from the M-terminal.
6. If the pinion doesn't have moved, the hold-in coil of the solenoid is working properly.

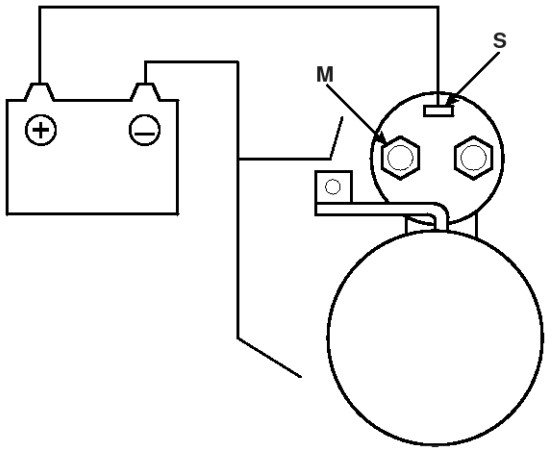
⚠CAUTION
This test must be performed quickly (in less than 10 seconds) to prevent the coil from burning.



SHDEE6018D

7. If the pinion goes back in its original position when you disconnecting the (-) line from the body, the system must be in good condition.

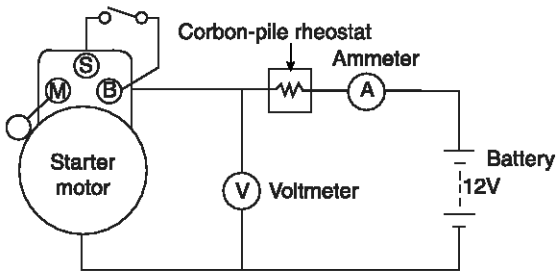
⚠CAUTION
This test must be performed quickly (in less than 10 seconds) to prevent the coil from burning.



SHDEE6019D

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.

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7. Confirm that the maximum amperage is within the specifications and that the starter motor turns smoothly and freely.

Current : 60A max
Speed : 5500 rpm

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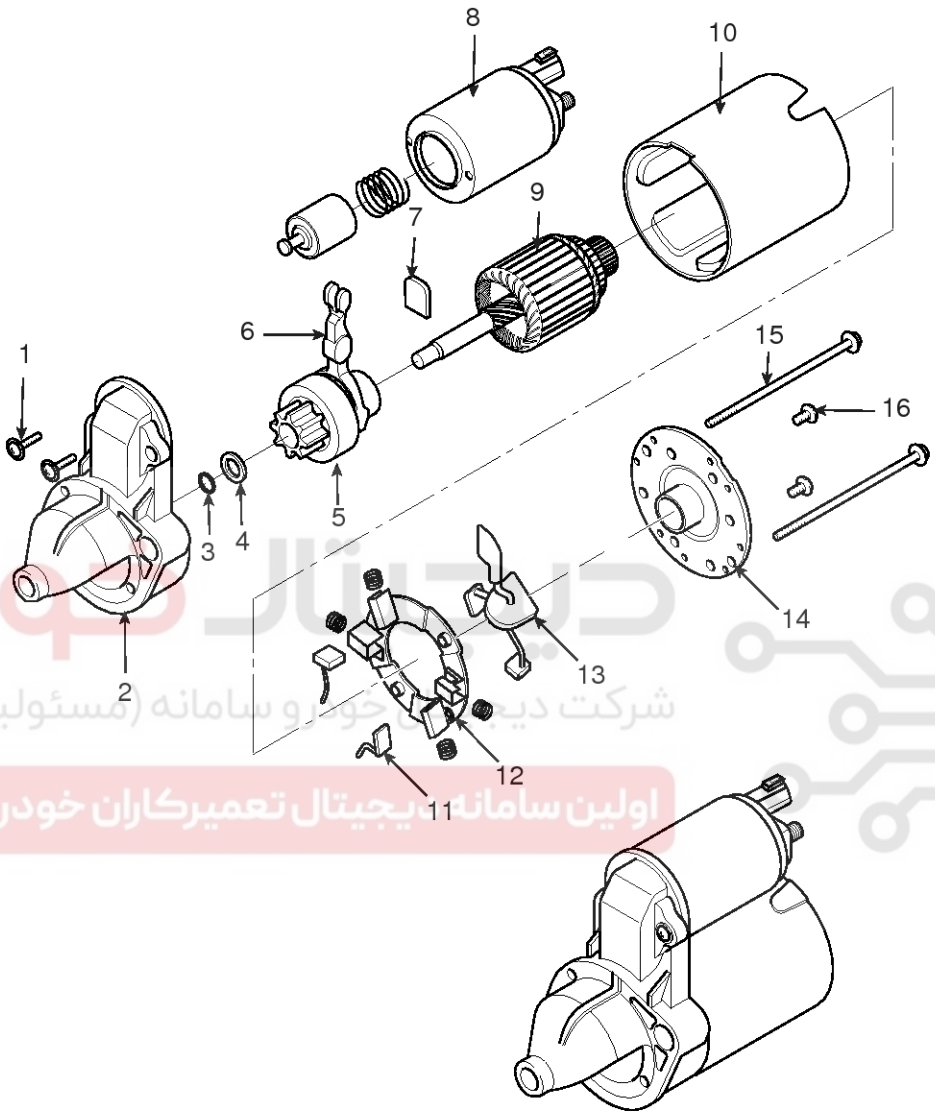
Starter

COMPONENTS



1. Screw
2. Front bracket assembly
3. Stop ring
4. Stopper
5. Overruning clutch assembly
6. Lever
7. Lever packing
8. Magnet switch assembly
9. Armature assembly
10. Yoke assembly
11. Brush (-)
12. Brush holder assembly
13. Brush (+)
14. Rear bracket
15. Through bolt
16. Screw

SLDEE7002L

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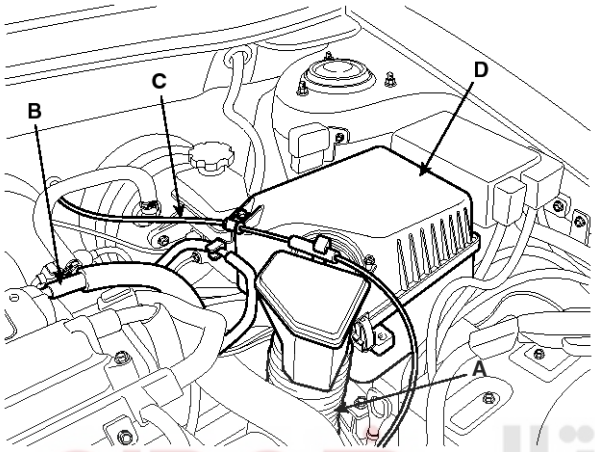
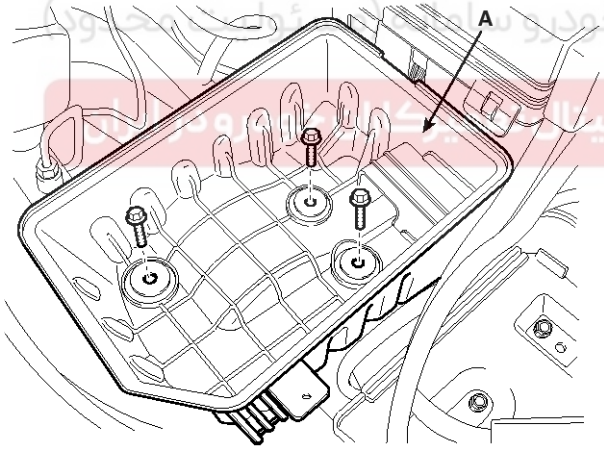
REMOVAL

1. Disconnect the battery negative cable.
2. Remove the air cleaner assembly.
   1) Disconnect the air cleaner hose (A) and the bleeder hose (B).
   2) Remove the accelerator cable (C) from the air cleaner.
   3) Remove the air cleaner upper cover (D).



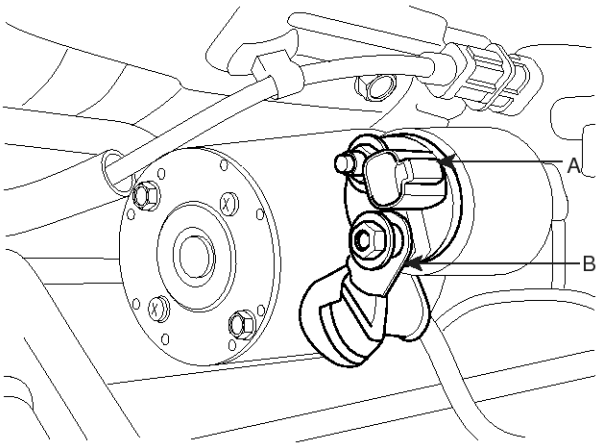
SLDEM7004D

3. Remove the air cleaner lower cover (A).



SLDEM7005D

4. Disconnect the starter cable (B) from the B terminal on the solenoid, then disconnect the connector (A) from the S terminal.



SHDEE6010D

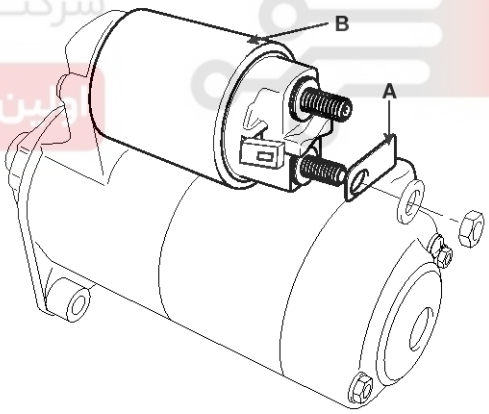
5. Remove the 2 bolts holding the starter, then remove the starter.

Tightening torque :
42.2~53.9 Nm (4.3~5.5 kgf.m, 31.1~39.8 lb-ft)

6. Installation is the reverse of removal.
7. Connect the battery negative cable to the battery.

DISASSEMBLY

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



SLDEA6004D

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

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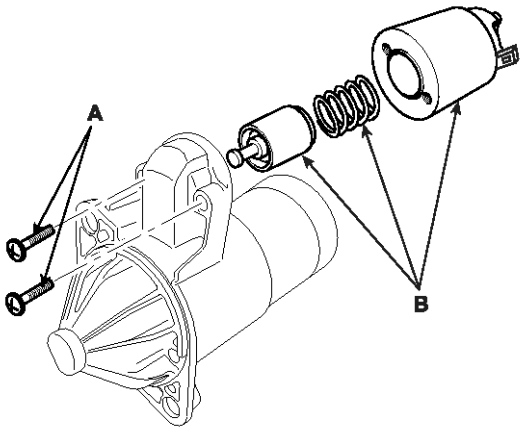
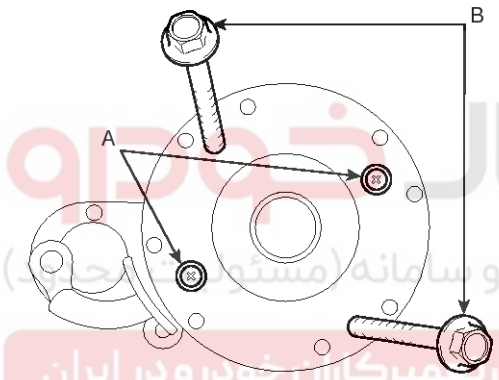


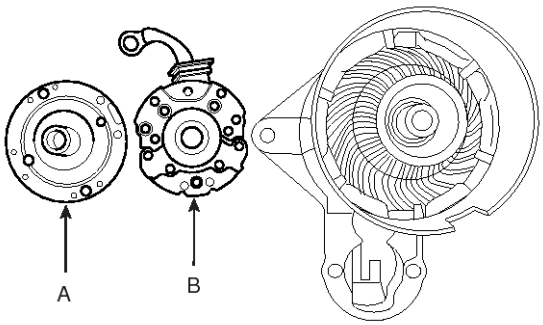
SLDEA6005D

3. Loosen the brush holder mounting screw (A) and through bolts (B).



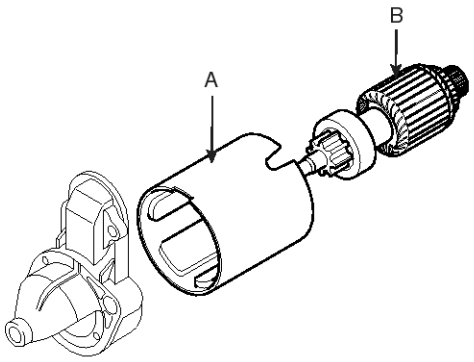
ABHE005A

4. Remove the rear bracket (A) and brush holder assembly (B).



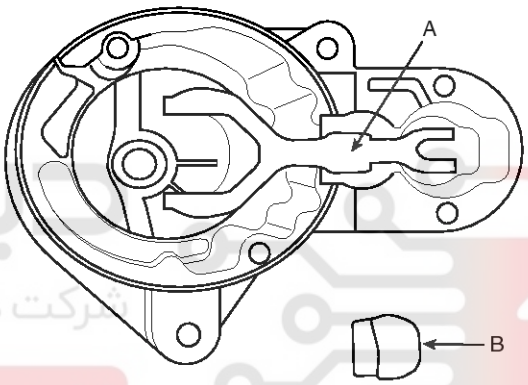
SHDEE6004L

5. Remove the yoke (A) and armature (B).



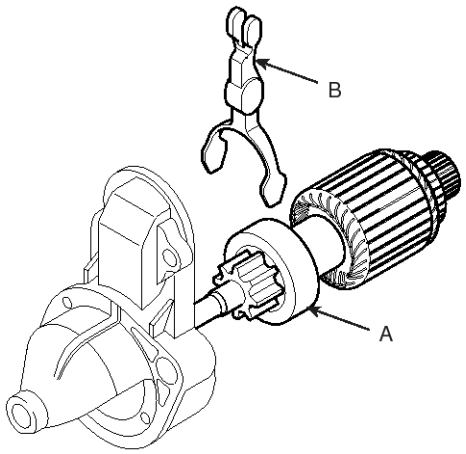
SHDEE6006L

6. Remove the, lever plate (A) and packing (B).



ABJF006A

7. Remove the overrunning clutch (A) and lever (B).



SHDEE6001L

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

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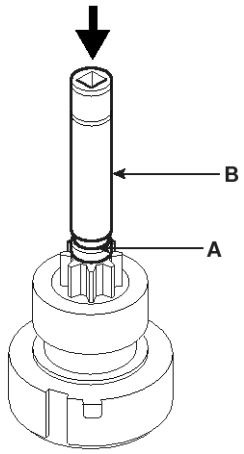
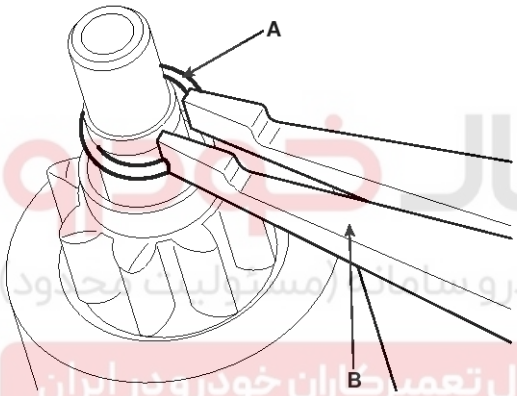


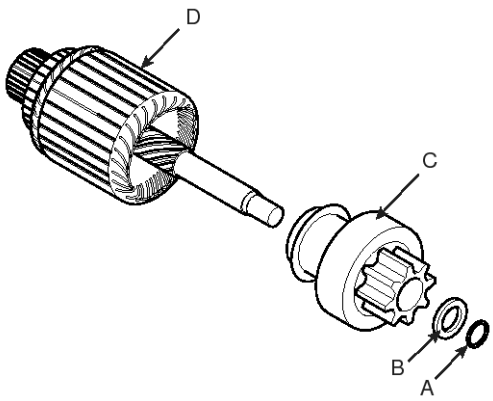
EBKD011K

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



EBKD011L

10. Remove the stopper (A), stop ring (B), overrunning clutch (C) and armature (D).

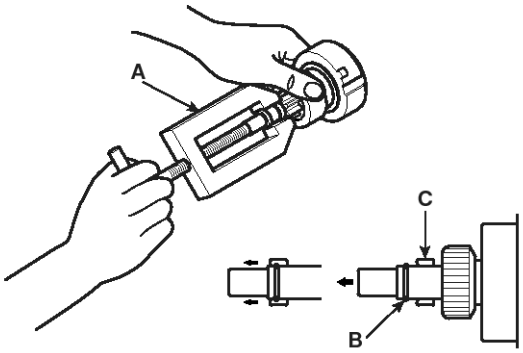


ABHE010A

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).

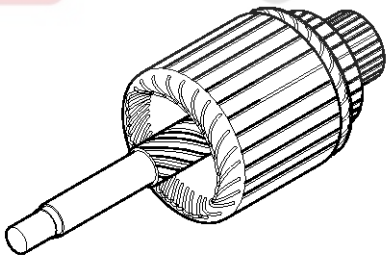


EBKD011O

INSPECTION

ARMATURE INSPECTION AND TEST

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.



ABHE011A

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).

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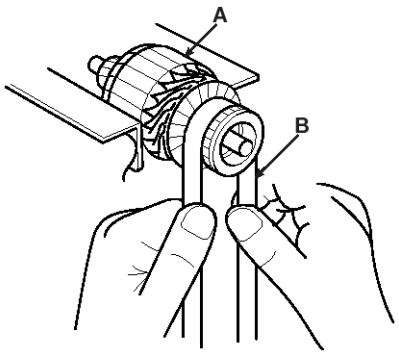


EBKD012B

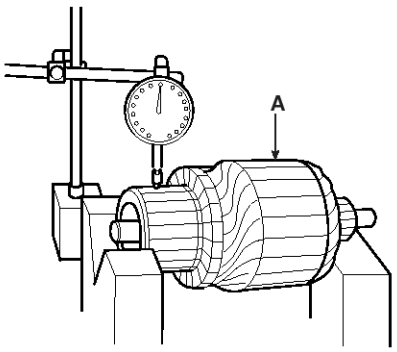
5. Check the commutator diameter. If the diameter is below the service limit, replace the armature.

Commutator diameter
Standard (New) : 32.9 ~ 33.1mm (1.2953 ~ 1.3031 in)

EBKD012C

6. 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.

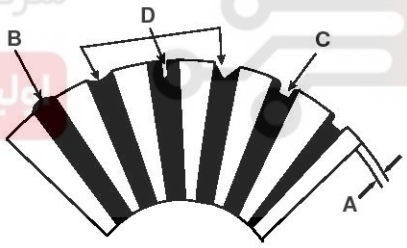
Commutator runout
Standard (New) : 0.02mm (0.0008 in.) max
Service limit : 0.05mm (0.0020 in.)



EBKD012D

7. 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 ~ 1.0mm (0.0197 ~ 0.0394 in.)
Limit : 0.2mm (0.0079 in.)



EBKD012E

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

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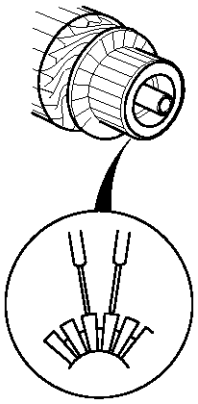
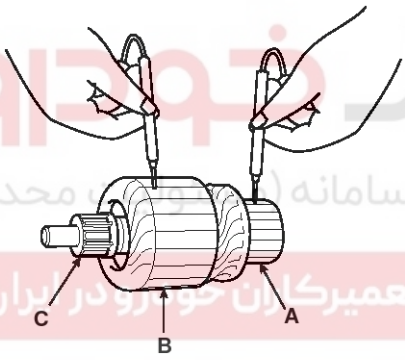


EBKD012F

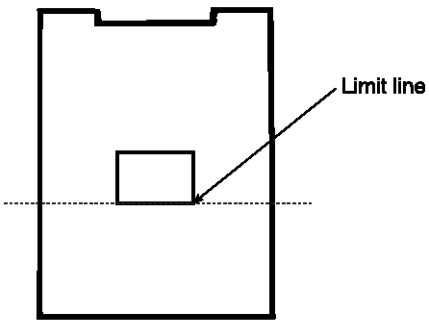
9. Check with an ohmmeter that no continuity exists between the commutator (A) and armature coil core (B), and between the commutator and armature shaft (C). If continuity exists, replace the armature.



EBKD012G

STARTER BRUSH

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



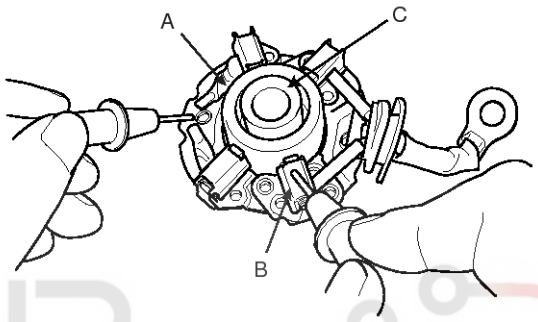
BBGE008A

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.

STARTER BRUSH HOLDER TEST

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.



ABHE012A

NOTICE

Use a pipe (C) of suitable size for the brushes not to get removed from the brush holder.

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.

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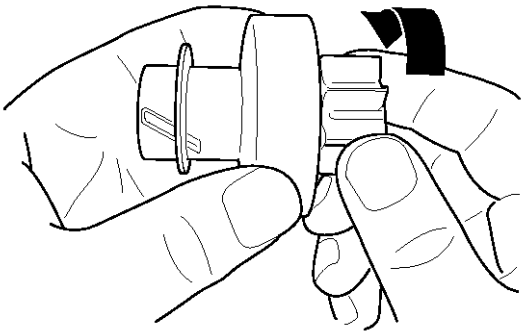

ABHE013A

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.

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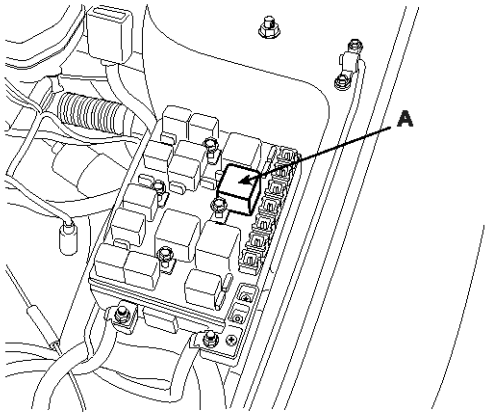
Starter Relay

INSPECTION

1. Remove the fuse box cover.
2. Remove the starter relay (A).



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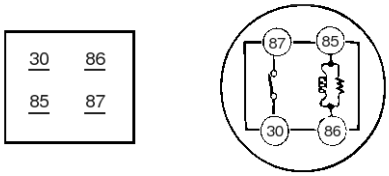
3. Using an ohmmeter, check that there is continuity between each terminal.

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.



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

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