Engine Electrical System

GENERAL

SPECIFICATIONS EBNC0010

IGNITION COIL

Type	Mold dual coil
Primary coil resistance	0.5 ± 0.05Ω
Secondary coil resistance	12.1 ± 1.8kΩ

SPARK PLUG

Type	UNLEADED	LEADED
NGK	BKR5ES-11	BKR5ES
Champion	RC10YC4	RC10YC
Plug gap mm (in.)	1.0-1.1 (0.039-0.043)	0.7-0.8 (0.028-0.032)

STARTER MOTOR

Type	Reduction drive (with planetary gear)
Rated output	12V 0.9 kW, 1.2 kW
Rated time	30 sec.
No-load characteristics	
Terminal voltage	11.5V
Amperage	90A or less
Maximum speed	6,600 rpm or more
No. of pinion teeth	8
Pinion gap mm (in.)	0.5-2 (0.0197-0.079)

GENERATOR

Type	Battery voltage sensing
Rated output	13.5V 75A, 90A
Voltage regulator type	Electronic built-in type
Regulator setting voltage	14.4 ± 0.3V
Temperature compensation	-10 ± 3mV/°C

BATTERY

Type	MF 45Ah	MF 60Ah
Ampere hours (5HR)	36 Ah or more	48 Ah or more
Ampere hours (20HR)	45 Ah or more	60 Ah or more
Cold cranking [at -17.8°C (0°F)]	380A or more	550A or more
Reserve capacity	80 min.	92 min.
Specific gravity [at 25°C (77°F)]	1.280 ± 0.01	1.280 ± 0.01

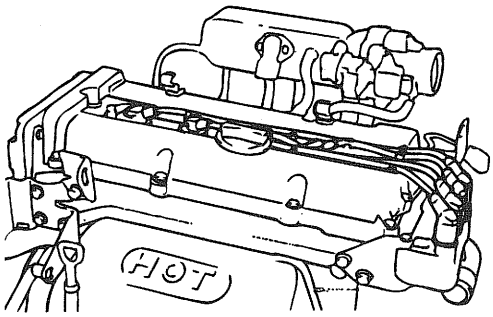
NOTE
COLD CRANKING AMPERAGE is the amperage that the battery can delivery for 30 seconds and maintain a terminal voltage of 7.2 volts or greater at a specified temperature.
RESERVE CAPACITY RATING is the amount of time a battery can deliver 25A and maintain a minimum terminal voltage of 10.5 volts at 26.7°C (80°F).

IGNITION SYSTEM (DOHC)

GENERAL INFORMATION EBKB0150

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 engine control module (ECM).

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.



EBDA015A

TROUBLESHOOTING

Trouble condition	Probable cause	Remedy
Engine cranks, but will not start or is hard to start.	Ignition coil faulty	Replace ignition coil
	High tension cable faulty	Replace high tension cable
	Spark plugs faulty	Replace plugs
	Incorrect immobilizer system	Adjust
	Ignition wiring disconnected or broken	Inspect and replace
Rough idle or stalling	Spark plugs faulty	Replace plugs
	Ignition wiring faulty	Replace wiring
	Ignition coil faulty	Replace ignition coil
	High tension cord faulty	Replace high tension cord
Engine hesitates/poor acceleration	Spark plugs faulty	Replace plugs
	Ignition wiring faulty	Replace wiring
Poor fuel economy	Spark plugs faulty	Replace plugs

IGNITION SWITCH EBKB0050

INSPECTION

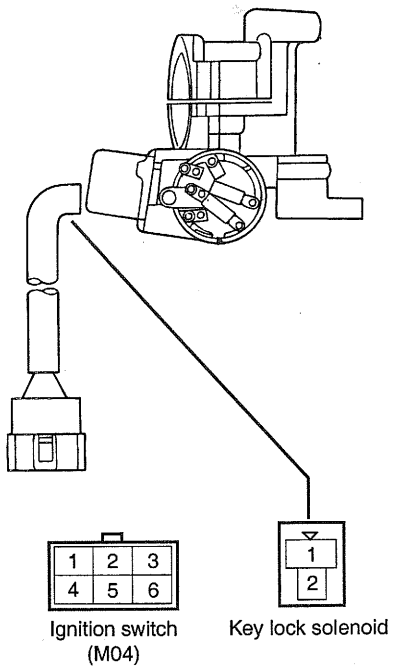
1. Remove the connector located under the steering column.
2. Check for continuity between terminals.

Position \ Terminal / Key		Ignition switch 1	2	3	4	5	6	Key lock solenoid 1	2
LOCK	Removed								
	Inserted								
ACC		○—○	○—○					○—○	
ON1		○—○	○—○	○—○	○—○		○—○		
START					○—○	○—○	○—○		

NOTE

○—○ **indicates that there is continuity between the terminals.**

EBDA005A

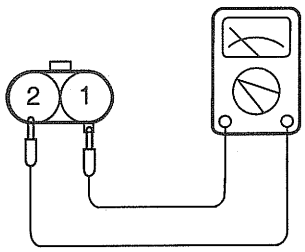


EBKB005A

IGNITION COILS EBKB0170

CHECKING IGNITION COILS

1. Measure the primary coil resistance between terminals 1 and 2 of connectors C18-2 and C68-1 (the coils at the No.1 and No.4 cylinder sides) of the ignition coil, and between terminals 1 and 2 of connectors C18-1 and C68-2 (the coils at the No.2 and No.3 cylinder sides).
   Standard value : 0.5 ± 0.05kΩ

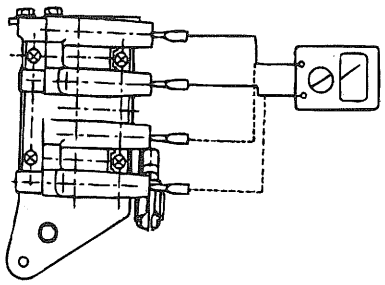


EBKB017A

2. Measure the secondary coil resistance between the high-voltage terminal for the No.1 and No.4 cylinders, and between the high-voltage terminals for the No.2 and No.3 cylinders.
   Standard value : 12.1 ± 1.8kΩ

⚠ ***CAUTION***

When measuring the resistance of the secondary coil, be sure to disconnect the ignition coil connector.



EBDA017B

INSPECTION AND CLEANING OF SPARK PLUGS EBDA0190

1. Disconnect the spark plug cables from the spark plugs.

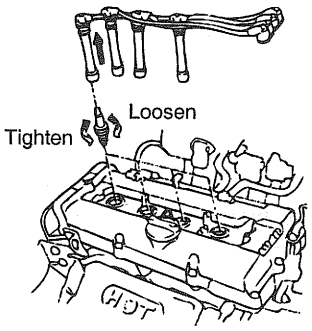
   NOTE

   When removing the spark plug cable, pull on the spark plug cable boot (not the cable), as it may be damaged.

2. Using a spark plug socket, remove all spark plugs from the cylinder head.

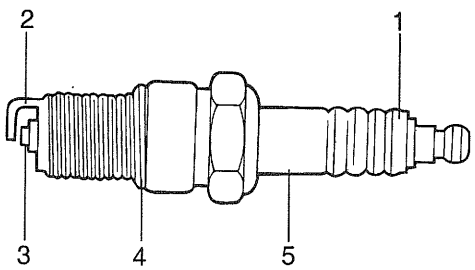
   CAUTION

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



EBDA019A

3. Check the spark plugs for the following :
   1) Broken insulator
   2) Worn electrode
   3) Carbon deposits
   4) Damaged or broken gasket
   5) Condition of the porcelain insulator at the tip of the spark plug

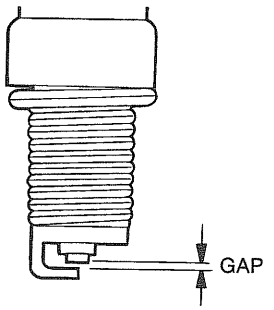


EBDA009B

4. Check the spark plug gap using a wire gap gauge, and adjust if necessary.

Standard value :

1.0-1.1 mm (0.039-0.043 in.)

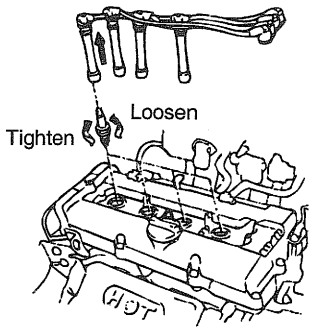


EBDA009C

5. Re- insert the spark plug and tighten to the specified torque.
   If it is over torqued, damage to the threads of the cylinder head may result.

Tightening torque :

20-30 Nm (204-306 kg.cm, 15-21 lb.ft)



EBDA019A

ANALYZING SPARK PLUGS

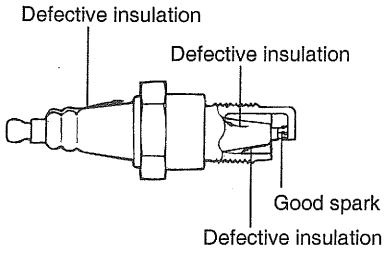
Engine conditions can be analyzed by examining the tip deposits near the electrode.

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

SPARK PLUG TEST (WHEN ENGINE CAN BE CRANKED)

Connect the spark plug cable. Ground the outer electrode (main body), and crank the engine. In the atmosphere, only short sparks are produced because of the small discharge gap. If the spark plug is good, however, sparks will occur in the discharge gap (between the electrodes). In

a defective spark plug, no sparks will occur because of a leak through the insulation.



EBDA019E

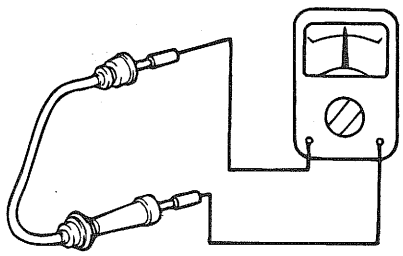
CHECKING SPARK PLUG CABLES

1. Check the cap and outer shell for cracks.
2. Measure the resistance

Spark plug cable				
CYLINDER	No.1	No.2	No.3	No.4
LENGTH (mm)	605	545	450	370
RESIS-TANCE (BOUGI)Ω	2.71-4.07	2.44-3.66	2.02-3.02	1.66-2.49
RESIS-TANCE (R16AIPS)Ω	6.05-12.71	5.45-11.45	4.50-9.45	3.70-7.77

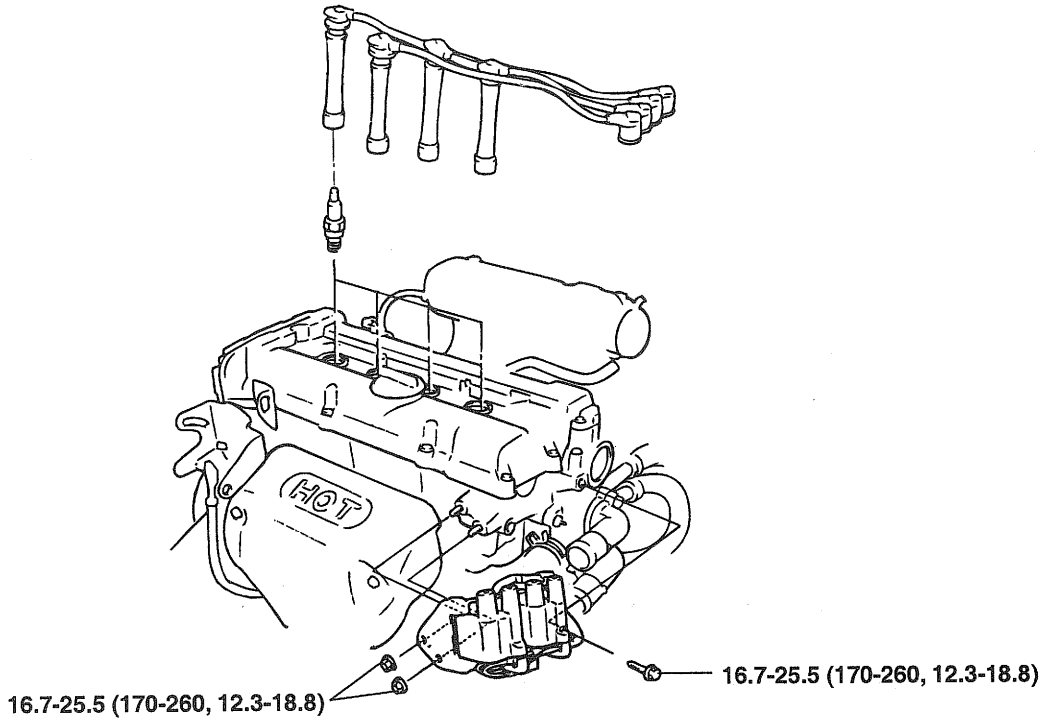
NOTE

Resistance should not be higher than 10KΩ per foot of cable. If resistance is higher, replace the cable.



EBDA019F

COMPONENT EBNC0230

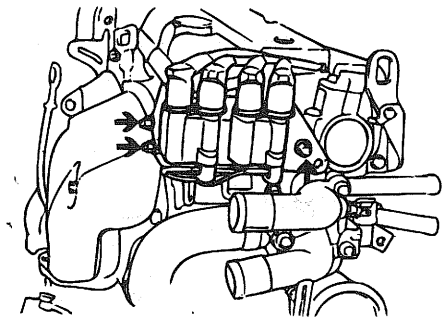


TORQUE : Nm (kg.cm, lb.ft)

EBDA023A

REMOVAL EBNC0240

1. Remove the ignition fuse (Fusible link-F (30A)).
2. Remove the rocker cover.
3. Disconnect the lead wire and spark plug cable.
4. Remove the ignition coil mounting bolt and remove the ignition coil assembly.
5. Installation is the reverse order of removal.

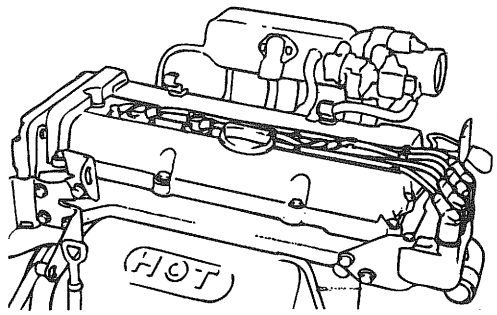


EBDA023B

INSTALLATION SPARK PLUG CABLE EBNC0250

Improper arrangement of spark plug cables will induce a voltage between the cables, causing misfire and develop a surge in acceleration during high-speed operation.

Therefore, be careful to arrange the spark plug cables properly.



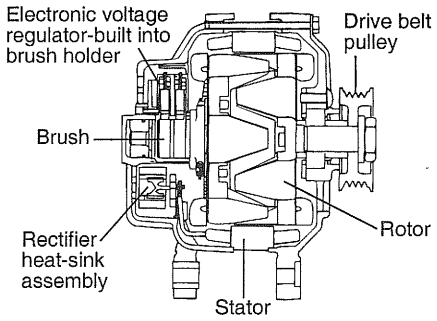
EBDA023C

CHARGING SYSTEM

GENERAL INFORMATION EBNC0260

The charging system includes a battery, a generator with a built-in regulator, and the charging indicator light and wire. The generator has six built-in diodes (three positive and three negative), each rectifying an AC current to DC current. Therefore, the DC current appears at generator "B" terminal.

In addition, the charging voltage of 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 drive belt pulley. The brush holder contains a built-in electronic voltage regulator.



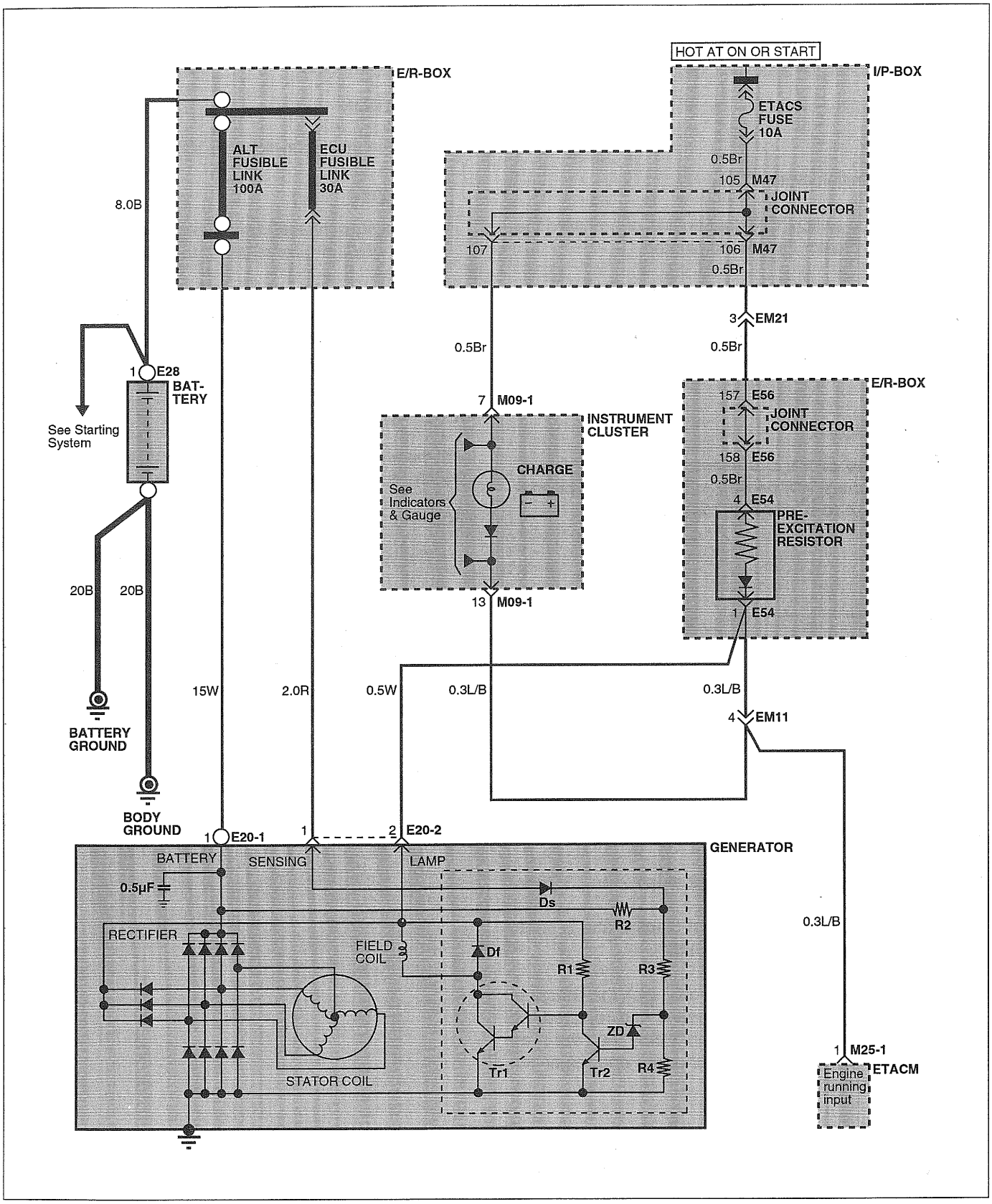
EBDA024A

EBNC0270

TROUBLESHOOTING

Trouble condition	Probable cause	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 connections
	Electronic voltage regulator faulty	Replace voltage regulator
Charging warning indicator does not go out with engine runing. (Battery requires fequent recharging)	Drive belt loose or worn	Adjust tension or replace cables
	Battery cables loose, corroded or worn	Repair or replace cables
	Fuse blown	Check fuses
	Fusible link blown	Replace fusible link
	Electronic voltage regulator or generator faulty	Test generator
	Wiring faulty	Repair wiring.
Discharged battery	Drive belt loose or worn	Adjust tension or replace drive belt
	Wiring connection loose or open circuit	Tighten loose connection or repair wiring
	Fusible link blown	Replace fusible link
	Warning indicator and pre-excitation resistor faulty	Replace components
	Poor grounding	Repair
	Electronic voltage regulator or generator faulty	Test generator
	Battery life	Replace battery
Overcharging	Electronic voltage regulator faulty	Replace voltage regulator
	Voltage sensing wire faulty	Repair wire

CIRCUIT DIAGRAM FOR CHARGING SYSTEM EBNC0280



E2FC009A

INSPECTION OF CHARGING SYSTEM EBDA0270

CHECKING POWER SOURCE CIRCUIT

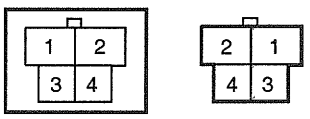
The field coil excites the stator coil, which generates charging current.

TEST

1. Turn the ignition switch "ON".
2. With ignition switch "ON" (but engine off), ensure the charging indicator lamp is illuminated.
3. Disconnect the pre-excitation resistor connector. Connect an ohmmeter between terminals 1 and 3 (component side). Connect the (+) lead wire of the ohmmeter to terminal 3 and the (-) lead wire to terminal 1.

⚠ CAUTION

If the leads of the ohmmeter are not connected properly, there will be no reading on the ohmmeter. Be sure to connect the leads correctly.



COMPONENTS SIDE HARNESS SIDE

EBDA027A

RESULT

1. If there is continuity throughout steps 2 and 3, then the circuit is OK.
   If there is continuity throughout steps 2 and 3, then the circuit, not the battery, is faulty.
2. If continuity is absent in step 2 only, then the charging indicator circuit should be checked and repaired. If continuity is absent during step 3 only then the pre-excitation register should be checked and replaced. (Refer to the circuit diagram).

NOTE

If continuity is absent in only one of steps 2 and 3, then the system is working normally. However, the individual circuit should be repaired for more reliable system operation.

VOLTAGE DROP TEST OF GENERATOR OUTPUT WIRE EBDA0290

This test determines if 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."

   NOTE

   To identify connection problems, be sure not to disturb either of the two terminals or their connections during this test.

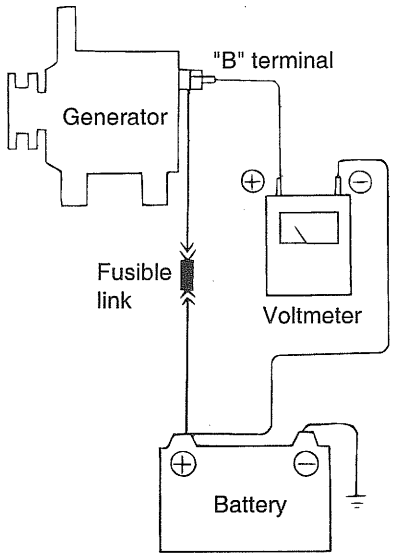
2. Connect a digital voltmeter between the generator "B" terminal and battery (+) terminal. Connect the (+) lead wire of the voltmeter to the "B" terminal and the (-) lead wire to the battery (+) terminal.

CONDITIONS FOR TESTING

With the engine running and headlamps, blower motor etc. ON, check the reading on the voltmeter.

RESULT

1. The voltmeter should read a standard 0.3V.
2. If the reading is above 0.3V, poor wiring should be suspected.
   Check wiring from generator 'B' terminal through the fusible link to the battery (+) terminal.
   Check for loose wiring or color change from an overheated harness. Correct and check again.
3. On completion of the test, set the engine at idle. Then turn off the headlamps, blower motor etc., and ignition.



EBDA029A

OUTPUT CURRENT TEST EBDA0310

This test determines if the generator gives an output current that is equivalent to the nominal output.

PREPARATION

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

   1) Check if that the battery installed in the vehicle is in good condition. For details, see "BATTERY".

   NOTE

   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.

   2) Check the tension of the generator drive belt. See "COOLING".

2. Turn the ignition switch to "OFF".

3. Disconnect the battery ground cable.

4. Disconnect the generator output wire from the generator "B" terminal.

5. Connect a DC ammeter (0 to 100A) 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.

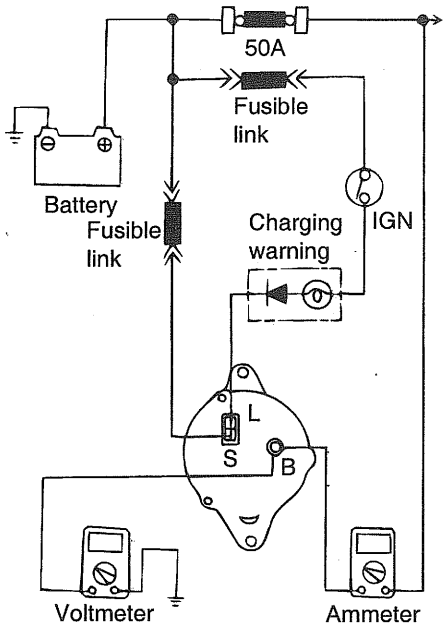
NOTE

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.



EBDA031A

TEST

1. Check to see that the voltmeter reads the same value as the battery voltage. If the voltmeter reads 0V, an open circuit in the wire between the generator "B" terminal and battery (-) terminal, a blown fusible link or poor ground is suspected.

2. Start the engine and turn the headlights on.

3. Set the headlights 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.

NOTE

After the engine starts, 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 generator output wire is in good condition, remove the generator from the vehicle and test it.

Limit value	
52.5 A min.	75A generator
63.0 A min.	90A generator

NOTE

1. *The nominal output current value is shown on the nameplate affixed to the generator body.*
2. *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. In such case, keep the headlights on to discharge 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.*

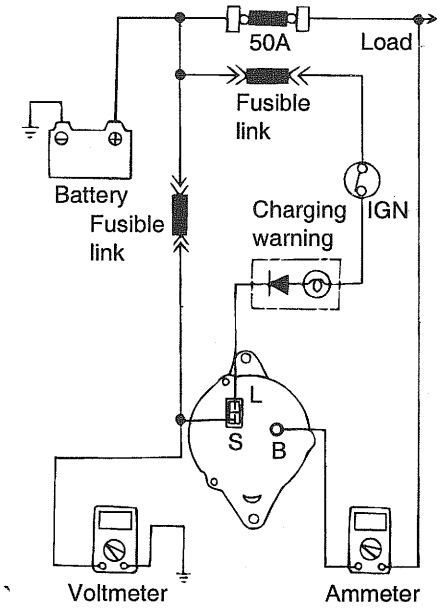
2. Upon completion of the output current test, lower the engine speed to idle and turn off the ignition switch.
3. Disconnect the battery ground cable.
4. Remove the ammeter and voltmeter and the engine tachometer.
5. Connect the generator output wire to the generator "B" terminal.
6. Connect the battery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

REGULATED VOLTAGE TEST EBDA0330

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

PREPARATION

1. Prior to the test, check the following items and correct if necessary.
   1) Check that the battery installed in the vehicle is fully charged. For battery checking method, see the "BATTERY" section.
   2) Check the generator drive belt tension. For belt tension check, see section, "COOLING."
2. Turn ignition switch to "OFF."
3. Disconnect the battery ground cable.
4. Connect a digital voltmeter between the "S(L)" terminal of the generator and ground.
   Connect the (+) lead of the voltmeter to the "S(L)" terminal of the generator. Connect the (-) lead to a good ground or the battery (-) terminal.
5. Disconnect the generator output wire from the generator "B" terminal.
6. Connect a DC ammeter (0 to 100A) 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.



EBDA033A

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 "S(L)" terminal and the battery and the battery (+), or the fusible link is blown.
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

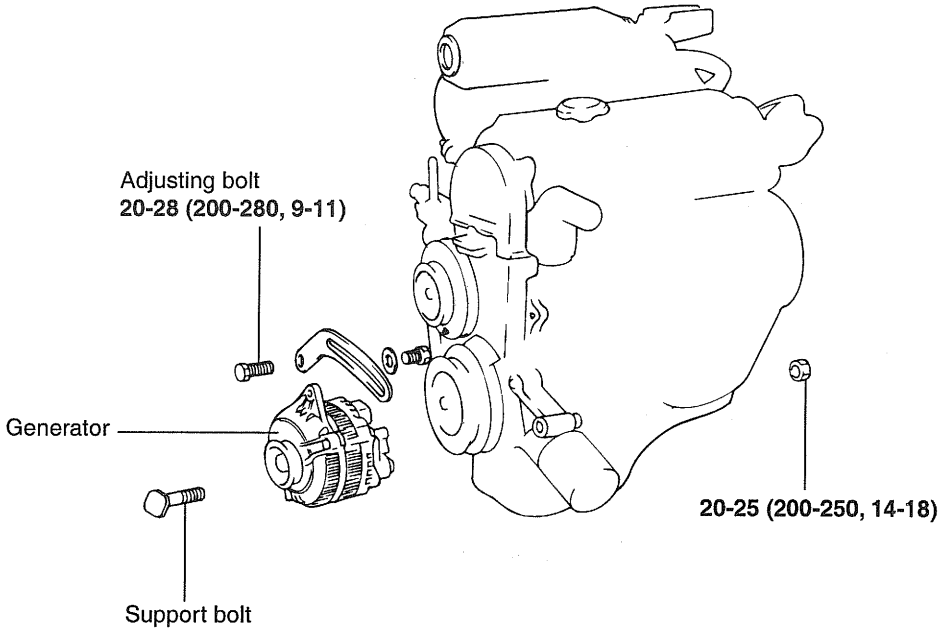
Voltage regulator ambient temperature °C(°F)	Regulating voltage V	
	75A generator	90A generator
-20 (-4)	14.2-15.4	14.3-15.2
20 (68)	13.9-14.9	14.1-14.7
60 (140)	13.4-14.6	13.5-14.4
80 (176)	13.1-14.5	13.3-14.3

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, ammeter, and the engine tachometer.
5. Connect the generator output wire to the generator "B" terminal.
6. Reconnect the battery ground cable.

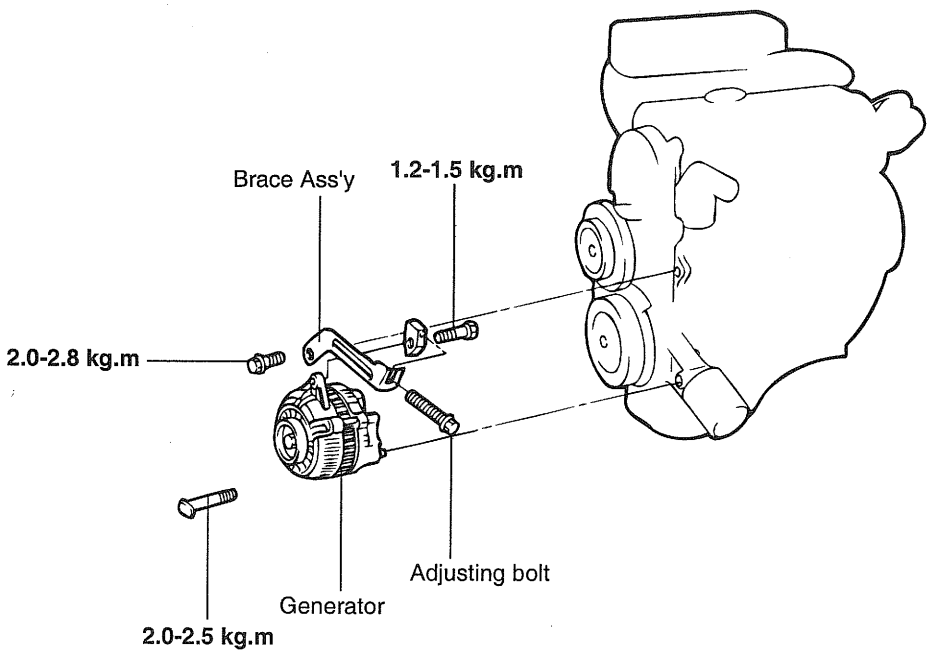
GENERATOR EBNC0350

COMPONENTS

75A



90A

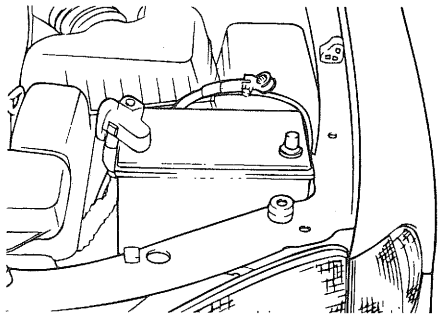


TORQUE : Nm (kg.cm, lb.ft)

EBDA035A

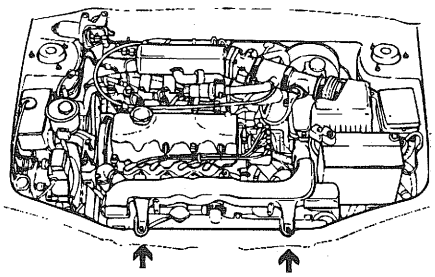
REMOVAL EBNC0360

1. Disconnect the negative(-) terminal from the battery and disconnect the radiator fan connector and condenser fan connector.



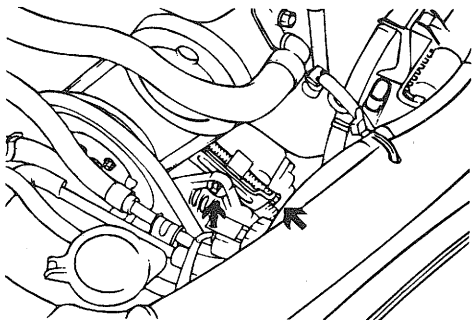
EBDA035B

2. Remove the radiator mounting bolts



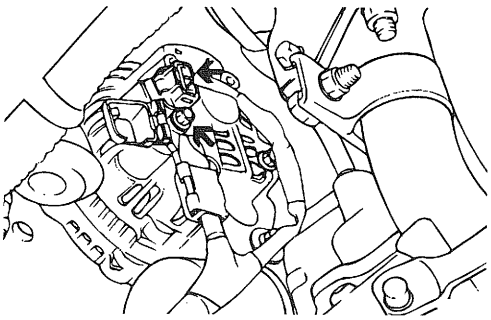
EBDA035C

3. Loosen the belt tension adjusting bolt and remove the mounting bolt.
Then, raise the vehicle.



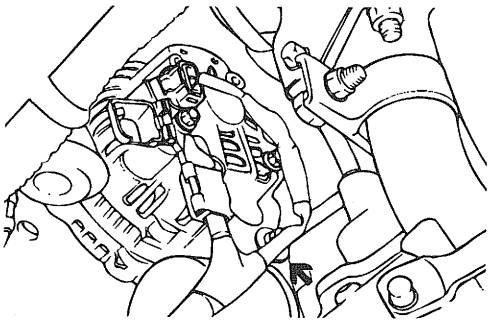
EBDA035D

4. Disconnect the generator connector and remove the B+ terminal cable.



EBDA035E

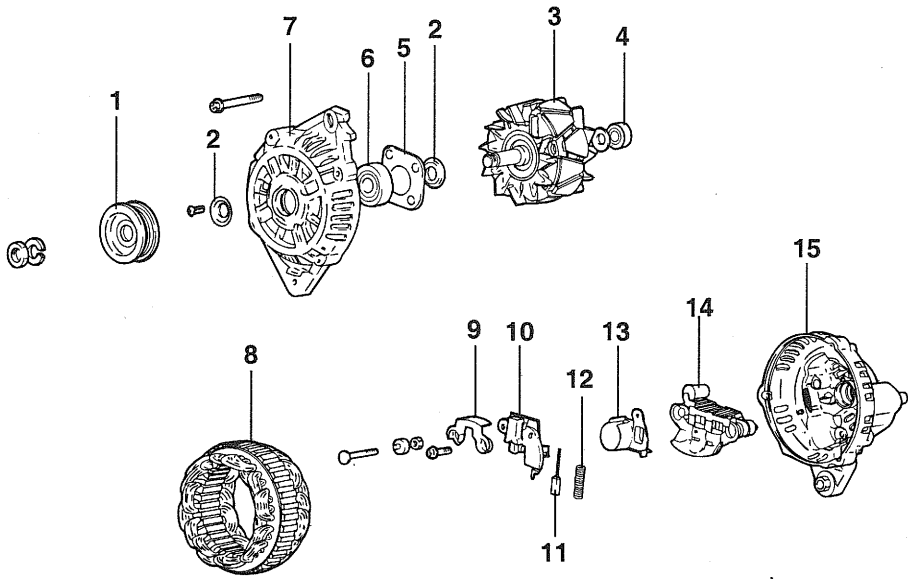
5. Remove the belt and detach the generator mounting bolt and nut.
Then, remove the generator assembly while raising the radiator.



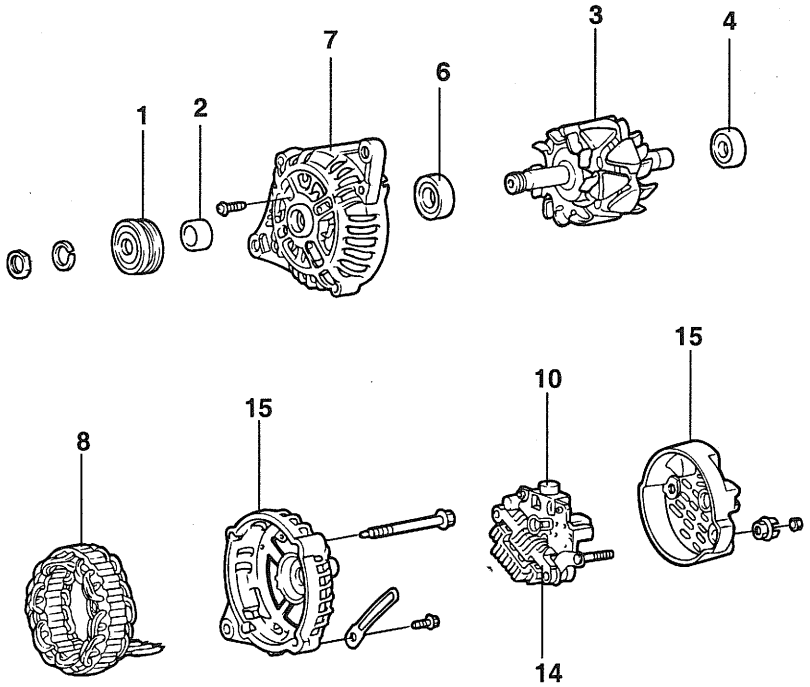
EBDA035F

COMPONENTS EBNC0370

<75A>



<90A>



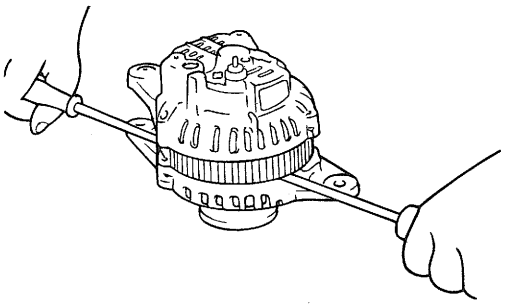
1. Pulley
2. Seal
3. Rotor assembly
4. Rear bearing
5. Bearing retainer
6. Front bearing
7. Front bracket
8. Stator
9. Plate
10. Voltage regulator and brush holder
11. Brush
12. Brush spring
13. Slinger
14. Rectifier
15. Rear bracket

EBDA037A

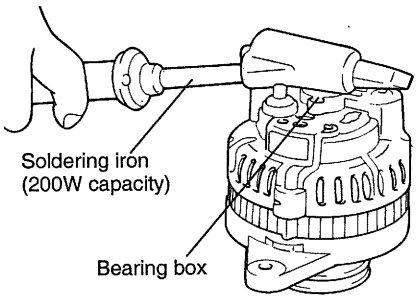
DISASSEMBLY (75A) EBNC0380

1. Remove the three through bolts.
2. Insert a flat screwdriver between the front bracket and stator core, and pry downward.

> ⚠ ***CAUTION***
>
> 1. ***Do not insert the screwdriver too deeply, as there is a danger of damaging the stator coil.***
> 2. ***The rear cover may be hard to remove because a ring is used to lock the outer race of the rear bearing. To facilitate removal of the rear cover, heat the bearing box section with a 200-watt soldering iron.***
>
> ***Do not use a heat gun, as it may damage the diode assembly.***



EBDA037B



EBDA037C

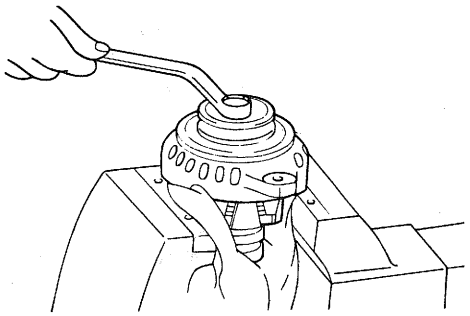
3. Secure the rotor in a vise with the pulley side up.

> ⚠ ***CAUTION***
>
> ***Be careful that the vise jaws do not damage the rotor.***

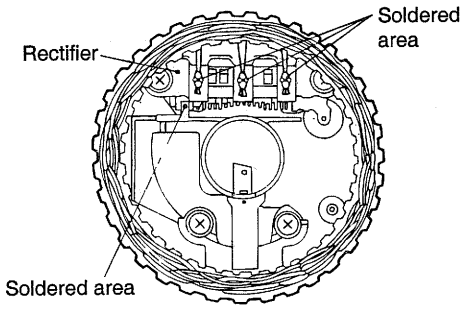
4. Remove the pulley nut, then remove the spring washer, then the pulley, and then the spacer.
5. Remove the front bracket and two seals.
6. Remove the rotor from the vise.
7. Remove the brush holder screws, rectifier screws, and nut from the B terminal.
8. Remove the stator assembly from the rear bracket.
9. Detach the slinger from the brush holder.
10. When the stator is to be removed, unsolder the three stator leads to the main diodes on the rectifier.

> ⚠ ***CAUTION***
>
> 1. ***When soldering or unsoldering, be careful not to heat the diodes for too long.***
> 2. ***Be careful that excessive force is not exerted on the leads of the diodes.***

11. When separating the rectifier from the brush holder, unsolder the two plates that are soldered to the rectifier



EBDA037D

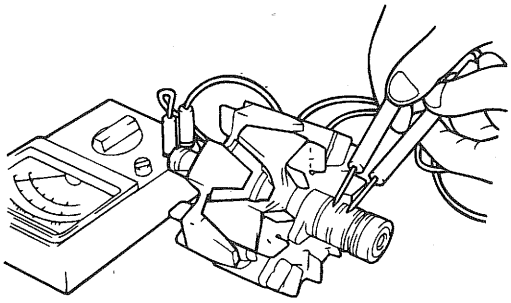


EBDA037E

INSPECTION (75A) EBDA0390

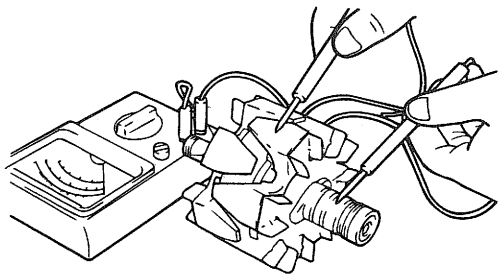
ROTOR

1. Check the rotor coil for continuity. Check to make sure that there is continuity between the slip rings. If resistance is extremely low, it means that there is a short. If there is no continuity or if there is a short circuit, replace the rotor assembly.
   Resistance value : Approx. 3.1Ω



EBDA039A

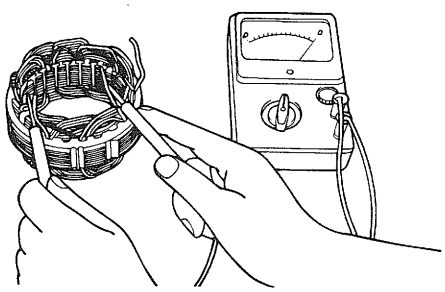
2. Check the rotor coil for ground. Check to make sure that there is no continuity between the slip ring and the core.
   If there is continuity, replace the rotor assembly.



EBDA039B

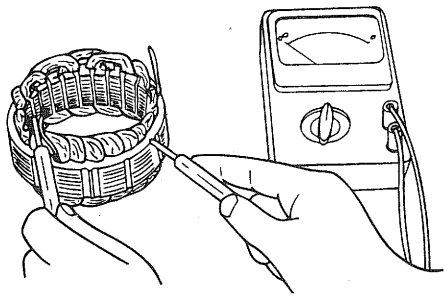
STATOR

1. Make a continuity check on the stator coil. Check to make sure that there is continuity between the coil leads.
   If there is no continuity, replace the stator assembly.



EBDA039C

2. Check the coil for grounding. Check to make sure that there is no continuity between the coil and the core. If there is continuity, replace the stator assembly.



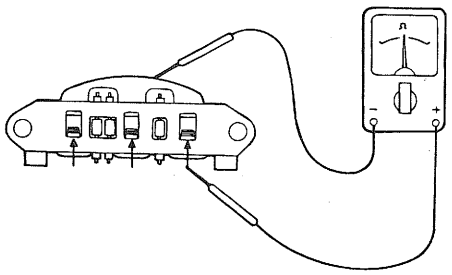
EBDA039D

RECTIFIERS

POSITIVE RECTIFIER TEST

Check for continuity between the positive rectifier and stator coil lead connection terminal with an ohmmeter. The ohmmeter should read continuity in only one direction. If there is continuity in both directions, a diode is shorted.

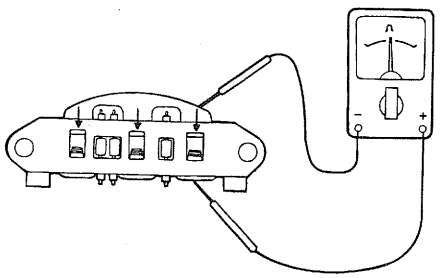
Replace the rectifier assembly.



EBDA039E

NEGATIVE RECTIFIER TEST

Check for continuity between the negative rectifier and the stator coil lead connection terminal. The ohmmeter should read continuity in only one direction. If there is continuity in both directions, a diode is shorted, and the rectifier assembly must be replaced.

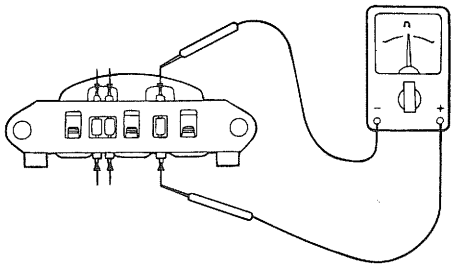


EBDA039F

DIODE TRIO TEST

Check the three diodes for continuity by connecting an ohmmeter to both ends of each diode. Each diode should have continuity in only one direction.

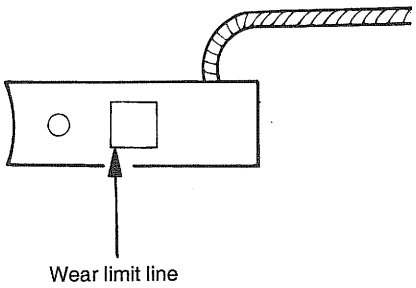
If continuity is present in both directions, a diode is defective and the heatsink assembly must be replaced.



EBDA039G

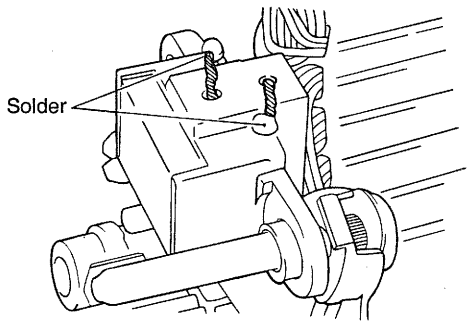
BRUSH REPLACEMENT

Replace the brushes if they are worn to the limit line.



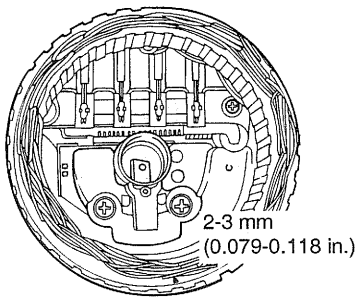
EBDA039H

1. Unsolder the pigtail and remove the old brush and spring.



EBDA039I

2. Install the brush spring and a new brush in the brush holder.
3. Insert the brush so that there is a space of 2 to 3 mm (0.079 to 0.118 in.) between the limit line and the end of the brush holder.
4. Solder the pigtail to the brush holder.



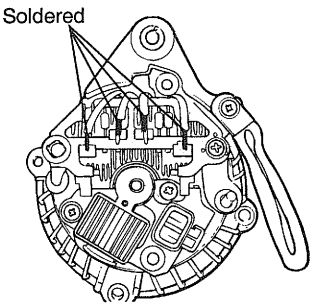
EBDA039J

INSPECTION (90A) EBDA0410

1. Remove the nut from the "B" terminal, and rear cover.
2. When the stator is to be removed, unsolder the four stator leads to the main diodes on the rectifier.

NOTE

1. *When soldering or unsoldering, be careful to make sure that the heat of the soldering iron is not transmitted to the diodes for a long period.*
2. *Be careful that excessive force is not exerted on the leads of the diodes.*

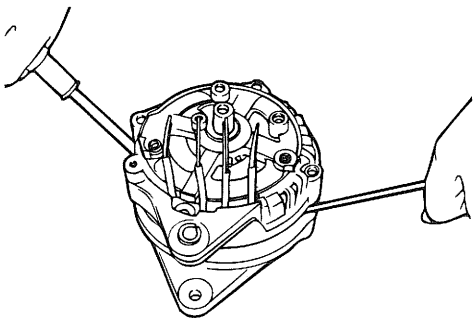


EBDA041A

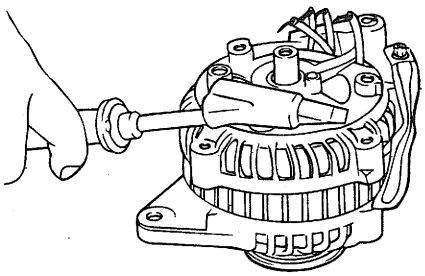
3. Remove the stator assembly from the rear bracket.
4. Remove the brush holder and the rectifier.
5. Remove the four through bolts.
6. Insert a flat screwdriver between the front bracket and stator core, and pry downward.

NOTE

1. *Do not insert the screwdriver too deeply, as there is a danger of damaging the stator coil.*
2. *The rear cover may be hard to remove because a ring is used to lock the outer race of the rear bearing. To facilitate removal of the rear cover, heat just the bearing box section with a 200-watt soldering iron. Do not use a heat gun, as it may damage the diode assembly.*



EBDA041B



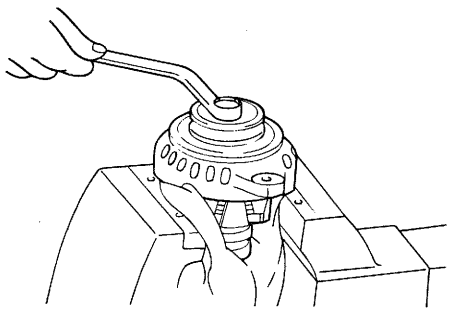
EBDA041C

7. Secure the rotor in a vise with the pulley side up.

   NOTE

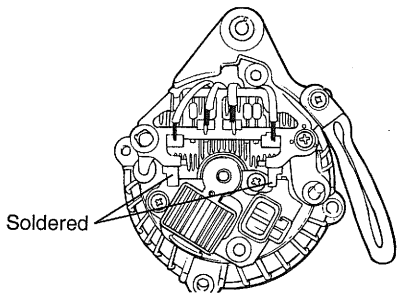
   Be careful that the vise jaws do not damage the rotor.

8. Remove the pulley nut, then remove the spring washer, then the pulley, and then the spacer.
9. Remove the front bracket and seals.
10. Remove the rotor from the vise.



EBDA041D

11. When separating the rectifier from the brush holder, unsolder the two plates soldered to the rectifier.



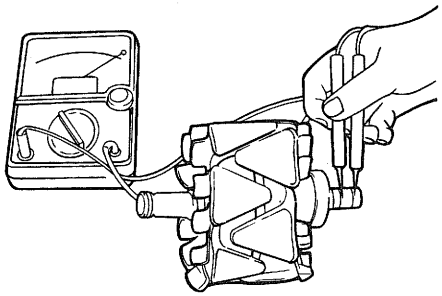
EBDA041E

INSPECTION (90A) EBDA0430

ROTOR

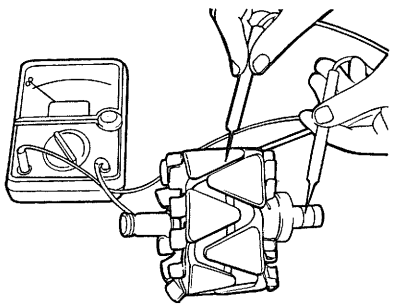
1. Check the rotor coil for continuity. Check to make sure that there is continuity between the slip rings. If resistance is extremely low, it means that there is a short. If there is no continuity or if there is a short circuit, replace the rotor assembly.

   Resistance value : Approx. 3.1Ω



EBDA043A

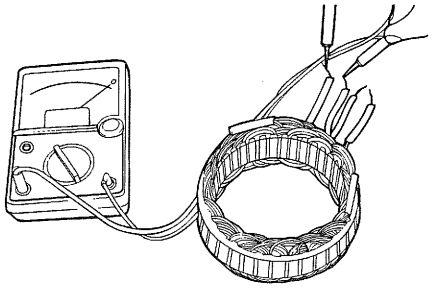
2. Check the rotor coil for ground. Check to make sure that there is no continuity between the slip ring and the core.
   If there is continuity, replace the rotor assembly.



EBDA043B

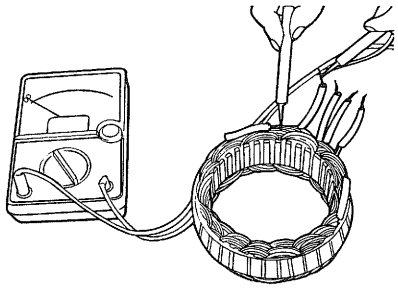
STATOR

1. Make a continuity check on the stator coil. Check to make sure that there is continuity between the coil leads.
   If there is no continuity, replace the stator assembly.



EBDA043C

2. Check the coil for grounding. Check to make sure that there is no continuity between the coil and the core. If there is continuity, replace the stator assembly.

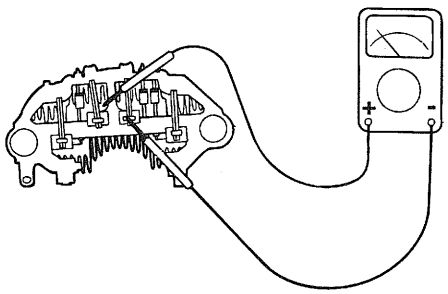


EBDA043D

RECTIFIERS

POSITIVE RECTIFIER TEST

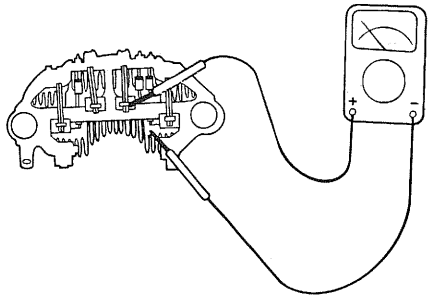
Check for continuity between the positive rectifier and stator coil lead connection terminal with an ohmmeter. The ohmmeter should read continuity in only one direction. If there is continuity in both directions, a diode is shorted.



EBDA043E

NEGATIVE RECTIFIER TEST

Check for continuity between the negative rectifier and the stator coil lead connection terminal. The ohmmeter should read continuity in only one direction. If there is continuity in both directions, a diode is shorted, and the rectifier assembly must be replaced.

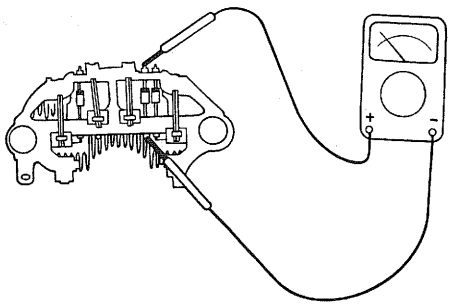


EBDA043F

DIODE TRIO TEST

Check the three diodes for continuity by connecting an ohmmeter to both ends of each diode. Each diode should have continuity in only one direction.

If continuity is present in both directions, a diode is defective and the heatsink assembly must be replaced.

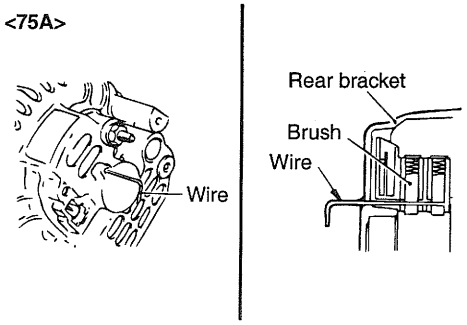


EBDA043G

REASSEMBLY EBDA0450

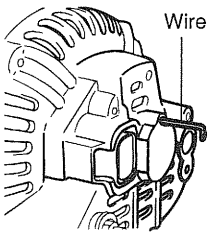
Reassembly is the reverse procedure of disassembly. Pay attention to the following:

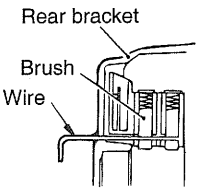
Before the rotor is attached to the rear bracket, insert a wire through the small hole in the rear bracket to lock the brush. After the rotor has been installed, the wire can be removed.



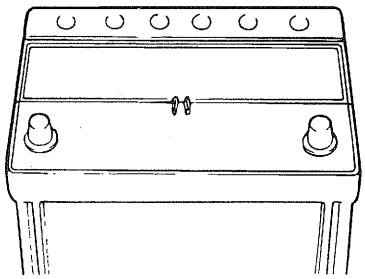
EBDA045A

<90A>





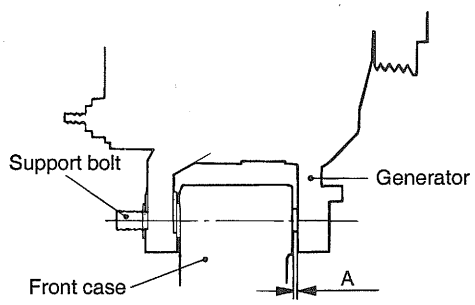
EBDA045B



EBDA049A

INSTALLATION EBDA0470

1. Position the generator and insert the support bolt. (Do not attach the nut.)
2. Push the generator forward and determine how many spacers (thickness : 0.198mm) should be inserted between the front leg of the generator and the front case (space "A" in the illustration).
   (There should be enough spacers so that they do not fall out when you let go of them.)
3. Insert the spacers (space "A" in the illustration), attach the nut, and complete the installation.

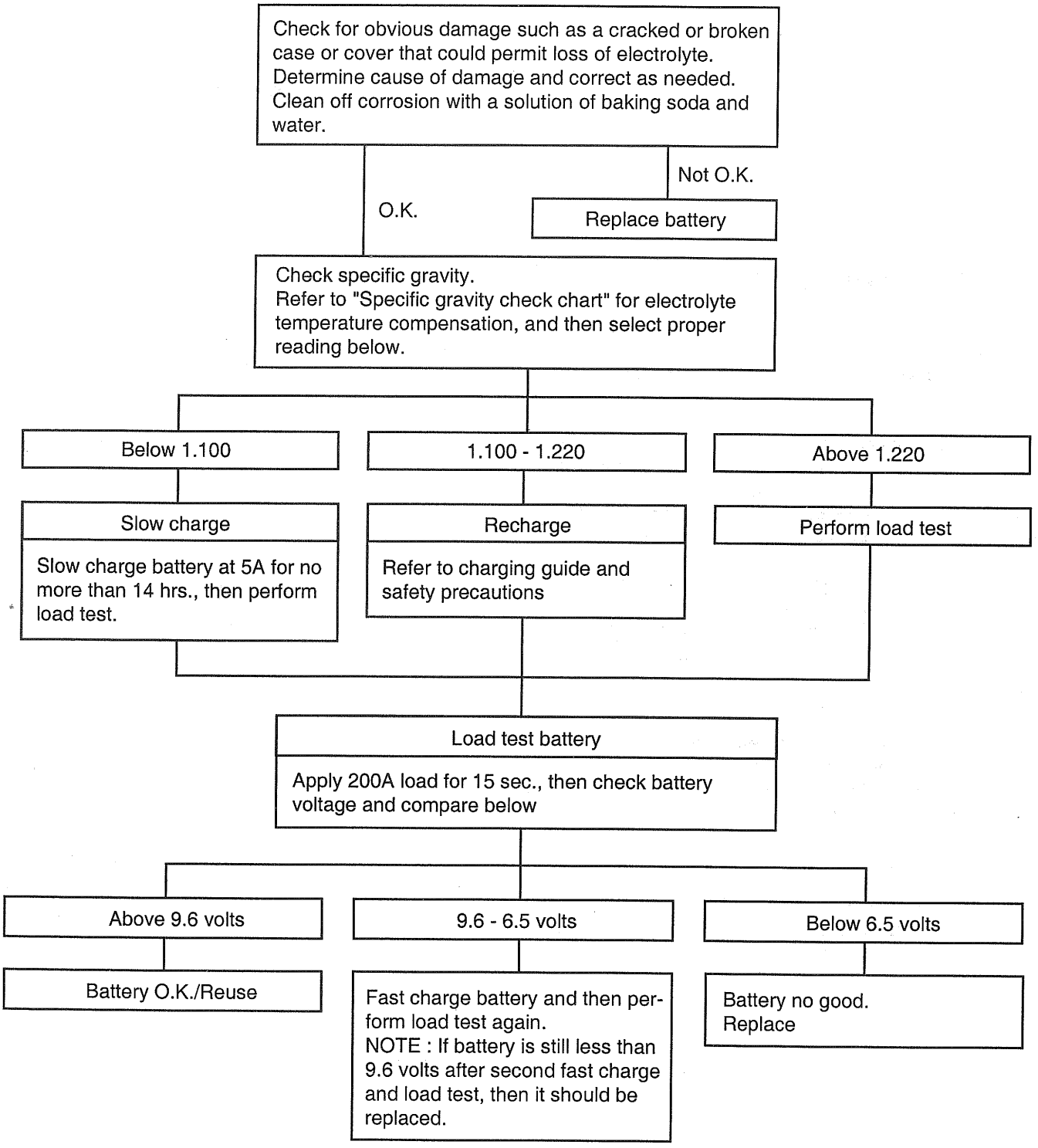


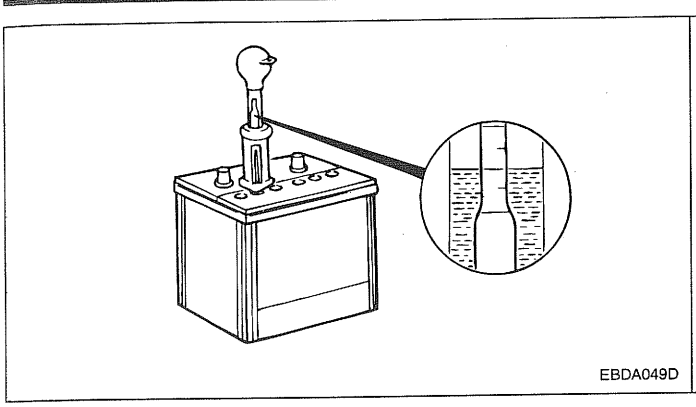
EBDA047A

BATTERY EBDA0490

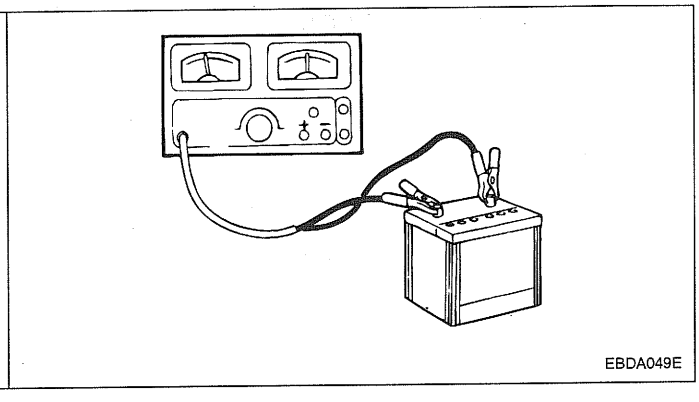
1. The maintenance-free battery is, as the name implies, totally maintenance free and has no removable battery cell caps.
2. Water never needs to be added to the maintenance-free battery.
3. The battery is completely sealed, except for small vent holes in the cover.

BATTERY VISUAL INSPECTION (1)





EBDA049D



EBDA049E

SPECIFIC GRAVITY CHECK CHART EBDA0510

The specific gravity of battery electrolyte changes with temperature. Heat thins the solution and lowers the specific gravity. Cold thickens the solution and raises the specific gravity.

A fully charged battery should have a specific gravity between 1.260 and 1.280, with the electrolyte temperature at 26.7°C. The specific gravity reading must be corrected by adding 4 points (.004) for each 5.56°C above 26.7°C or subtracting 4 points for every 5.56°C below 26.7°C.

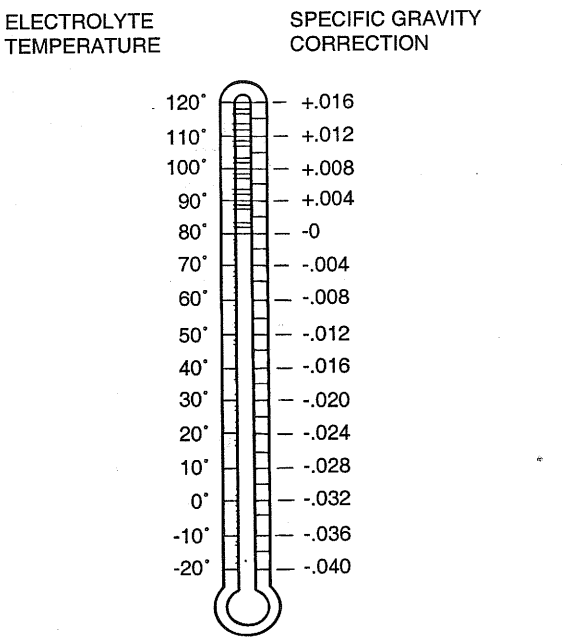
For example : The hydrometer reading is 1.280, and the electrolyte temperature reading is 5.56°C. According to the chart below, the specific gravity must be lowered by 0.028 points. The true corrected reading is 1.252.

1.280 - 0.028 = 1.252

You should never take a hydrometer reading immediately after water has been added. The water and electrolyte must be mixed by either charging for a few minutes at a low rate or by allowing the battery to sit for an hour.

⚠ ***CAUTION***

A difference of 50 points (0.050) or more between one or more cells indicates a defective battery. It should be replaced.



EBDA051A

BATTERY CHARGE RATE EBDA0530

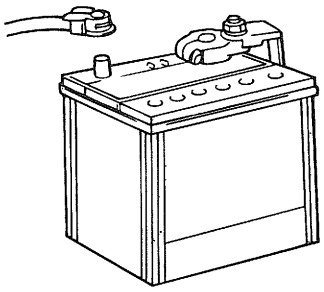
Specific gravity	Charge method	
	Slow charge (5A)	Fast charge (20A)
Below 1.100	14 hours	4 hours
100 - 1.130	12 hours	3 hours
130 - 1.160	10 hours	2.5 hours
160 - 1.190	8 hours	2.0 hours
190 - 1.220	6 hours	1.5 hours
Above 1.220	4 hours	1.0 hour

BATTERY VISUAL INSPECTION (2) EBDA0550

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

⚠ ***CAUTION***

Care should be taken in the event that the battery case is cracked or leaking, to protect your skin from the electrolyte. A suitable pair of rubber gloves (not household type) should be worn when removing the battery.

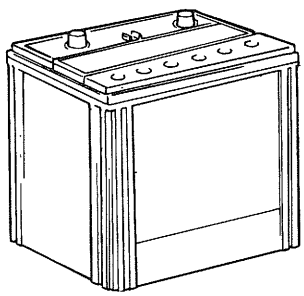


EBDA055A

4. Inspect the battery carrier for damage caused by the loss of acid from the battery. 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 in step 4.
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 cleaner.
8. Clean the inside surface of the terminal clamps with a suitable battery terminal 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 the top of the terminals are flush with the top of the post.
11. Tighten the terminal nut 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 circuits at the terminals of the batteries being charged. A spark will occur where the circuit is broken. Keep all flames away from an open battery.



EBDA055B

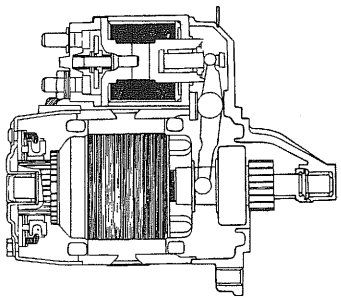
STARTING SYSTEM

GENERAL INFORMATION EBDA0570

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

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.

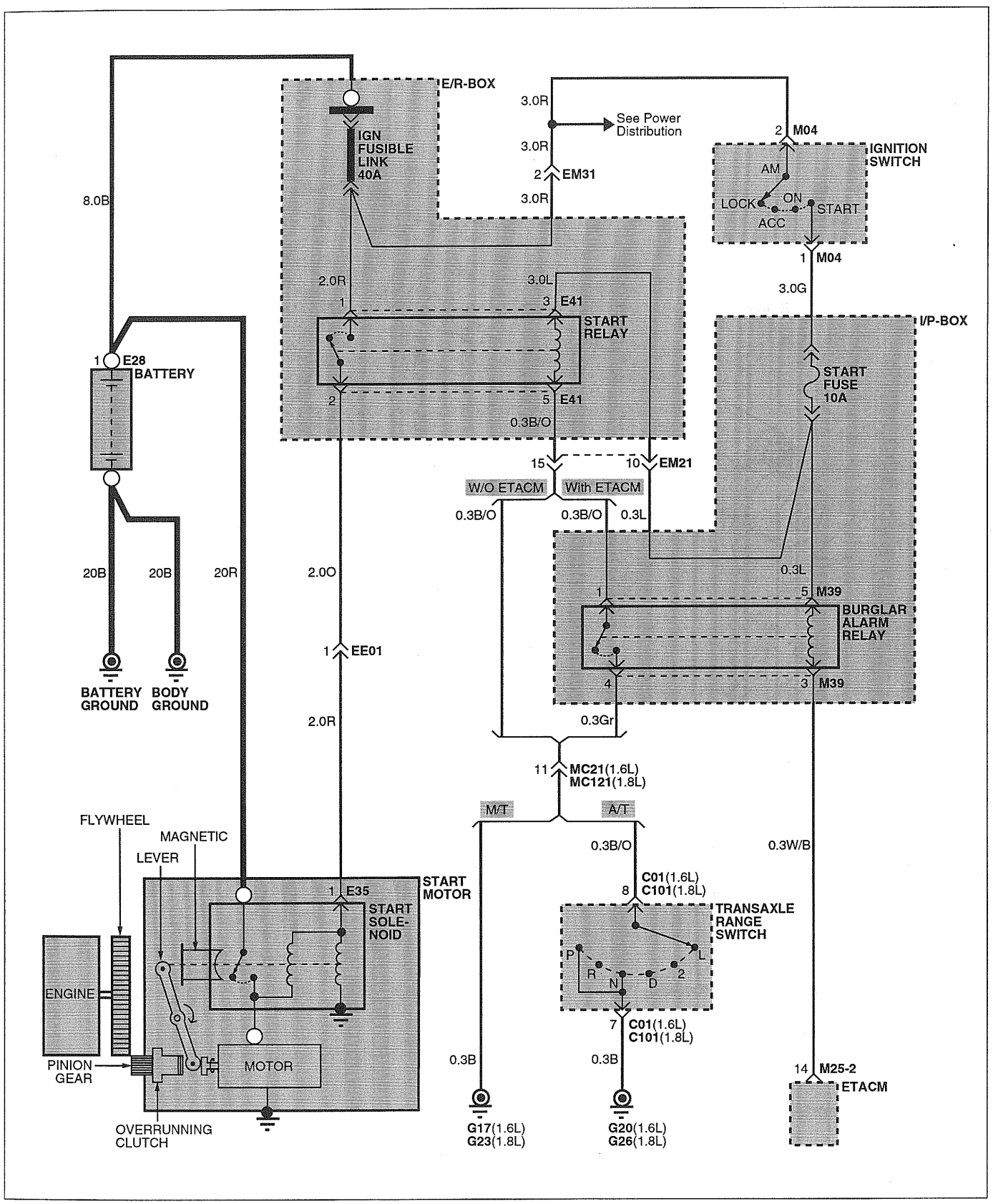


EBDA057A

TROUBLESHOOTING

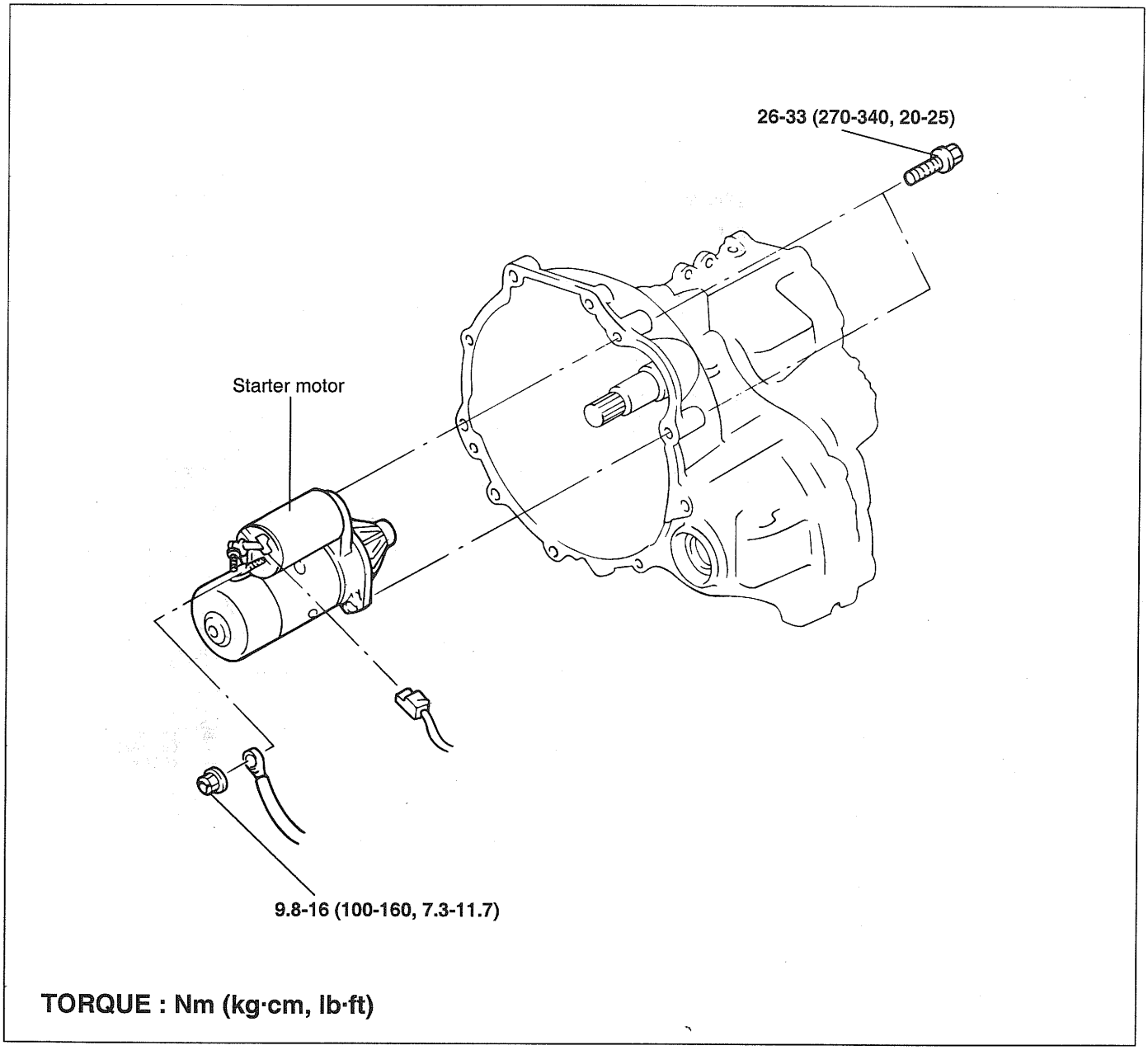
Trouble condition	Probable cause	Remedy
Engine will not crank	Battery charge low	Charge or replace battery
	Battery cables loose, corroded or worn	Repair or replace cables
	Transaxle range switch faulty (Vehicle with automatic transaxle only)	Adjust or replace switch
	Fusible link blown	Replace fusible link
	Starter motor faulty	Repair starter motor
	Ignition switch faulty	Replace ignition switch
Engine cranks slowly	Battery charge low	Charge or replace battery
	Battery cables loose, corroded or worn	Inspect wiring and fix
	Starter motor faulty	Repair starter motor
Starter keeps running	Starter motor faulty	Repair starter motor
	Ignition wiring faulty	Repair or replace
Starter spins but engine will not crank	Short in wiring	Repair wiring
	Pinion gear teeth broken or starter motor faulty	Repair starter motor
	Ring gear teeth broken	Replace flywheel ring gear or torque converter

CIRCUIT DIAGRAM FOR STARTING SYSTEM EBNC0580



E2FC008A

COMPONENT EBNC0590

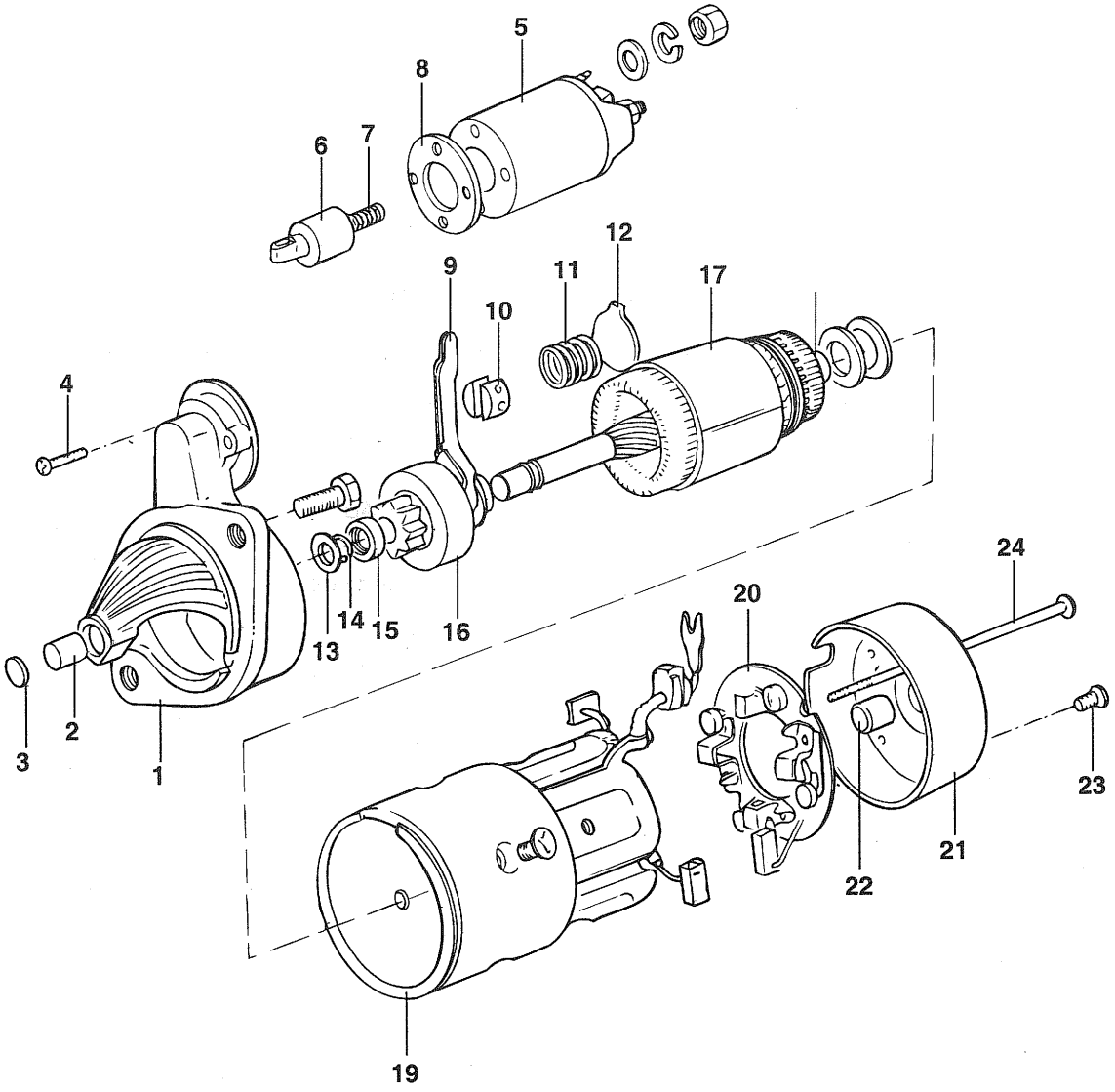


EBDA059A

REMOVAL EBNC0600

1. Disconnect the battery ground cable.
2. Remove the speedometer cable and the shift cable.
3. Disconnect the starter motor connector and terminal.
4. Remove the starter motor assembly.
5. Installation is the reverse order of removal.

COMPONENTS EBNC0610



1. Front bracket
2. Front bushing
3. Cap
4. Screw
5. Solenoid
6. Plunger
7. Spring
8. Packing
9. Lever
10. Holder
11. Spring
12. Packing
13. Washer
14. Stop ring
15. Stopper
16. ORC (Overrunning clutch)
17. Armature
18. Washer
19. Yoke ass'y
20. Plate ass'y
21. Rear cover
22. Rear bushing
23. Screw
24. Bolt

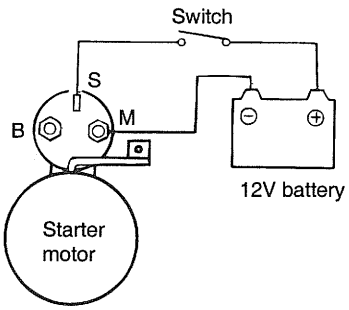
EBDA061A

ADJUSTMENT EBNC0620

PINION GAP

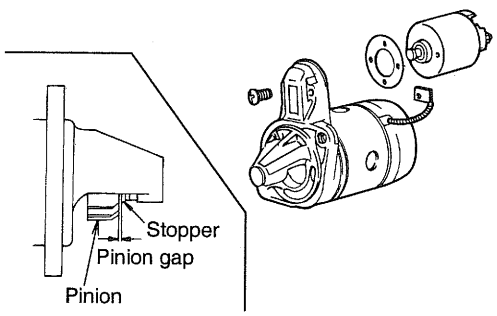
1. Disconnect the wire from the M-terminal.
2. Connect a 12V battery between the S-terminal and the M-terminal.
3. Set the switch to "ON", and the pinion will move out.

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



EBDA061B

4. Check the pinion to stopper clearance (pinion gap) with a feeler gauge. If the pinion gap is out of specification, adjust by adding or removing washers between the solenoid and the front bracket.
PINION GAP : 0.5–2.0 mm (0.0197–0.079 in.)



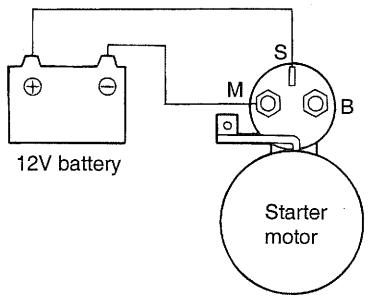
EBDA061C

SOLENOID PULL-IN TEST

1. Disconnect the connector from the M-terminal.
2. Connect a 12V battery between the S-terminal and M-terminal.

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

3. If the pinion moves out, the pull-in coil is good. If it doesn't, replace the solenoid.



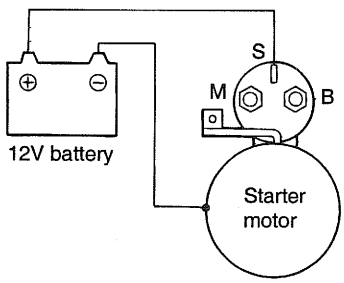
EBDA061D

SOLENOID HOLD-IN TEST

1. Disconnect the connector from the M-terminal.
2. Connect a 12V battery between the S-terminal and the body.

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

3. If the pinion remains out, everything is in order. If the pinion moves in, the hold-in circuit is open. Replace the magnetic switch.



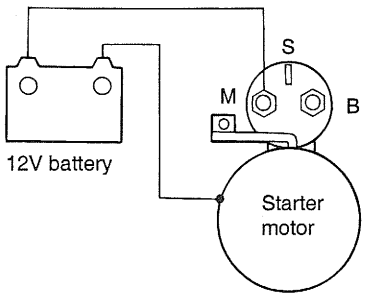
EBDA061E

SOLENOID RETURN TEST

1. Disconnect the connector from the M-terminal.
2. Connect a 12V battery between the M-terminal and the body.

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

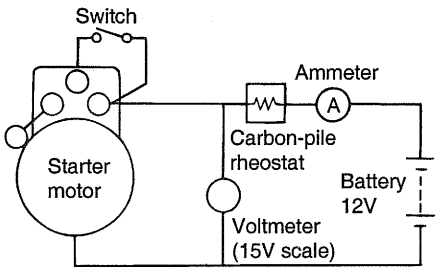
3. Pull out the pinion and then release it. If the pinion returns quickly to its original position, everything is in order. If it doesn't, replace the solenoid



EBDA061F

PERFORMANCE TEST (NO-LOAD)

1. Make the no-load circuit test as shown.
2. After adjusting the rheostat until the battery voltage shown on the voltmeter reads 11.5 volts, confirm that the maximum amperage draw is within the specifications and that the starter motor turns smoothly and freely.
   CURRENT : 60A or less

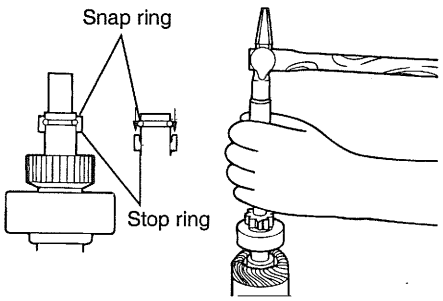


EBDA061G

DISASSEMBLY EBDA0630

To remove the overrunning clutch from the armature shaft, the stop ring must be removed.

Move the stop ring toward the pinion and remove the snap ring. Now the stop ring can be removed from the shaft.

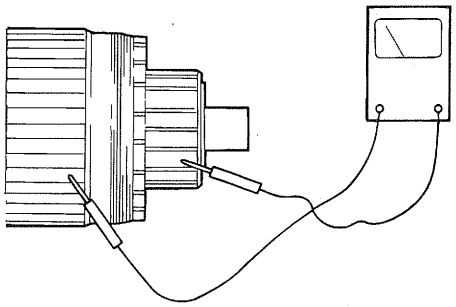


EBDA063A

INSPECTION (AFTER DISASSEMBLY) EBDA0650

ARMATURE COIL GROUND TEST

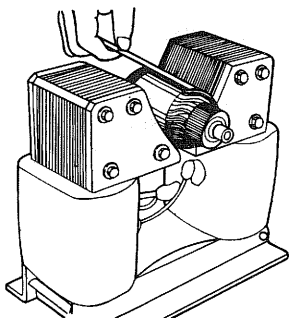
Using an ohmmeter, check to make sure that there is no continuity between the commutator and the armature coil core. If there is continuity, replace the armature assembly.



EBDA065A

ARMATURE COIL SHORT-CIRCUIT TEST

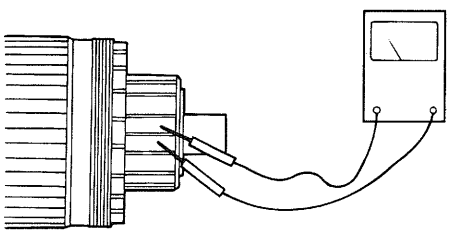
Test the armature coil in a growler. Replace the coil if there are signs of a short. If the blade attached to the core vibrates while the core is turned, the armature is shorted.



EBDA065B

ARMATURE COIL OPEN-CIRCUIT TEST

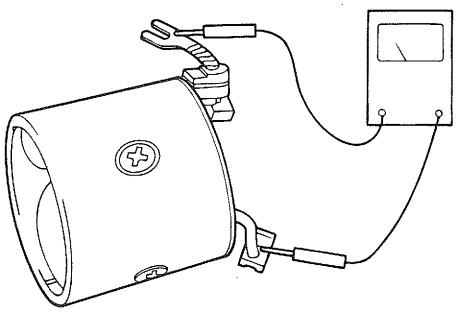
Using an ohmmeter, check for continuity between the commutator segments. If there is no continuity, the commutator segments are open. Replace the armature assembly.



EBDA065C

FIELD COIL OPEN-CIRCUIT TEST

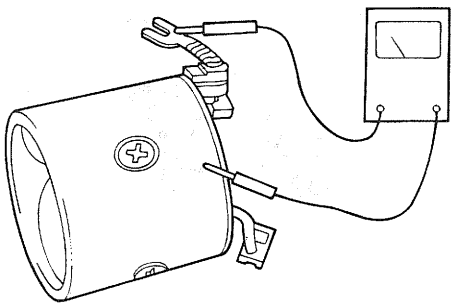
Using an ohmmeter, check the field coil for continuity. If there is no continuity, the field coil is open. Replace the field coil assembly.



EBDA065D

FIELD COIL GROUND TEST

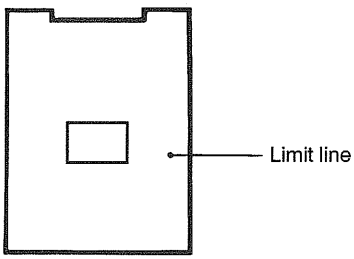
With the field coil mounted to the yoke, check for continuity between the field coil and the yoke using an ohmmeter. If there is continuity, replace the field coil.



EBDA065E

BRUSH

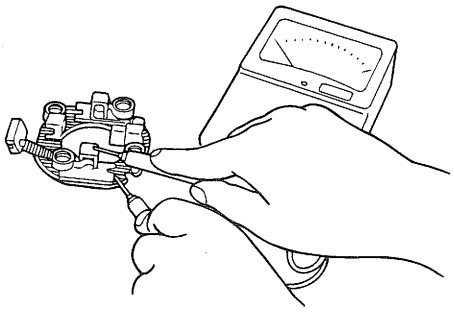
A brush worn down to the wear limit line should be replaced.



EBDA065F

BRUSH HOLDER

Check for continuity between the (+) side brush holder and brush holder base. If there is continuity, replace the holder assembly.

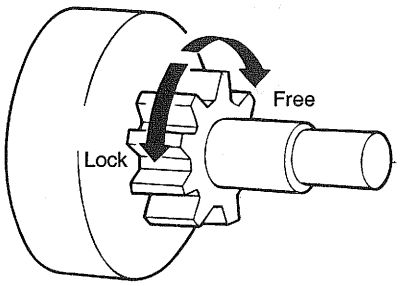


EBDA065G

OVERRUNNING CLUTCH

Inspect the pinion and spline teeth for wear or damage. Replace if damaged. Also inspect the flywheel ring gear for damage.

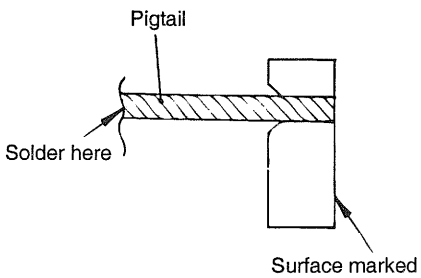
Rotate the pinion. It should turn freely in a clockwise direction, and lock when turned counterclockwise.



EBDA065H

BRUSH REPLACEMENT

1. Remove the worn brush while taking care not to damage the pigtail.
2. Sand the pigtail end with sandpaper to ensure a good soldering joint.
3. Solder the end of the pigtail.



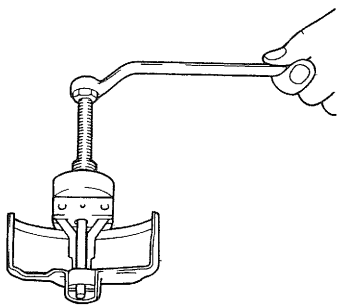
EBDA065I

REAR BRACKET BUSHING REPLACEMENT

1. Before the bushing is removed, measure and record the pressed-in position (depth) of the bushing.

2. The bushing can be removed by the use of a puller as shown in the illustration.

3. Press a new bushing in, up to the position recorded under Step. 1.

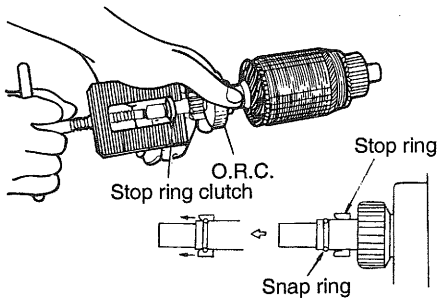


EBDA065J

REASSEMBLY EBDA0670

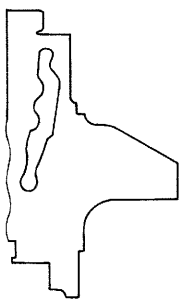
1. Install the overrunning clutch to the front end of the armature shaft.

2. Install the stop ring and the snap ring from the front end of the armature shaft. Push the stop ring all the way toward the snap ring.



EBDA067A

3. When the lever is mounted on the front bracket, pay attention to its direction. If it is mounted in a reverse direction, the pinion will remain in an outward position and fail to operate properly.

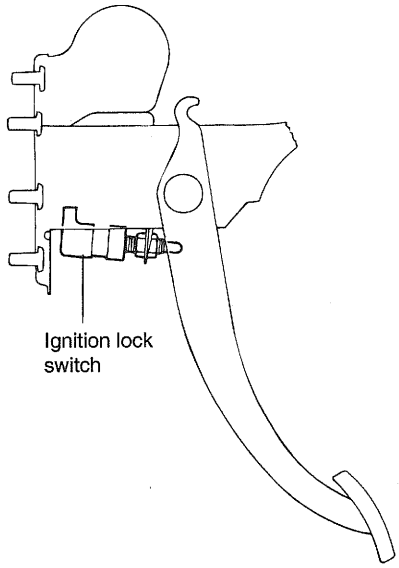


EBDA067B

INSPECTION OF CLUTCH START SYSTEM (IGNITION LOCK SYSTEM) EBDA0690

CHECK CLUTCH PEDAL

Check that pedal height, pedal freeplay and clutch pedal clevis pin play are correct. (Refer to CH group)



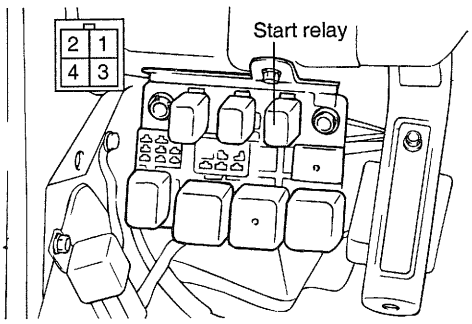
EBDA069A

CHECK STARTER RELAY EBDA0710

Remove the starter relay and check continuity between the terminals. If the continuity is not as specified, replace the relay.

Terminal / Condition	S1 (1)	S2 (3)	L (2)	B (4)
When de-energized	○	○		
When energized	○	○	○	○

EBDA071B



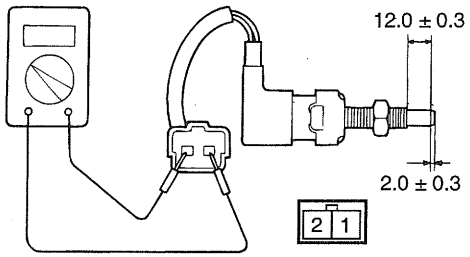
EBDA071A

CHECK IGNITION LOCK SWITCH EBDA0730

Check for continuity between terminals.

Terminal / Condition	1	2
Pushed	○	○
Free		

EBDA073B



EBDA073A