Chapter 1 Start System

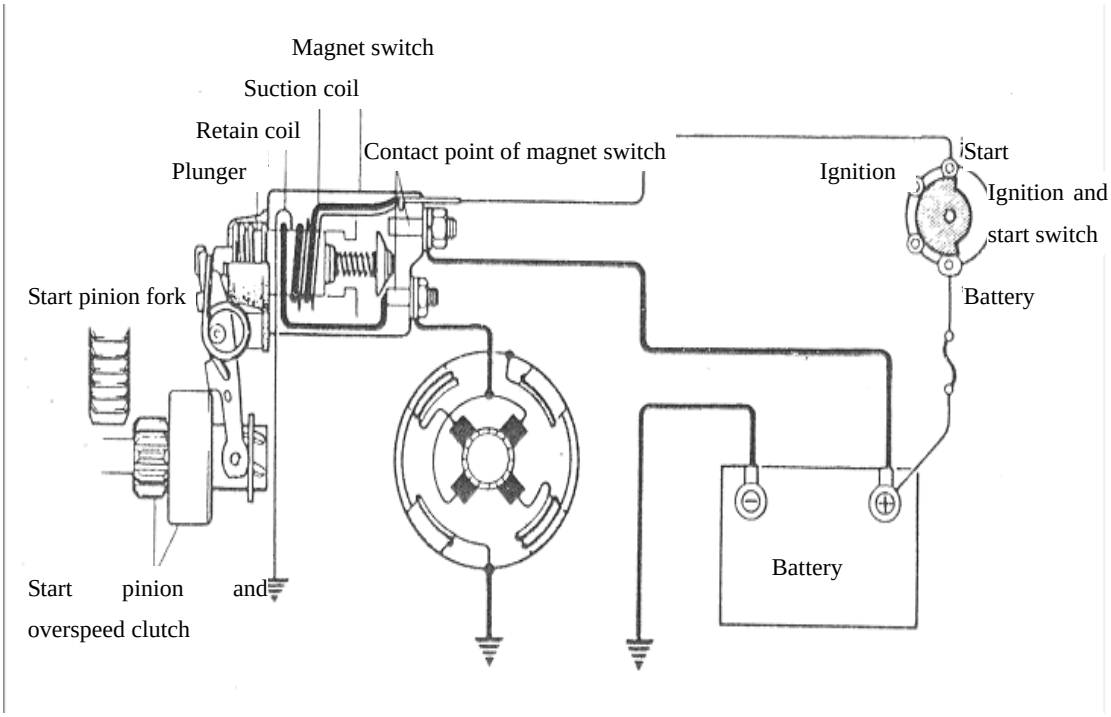
Section 1 Summary

Start circuit

Start circuit is composed of battery, start motor, ignition switch and relational circuit. The connection of these parts is shown in the following figure. This chapter only refers to start motor.

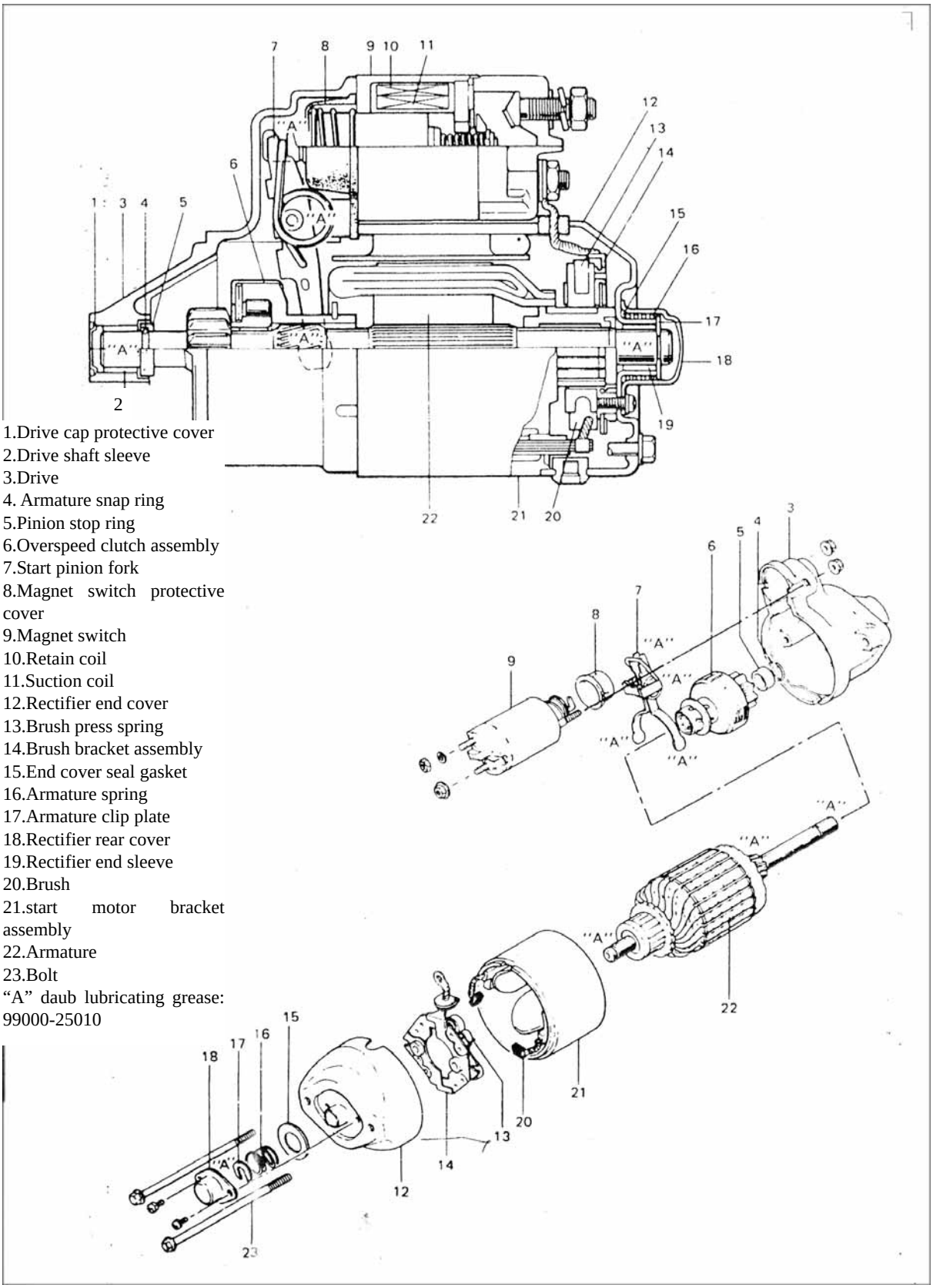
Starter motor

Starter motor is composed of start motor bracket, armature, overspeed clutch, magnet switch, end cover of rectifier, brush holder and start pinion fork.



In the circuit of following figure, when ignition switch is closed, magnet switch coil is magnetized, plunger and pinion fork moves, then start pinion mesh with the flywheel gear ring and magnet switch contact point close, so start is begin.

When engine starts, before magnet switch dose not cut off, overspeed clutch protect armature not overspeed. Here, return spring put the start pinion come away.



1.Drive cap protective cover
2.Drive shaft sleeve
3.Drive
4. Armature snap ring
5.Pinion stop ring
6.Overspeed clutch assembly
7.Start pinion fork
8.Magnet switch protective cover
9.Magnet switch
10.Retain coil
11.Suction coil
12.Rectifier end cover
13.Brush press spring
14.Brush bracket assembly
15.End cover seal gasket
16.Armature spring
17.Armature clip plate
18.Rectifier rear cover
19.Rectifier end sleeve
20.Brush
21.start motor bracket assembly
22.Armature
23.Bolt
"A" daub lubricating grease: 99000-25010

Section 2 Fault Diagnoses

The description of start system fault:

1. Starter motor dose not run (or run slowly)
2. Start motor can run but can not start the engine
3. Abnormal noise
4. Fault state
5. Battery connection post (include engine side earth wire link) and starter motor connection post is tightened or not.
6. Battery is charged or not.

It must put up correct diagnoses to ensure the fault position exactly ---battery, harness, starter motor, engine, or start switch. Don't removal starter motor vexedly when starter motor dose not run. You can check following items to lessen scope of fault reason.

Condition	Possible causes	Action
Starter motor dose not run	Magnet switch has no working sound	
	1.Battery is discharged	Charge the battery
	2.Owing to battery transformation, the voltage is too low	Replace the battery
	3.Battery post dose not connect well	Tighten or replace
	4.The connection of earth wire is loose	Tighten
	5.Fuse loose or break off	Replace
	6.Ignition switch contact not well	Tighten or replace
	7.Harness connector has not inserted in position	Inserted in position
	8.Ignition switch and magnet switch is open circuit	Inspect or replace
	9.Suction coil is turnoff	Repair
	10.Slippage of plunger is ineffective	Replace magnet switch
	11.Central guard against theft controller is in guard against theft state or central guard against theft controller has fault	Replace
Starter motor dose not run	Magnet switch has working sound	
	1.Battery is discharged	Charge the battery
	2.Owing to battery transformation, the voltage is too low	Replace the battery
	3.Battery wire connect loose	Tighten
	4.Magnet switch main contact point ablate or contact not well	Replace magnet switch

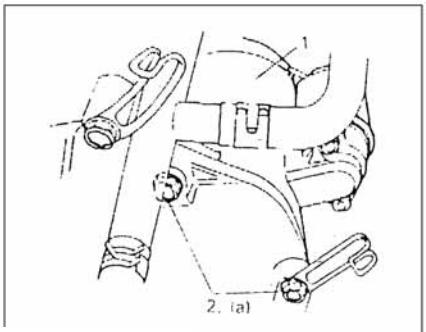
	5.Brush joint not well or wear and tear 6.Brush spring die down 7.Rectifier damage 8.Excitation coil connect earth not well 9.Armature layer short circuit 10. The running of crankshaft is not flexible	Repair or replace Replace Replace Repair Replace Repair
Starter motor run but slowly (Torque is small)	If battery connection normally, please check starter motor 1.Magnet switch main contact point contact not well 2.Armature layer short circuit 3.Rectifier burnout or wear and tear 4.Excitation coil connect earth not well 5.Brush wear and tear 6.Brush spring die down 7.Rectifier end cover damage or wear abnormally	 Replace Replace Repair or replace Repair Replace Replace spring Replace
Starter motor can run but can not start the crankshaft	1.Start pinion tooth tip wear and tear 2.Overspeed clutch slippage is not flexible 3.Overspeed clutch skid 4. Gear ring wear and tear	Replace Replace Replace Replace
Starter motor can not stop running	1.Magnet switch contact point melt and integrate 2.Magnet switch coil layer short circuit 3.Ignition switch can not return to original position	Replace Replace Replace

Section 3 disassemble and repair starter motor

Suggest: All the parts should be cleaned completely when check the starter motor, but starter motor bracket, armature, overspeed clutch, magnet switch and rubber parts should be cleaned by degrease fluid, and blown by compressed air, finally use cloth to rub-up.

Removal and installation

1. Disconnect the negative wire of the battery.
2. Disconnect the magnet switch and its wire from the connection post of starter motor.
3. Remove two fixing bolts.
4. Remove starter motor.
5. Installation is in reverse order of removal.



1.start motor
2.installation bolt

Tighten torque

(a):18~28N.m(1.8--2.8kg—m.13.5—20.01b—ft)

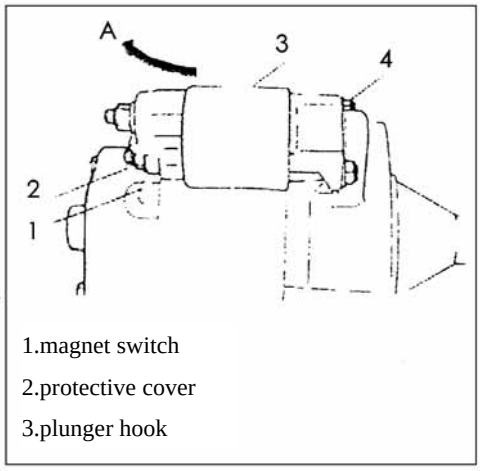
Magnet switch assembly

Disassembly

1. Loose the nut from the magnet switch then disconnect wire.

2. Take two nuts away, draw up the rear part of the magnet switch in order to separate the inner side hook and fork, then remove magnet switch.

Caution: Don't disassemble magnet switch, if necessary, please replace the whole assembly.



1.magnet switch
2.protective cover
3.plunger hook

Installation

1. If necessary, magnet switch or protective cover should be replaced by new parts, then daub lubricating grease on plunger.

2. Hook the plunger onto fork, then use nut to fix magnet switch.

3. Connect the wire, then check the working state of switch.

Notice:

Please check the plunger and fork is hooked firmly before install nut.

Protective cover ventilation side is downward.

Starter motor assembly

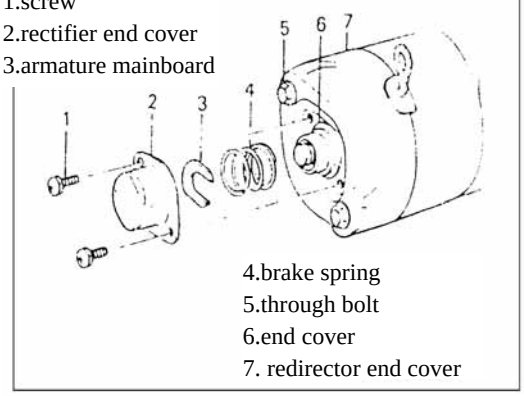
Disassembly

1. Remove magnet switch.

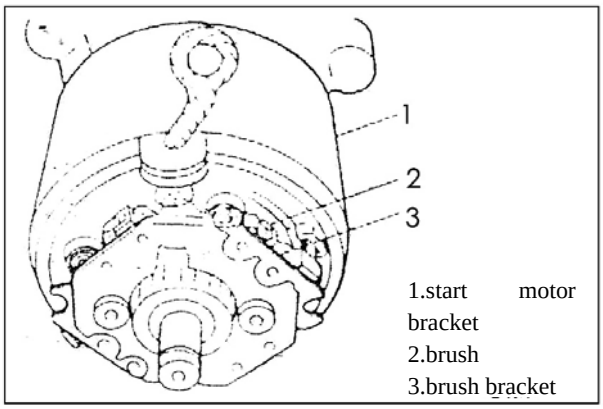
2. Remove two screws, take away the rectifier rear cover, armature retainer plate and braking spring.

3. Remove break through bolt, then draw out the rectifier end cover.

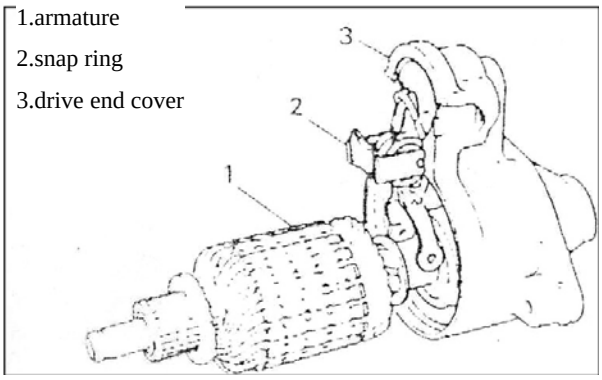
1.screw
2.rectifier end cover
3.armature mainboard



4.brake spring
5.through bolt
6.end cover
7. redirector end cover

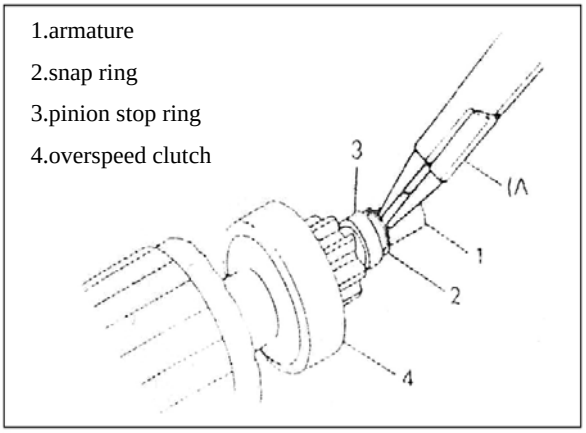


4. Use long-nose pliers to pull out the brush, then remove brush holder.



5. Remove starter bracket

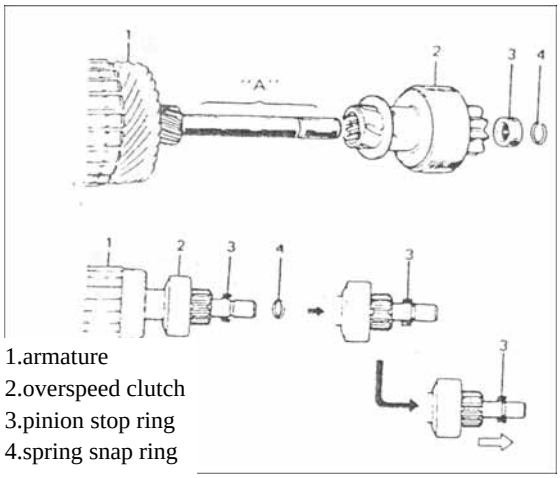
6. Use spring snap ring pliers and screwdriver to remove armature snap ring, then pull the pinion stop ring and overspeed clutch out.



Assembly

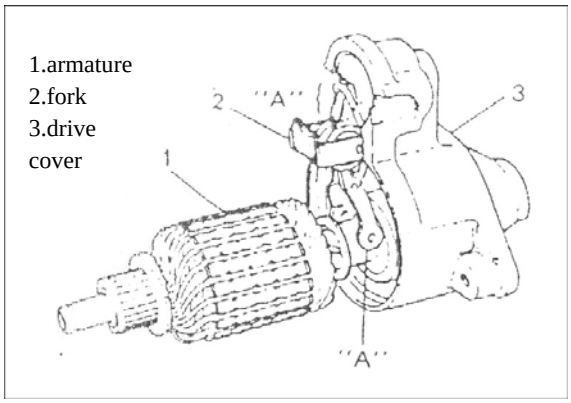
1. Check each part according to the method described in section “inspect and repair”, if necessary, please replace or repair it.

2. Daub lubricating grease according to the figure before install the overspeed clutch, then use spring snap ring to lock the stop ring.



1.armature
2.overspeed clutch
3.pinion stop ring
4.spring snap ring

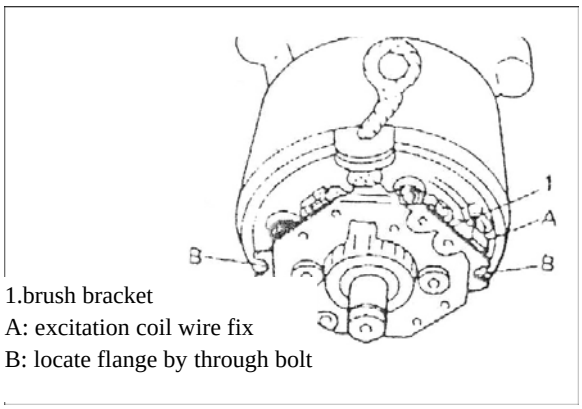
3. Daub lubricating grease on the fork, and make a combination with armature, then assemble with drive cover.



4. Assemble starter motor bracket and brush holder, then install four brushes and spring.

Notice:

Please check armature and rectifier disengaged completely or not when install the brush holder.



1.brush bracket
A: excitation coil wire fix
B: locate flange by through bolt

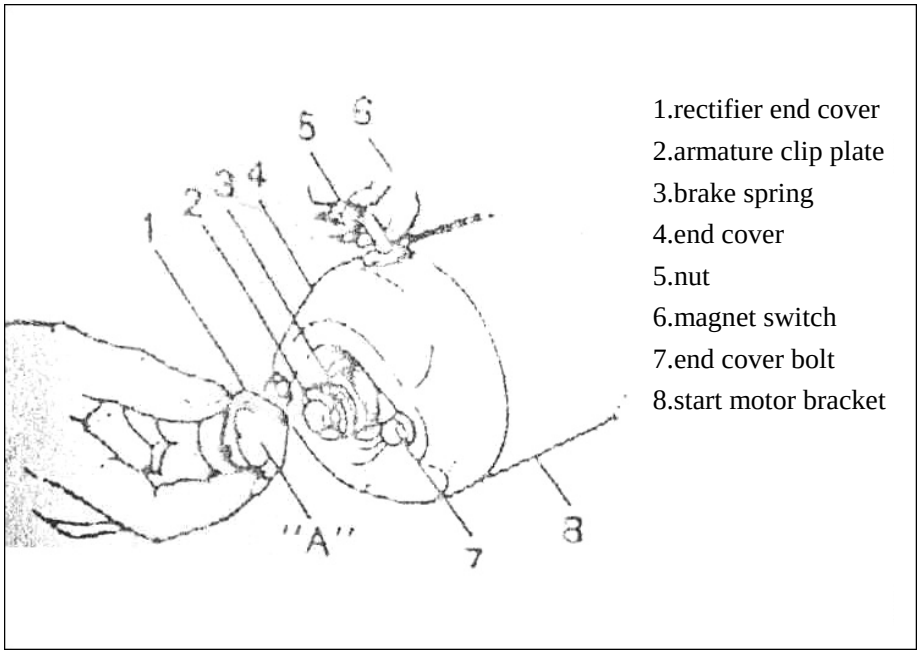
Check whether brush has unnecessary contact with other parts.

5. Daub lubricating grease on inside of the end cover, install rectifier end cover.

6. Install end cover sealing gasket and braking spring, then install armature retainer firmly, Daub lubricating grease on the 40% space before install the rear cover.

7. Install magnet switch.

8. After make a connection with battery, check the working condition of the starter motor is normal or not.

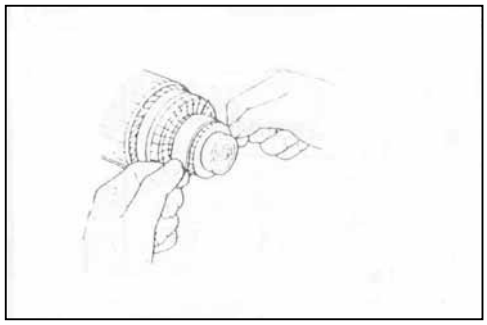


1.rectifier end cover
2.armature clip plate
3.brake spring
4.end cover
5.nut
6.magnet switch
7.end cover bolt
8.start motor bracket

Section 4 Check and Repair

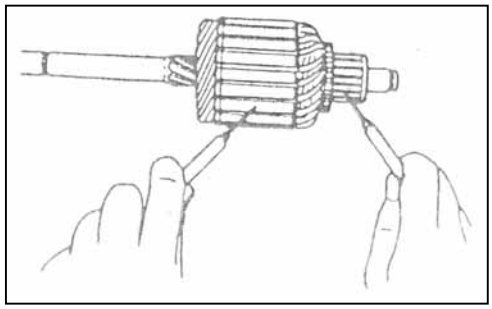
Armature

Check whether the rectifier is dirty or damaged. If need repair, repair it by sand paper or on the lathe.



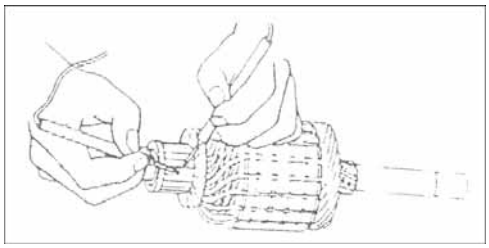
Earthing

It should be insulated between the rectifier plate and armature iron core, check it by ohmmeter.



Open circuit

Check whether it is connected between the rectifier plates, if it is not connected when you check in any test point, it shows that there is open circuit, you should replace the armature.

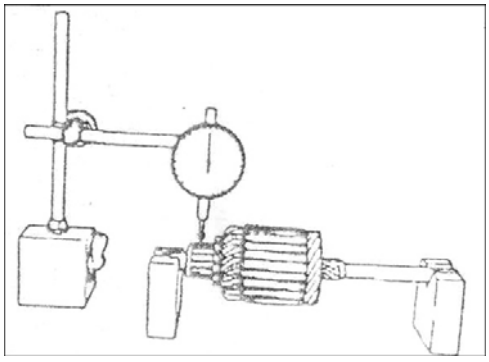


Jumpiness of the rectifier

Use V shape iron to support the armature, check the jumpiness of the rectifier. You can calibrate it on the lathe if necessary.

Radial jumpiness of the rectifier

Repair limit (max): 0.4mm (0.15in).

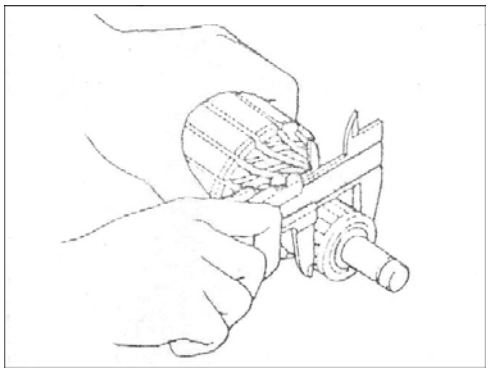


Diameter of the rectifier

Check whether the diameter of rectifier is worn; replace the armature if the diameter of rectifier is smaller than limit.

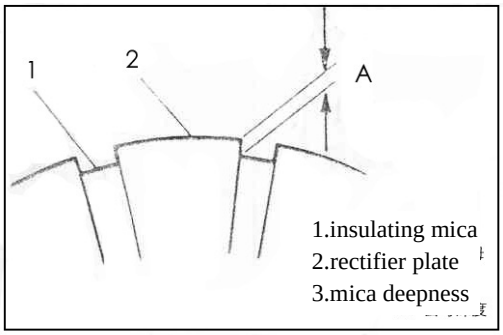
Diameter of the rectifier

Repair limit (min): 27mm (1.063in)



Surface of the rectifier

Use 100# emery cloth to trim and clean the surface of the rectifier, and check the deepness of the mica. If necessary, trim the deepness.

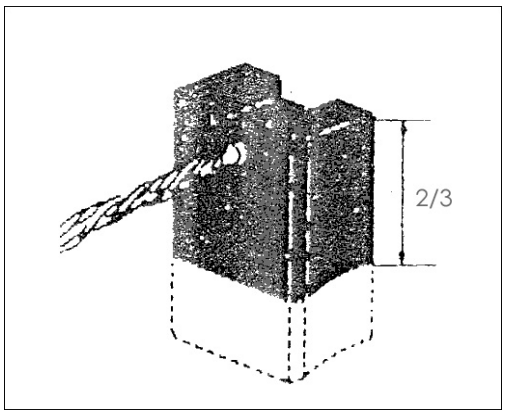


Deepness A of rectifier mica piece

Repair limit (min): 0.22mm (0.008in)

Starter motor bracket

Check the electric conduction of the excitation coil. It should be connected between the brush and the starter motor bracket body.



Check the brush

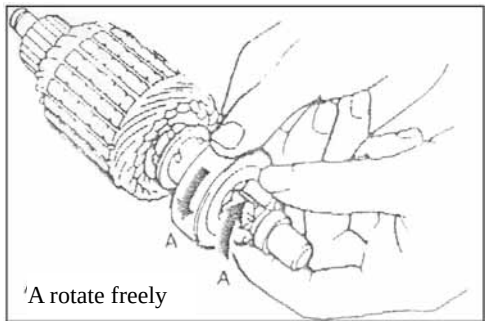
Measure the length of the brush, replace if necessary.

The length of the brush

Repair limit (min): 10.7mm (0.421in)

Brush holder

Check whether the brush spring is rubiginous or damaged. At the same time, check whether the brush holder is rubiginous and whether the positive plate is insulated. Replace the whole assembly if necessary.

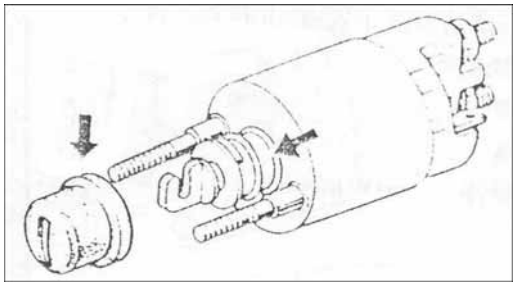


Overspeed clutch

Check whether the overspeed clutch can rotate freely in A direction and whether connected in the other direction. And check whether the pinion is worn abnormally. Replace the whole assembly if necessary.

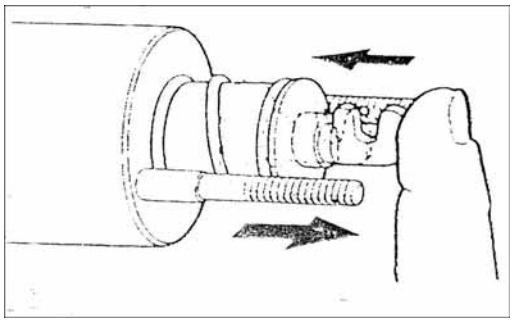
Magnet switch protective cover and plunger

Check whether magnet switch protective cover is damaged and whether plunger is worn or damaged, replace if necessary.



Magnet switch

Push plunger then loose hand, plunger should return to original position rapidly. Replace if necessary.



Motor shaft and shaft liner

Measure the clearance between the motor shaft and shaft liner, replace the shaft liner if the clearance exceed limit.

Notice:

1. The disassembly and assembly of shaft liner should use appropriate pressure machine.

2. After press the shaft liner in, then ream hole to make the clearance between shaft and liner is 0.05mm.

3. When replace front liner, protective cover of drive cover should be tightened.

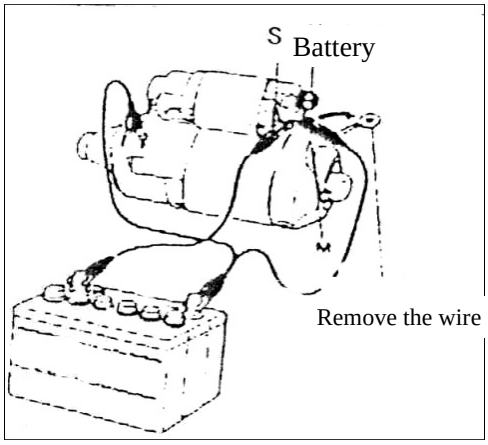
4. Use lubricating grease to lubricate shaft liner.

The clearance between shaft and liner operation limit A—B

0.22mm (0.008in)

Performance test

Caution: Each test should be finished in 3～5 seconds in order to avoid damaging coil.



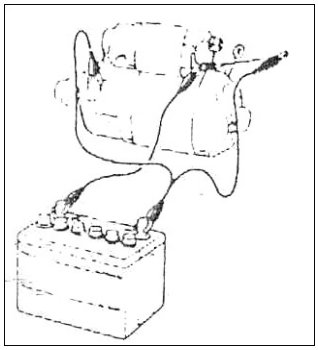
Attraction test

Connect test wire according to the figure. Check whether the pinion (overspeed clutch) bounce out. If don't bounce out, please replace magnet switch.

Caution: Disconnect the excitation coil wire at the connection post M before the test.

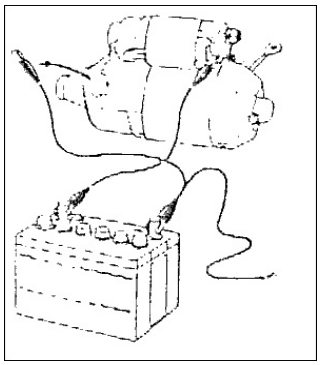
Retention test:

When connect wire according to state above, disconnect the negative wire at the connection post M and check whether pinion keep holding out, if not, please replace magnet switch.



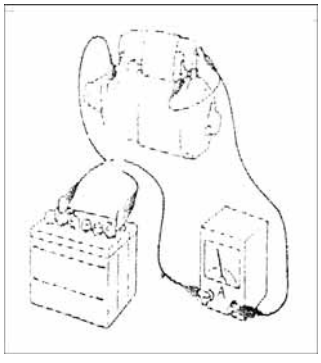
Pinion (plunger) return test

As the second step of above content, disconnect negative wire, check whether the pinion return to original position rapidly.



Empty load performance test

Connect test wire according to the figure，and check whether the starter motor can run normally when the pinion hold out. Meanwhile, check whether the indication current exceeds stated value.



Empty load current: The current is less than 55A when the battery voltage is 11V.

Starter technical data

Voltage		12V	
Output power		0.8 KW	
Start time		30 s	
Rotation direction		See from pinion side clockwise	
Brush length		19 ㎜（0.650in）	
Number of teeth of start pinion		9	
Characteristic		Condition	Ensure
Temperature 20℃（68℉）	Empty load	11V	Below 55A，above 5000 r/m
	Load	9.5V 0.7Kg・m	Below 270A，above 1200 r/m
	Braking	7.7V	Below 600A，above 1.3kg・m （94 pound/feet）
Magnet switch working voltage		Above 8V	