SUBARU

SVX

1992

M MECHANISM AND FUNCTION

1. Alternator

The alternator has a built-in regulator which provides the following diagnostic functions:

1) Voltage regulation

The on-off operation of transistor Tr_1 connects and disconnects the field current flow, providing a constant level of output voltage.

2) Diagnosis warning

When any of the following problems occur, the charge lamp illuminates.

a. No voltage generation
   Brush wear exceeds specified wear limits, field coil circuit is broken, etc.

b. Excessive output
   Output voltage is greater than 16 volts (approx.)

c. Terminal B disconnection
   Harness is disconnected from alternator terminal B.

d. Terminal S disconnection
   Harness is disconnected from alternator terminal S. In this case, voltage is slightly greater than specified regulated voltage; however, voltage regulation is still controlled and the battery is prevented from becoming overcharged.

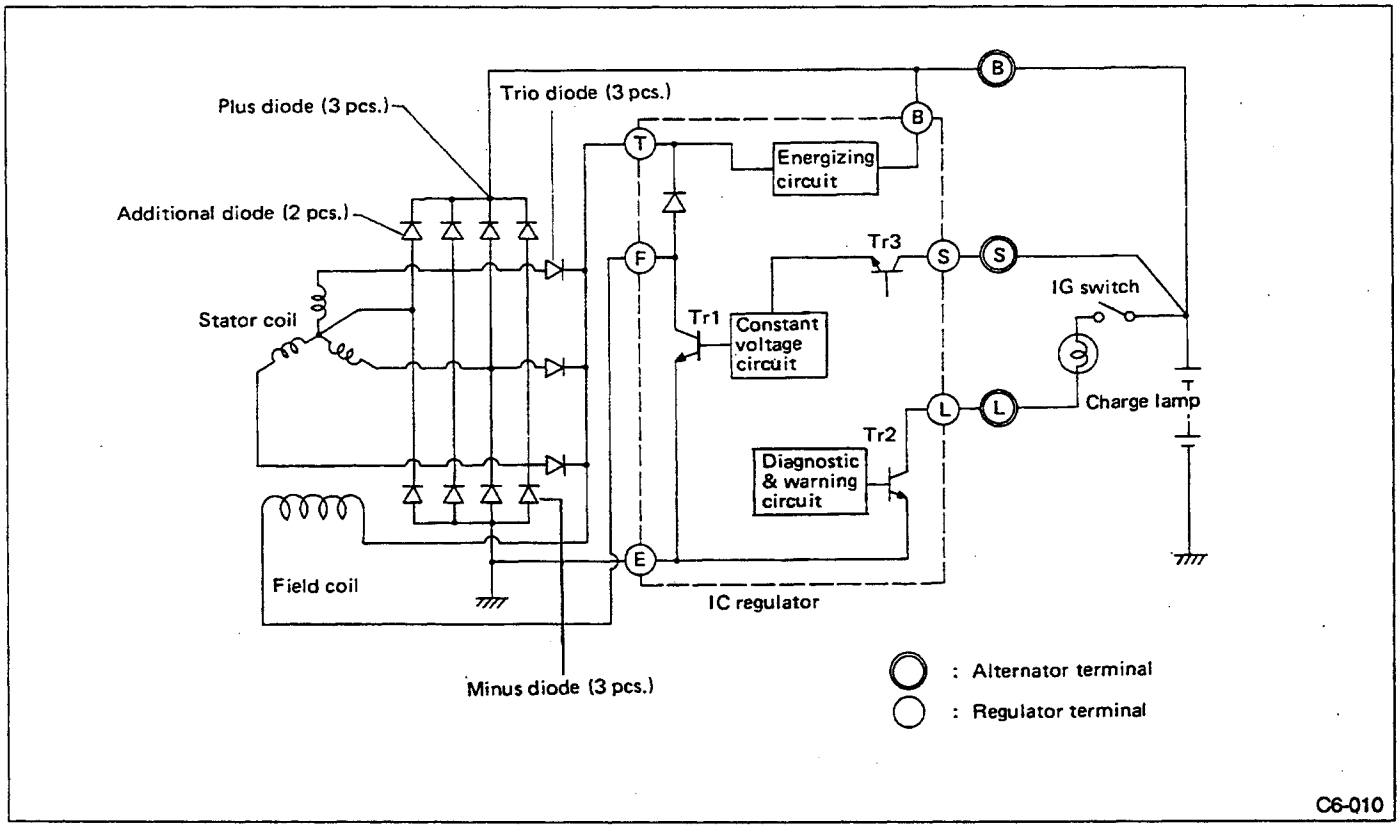


Fig. 1

2. Ignition Coil

One ignition coil is installed for each cylinder (or spark plug).
The secondary terminal of the ignition coil is in contact with the spark plug terminal nut.
Since spark plug cable is not used, secondary voltage drop, leaks, etc. do not occur. The result is high performance reliability.

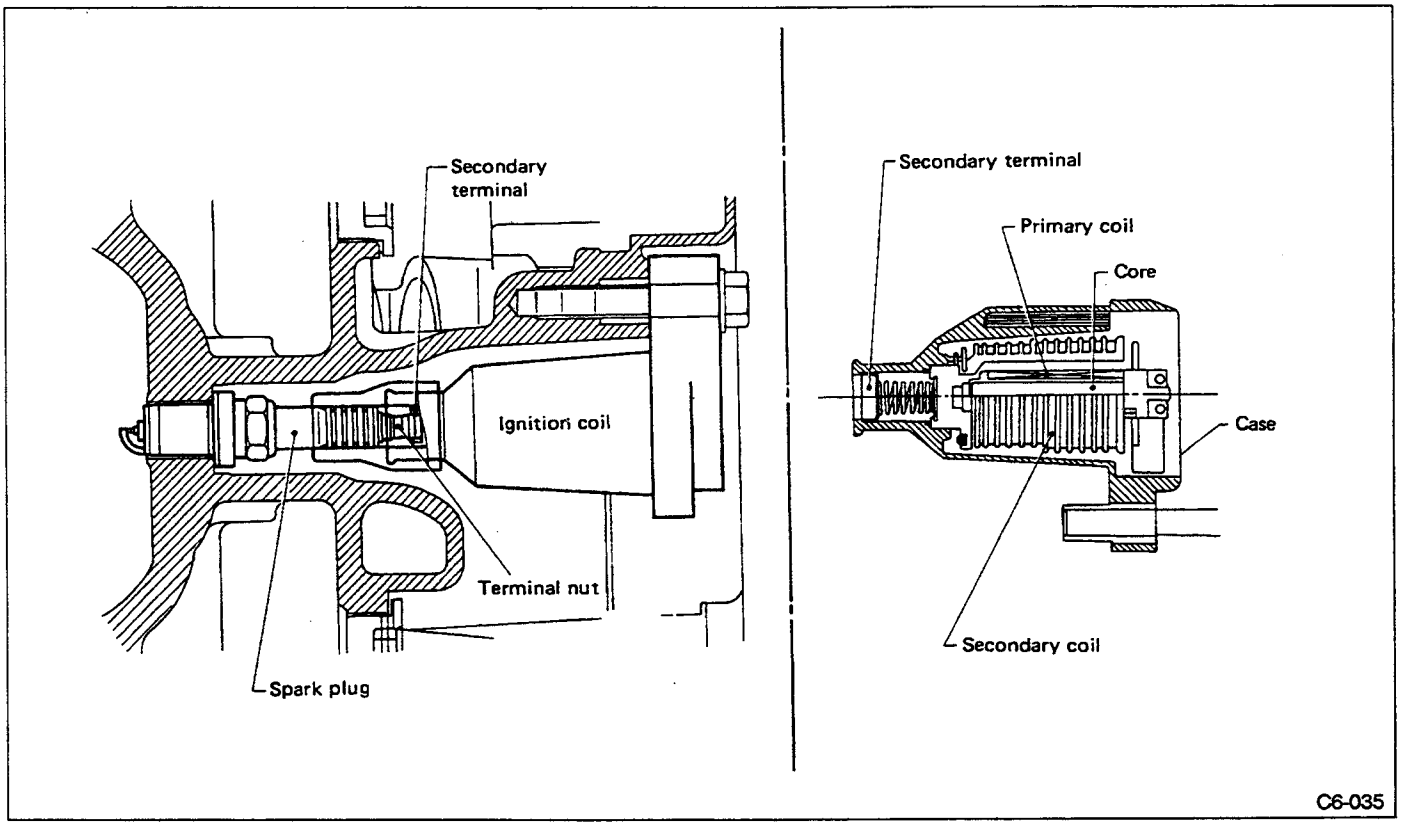


Fig. 2

3. Spark Plug

The spark plug has a platinum tipped type electrode, with 14 mm (0.551 in) threads and 1.0 to 1.1 mm (0.039 to 0.043 in) gap.

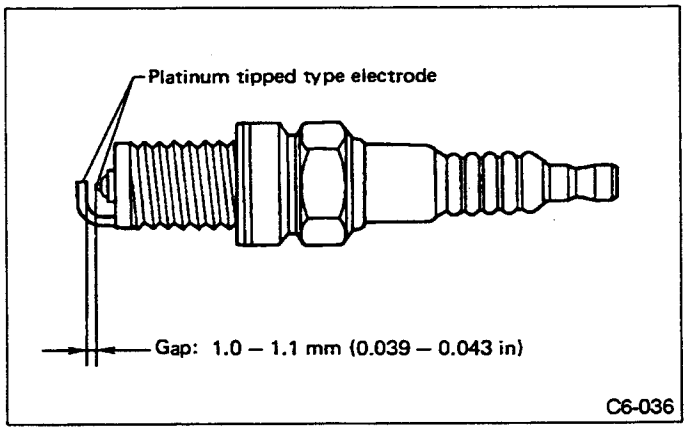


Fig. 3

S SPECIFICATIONS AND SERVICE DATA

A: SPECIFICATIONS

1. STARTER

Type		Reduction type
Model		MIT-75681
Manufacture		MITSUBISHI
Voltage and Output		12V — 1.4 kW
Direction of rotation		Counterclockwise (when observed from pinion)
Number of pinion teeth		9
No-load characteristics	Voltage	11 V
	Current	90 A or less
	Rotating speed	3,000 rpm or more
Load characteristics	Voltage	7.7 V
	Current	300 A or less
	Torque	10 N•m (1.0 kg-m, 7 ft-lb)
	Rotating speed	1,000 rpm or more
Lock characteristics	Voltage	4 V
	Current	980 A or less
	Torque	23 N•m (2.3 kg-m, 17 ft-lb) or more

2. ALTERNATOR

Type	Rotating-field three-phase type, Voltage regulator built-in type
Model	A3T08891
Regulator type	A866X21271
Manufacture	MITSUBISHI
Voltage and Output	12 V — 95 A
Polarity on ground side	Negative
Direction of rotation	Clockwise (when observed from pulley side)
Armature connection	3-phase Y-type
Rectifying system	Full wave rectification by eight self-contained silicone diode
Output current	1,500 rpm — 39 A or more 2,500 rpm — 73 A or more 5,000 rpm — 95 A or more
Regulated voltage	14.2 — 14.8 V [20°C (68°F)]

3. IGNITION COIL

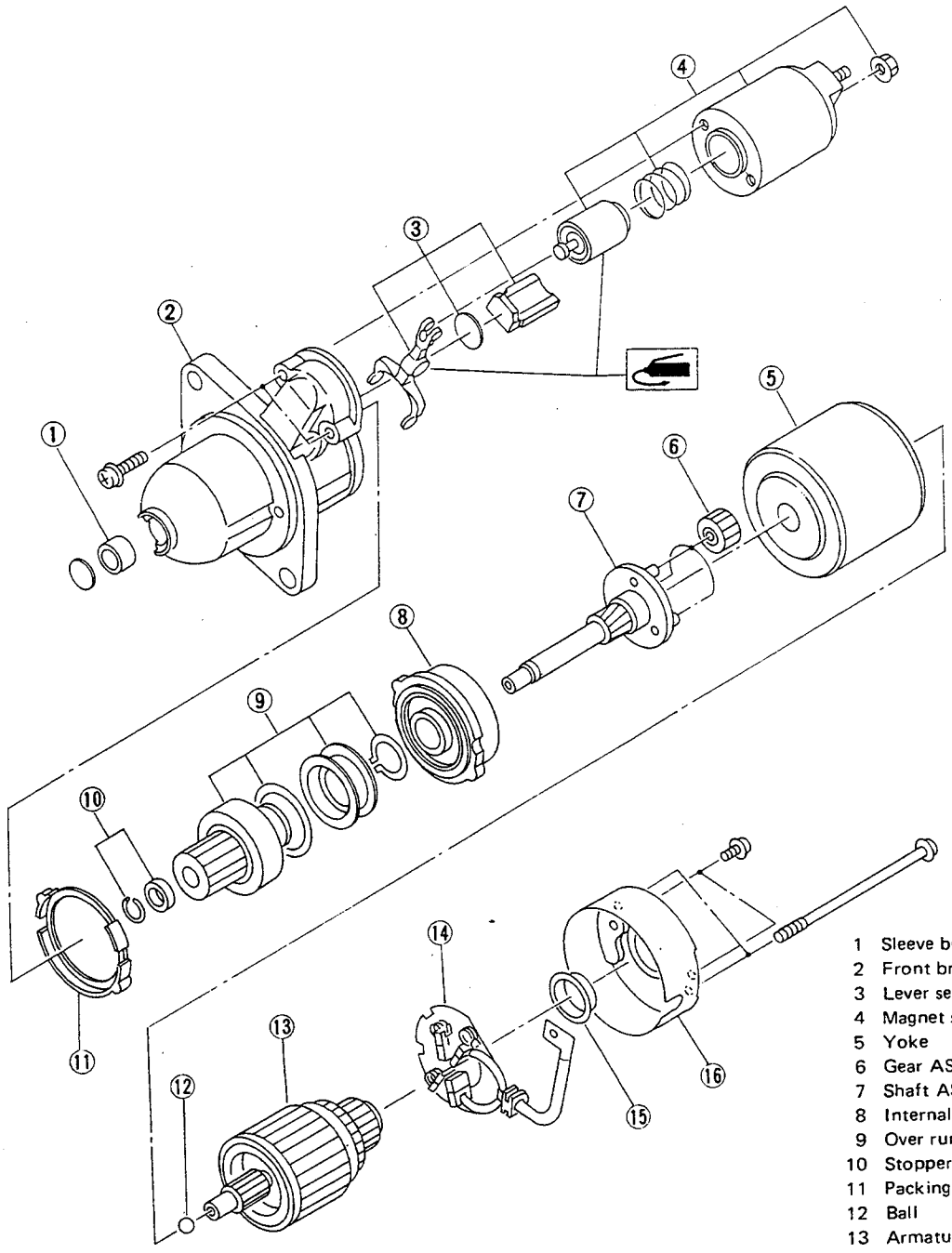
Type	Direct ignition type
Manufacture	DIAMOND
Primary coil resistance	0.68 — 0.83 Ω
Secondary coil resistance	—
Insulation resistance between primary terminal and case	More than 10 MΩ

4. SPARK PLUG

Type and Manufacture		PFR6B -11 PFR6G -11... NGK PK20PR-11 ... NIPPONDENSO
Thread size	mm	14, P = 1.25
Spark gap	mm (in)	1.0 — 1.1 (0.039 — 0.043)

C COMPONENT PARTS

1. Starter



1 Sleeve bearing
2 Front bracket
3 Lever set
4 Magnet switch ASSY
5 Yoke
6 Gear ASSY
7 Shaft ASSY
8 Internal gear ASSY
9 Over running clutch
10 Stopper set
11 Packing
12 Ball
13 Armature
14 Brash holder
15 Bearing
16 Rear bracket

C6-011

Fig. 4

2. Alternator

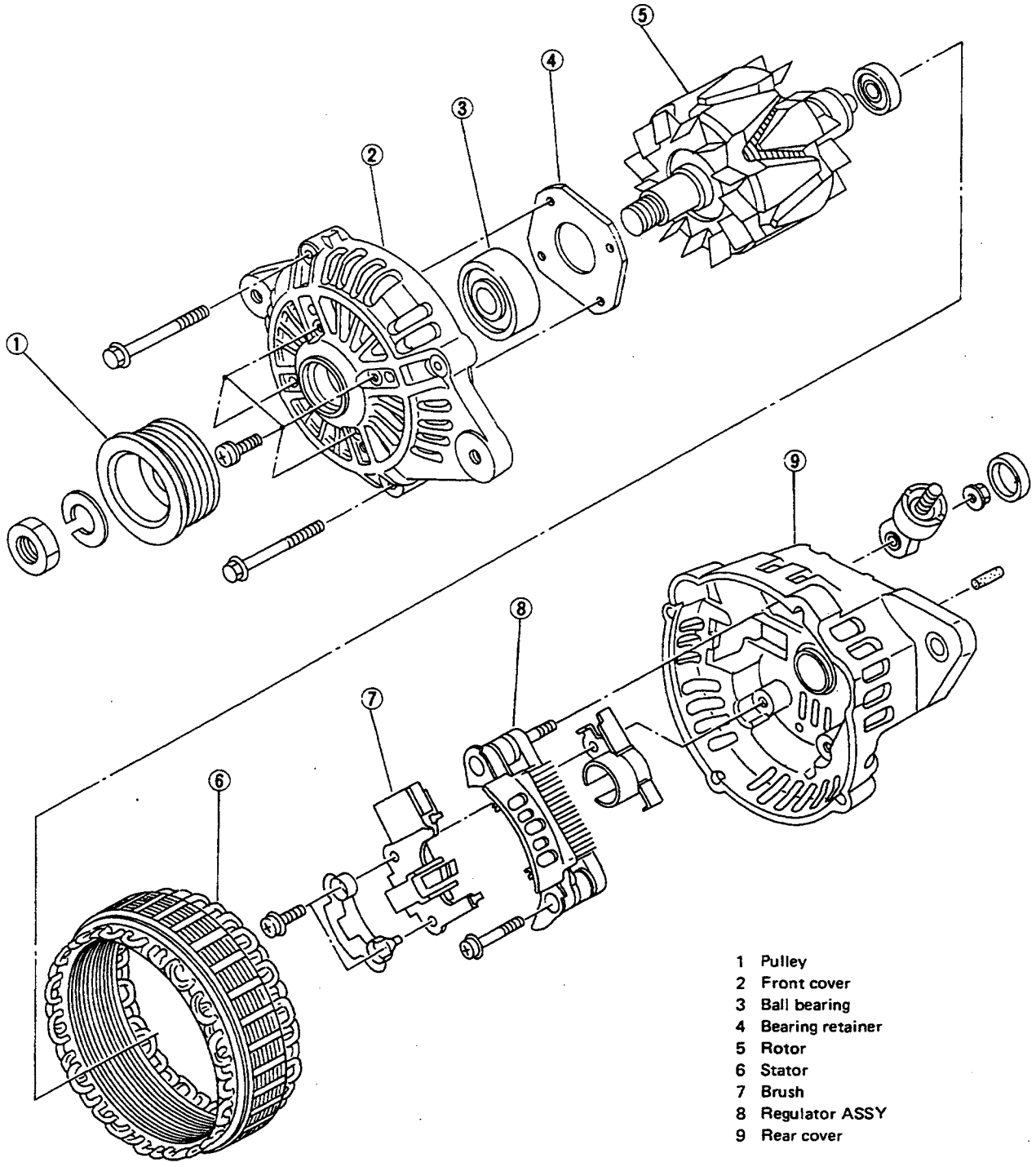


Fig. 5

W SERVICE PROCEDURE

1. Starter

A: TEST

1. SWITCH ASSEMBLY OPERATION

1) Connect terminal S of switch ASSY to positive terminal of battery with a lead wire, and starter body to ground terminal of battery. Pinion should be forced endwise on shaft.

With pinion forced endwise on shaft, starter motor can sometimes rotate because current flows, through pull-in coil, to motor. This is not a problem.

2) Disconnect connector from terminal M, and connect positive terminal of battery and terminal M using a lead wire and ground terminal to starter body.
In this test setup, pinion should return to its original position even when it is pulled out with a screwdriver.

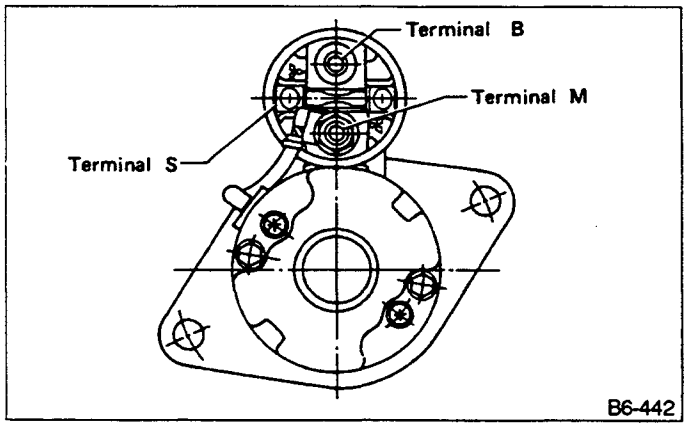


Fig. 6

2. PINION GAP

1) With pinion forced endwise on shaft, as outlined in step 1) above, measure pinion gap.

Pinion gap:
0.5 — 2.0 mm (0.020 — 0.079 in)

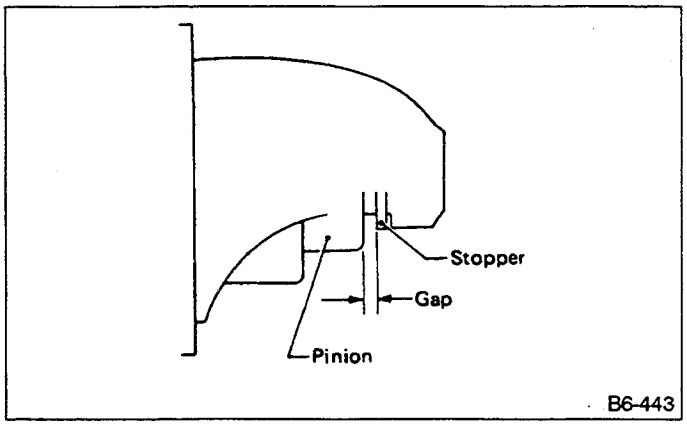


Fig. 7

If motor is running with the pinion forced endwise on the shaft, disconnect connector from terminal M of switch ASSY and connect terminal M to ground terminal (−) of battery with a lead wire. Next, gently push pinion back with your fingertips and measure pinion gap.
2) If pinion gap is outside specified range, remove or add number of adjustment washers used on the mounting surface of switch ASSY until correct pinion gap is obtained.

3. PERFORMANCE TEST

The starter should be submitted to performance tests whenever it has been overhauled, to assure its satisfactory performance when installed on the engine.
Three performance tests, no-load test, load test, and lock test, are presented here; however, if the load test and lock test cannot be performed, carry out at least the no-load test.
For these performance tests, use the circuit shown in figure.

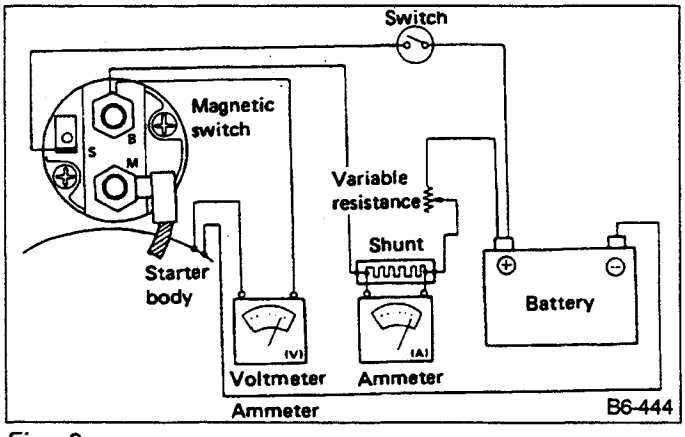


Fig. 8

1) No-load test
With switch on, adjust the variable resistance to obtain 11 V, take the ammeter reading and measure the starter speed. Compare these values with the specifications.

No-load test (Standard):
Voltage/Current
11 V/90 A max
Rotating speed
3,000 rpm/min

2) Load test
Apply the specified braking torque to starter. The condition is satisfactory if the current draw and starter speed are within specifications.

Load test (Standard):
Voltage/Load
7.7 V/10 N•m (1.0 kg-m, 7 ft-lb)
Current/Speed
300 A max/1,000 rpm/min

3) Lock test
With starter stalled, or not rotating, measure the torque developed and current draw when the voltage is adjusted to the specified voltage.

Lock test (Standard):
Voltage/Current
4 V/980 A max
Torque
23 N•m (2.3 kg-m, 17 ft-lb) min

B: DISASSEMBLY

1) Loosen nut which holds terminal M of switch ASSY, and disconnect connector.
2) Remove bolts which hold switch ASSY, and remove switch ASSY, plunger and plunger spring from starter as a unit.

Be careful because pinion gap adjustment washer may sometimes be used on the mounting surface of switch ASSY.

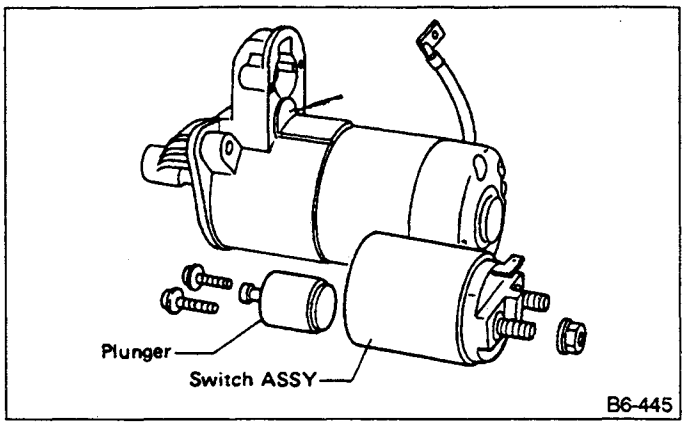


Fig. 9

3) Remove both through-bolts and brush holder screws, and detach rear bracket and brush holder.

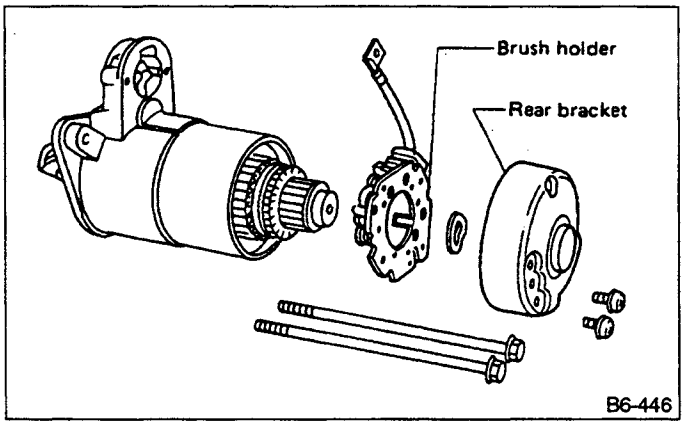


Fig. 10

4) Remove armature and yoke. Ball used as a bearing will then be removed from the end of armature.
Be sure to mark an alignment mark on yoke and front bracket before removing yoke.

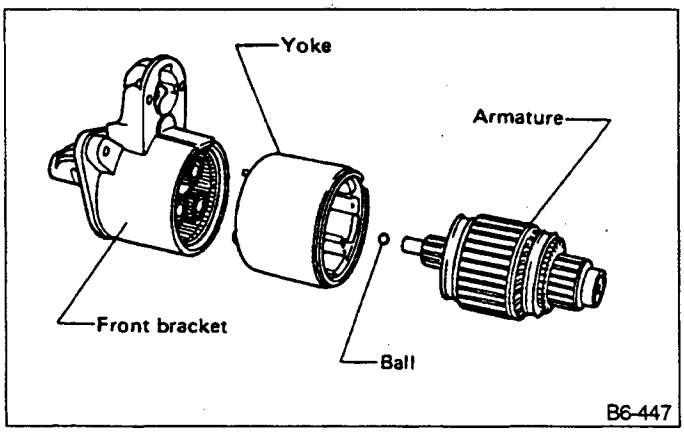


Fig. 11

5) Remove packing A, three planetary gears, packing B and plate.

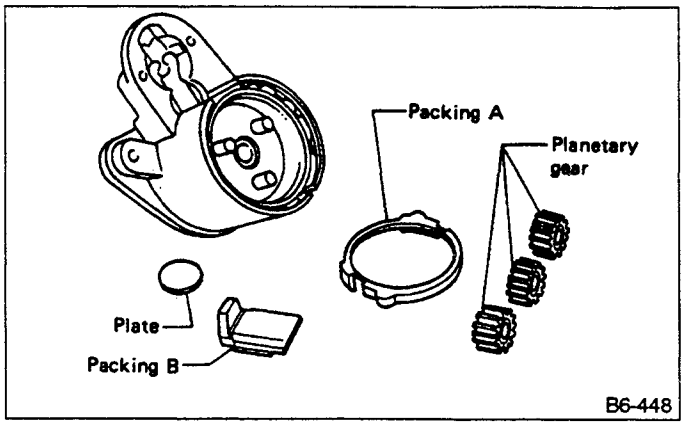


Fig. 12

6) Remove shaft ASSY and overrunning clutch as a unit.

Record the direction of lever before removing.

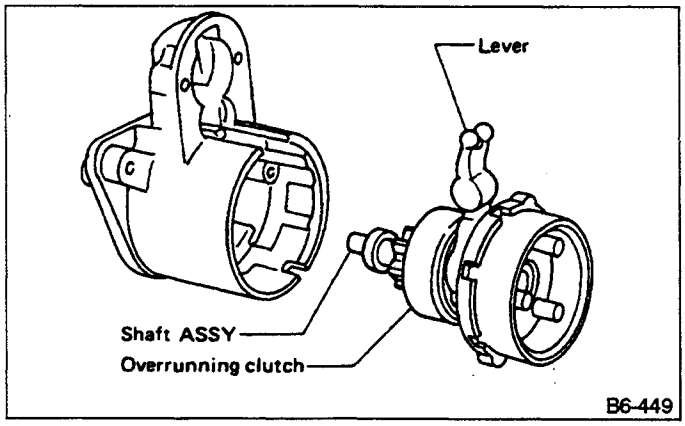


Fig. 13

7) Remove overrunning clutch from shaft ASSY as follows:

(1) Remove stopper from ring by lightly tapping a jig placed on stopper.

(2) Remove ring, stopper and clutch from shaft.

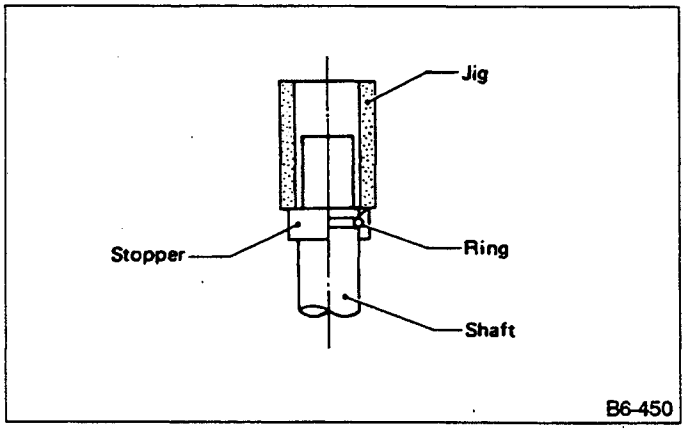


Fig. 14

C: INSPECTION

1. ARMATURE

1) Check commutator for any sign of burns of rough surfaces or stepped wear. If wear is of a minor nature, correct it by using sandpaper.

2) Run-out test

Check the commutator run-out and replace if it exceeds the limit.

Commutator run-out:
Standard
0.05 mm (0.0020 in)
Service limit
Less than 0.10 mm (0.0039 in)

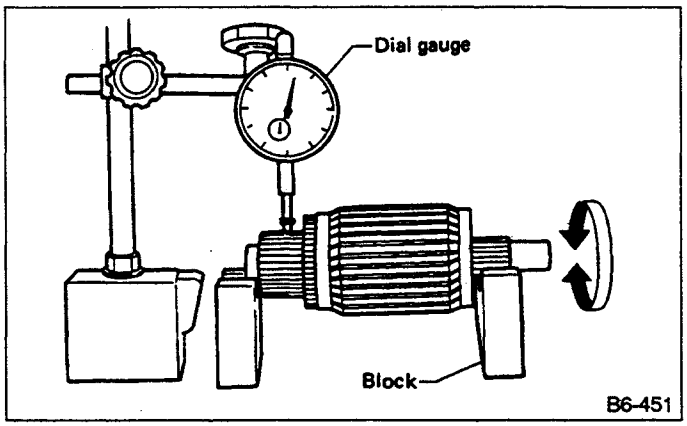


Fig. 15

3) Depth of segment mold

Check the depth of segment mold.

Depth of segment mold
0.5 — 0.8 mm (0.020 — 0.031 in)

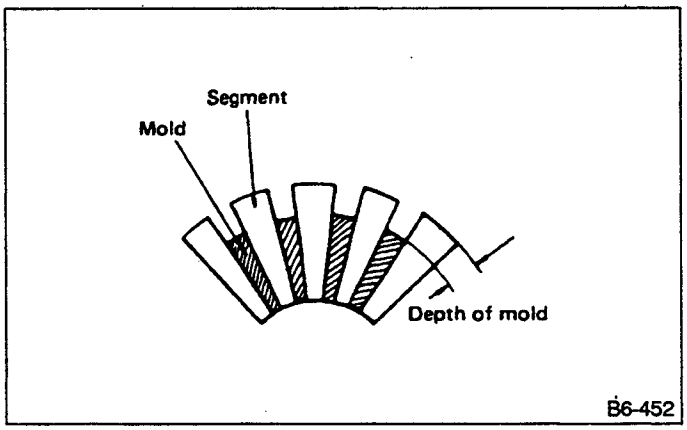


Fig. 16

4) Armature short-circuit test
Check armature for short-circuit by placing it on growler tester. Hold a hacksaw blade against armature core while slowly rotating armature. A short-circuited armature will cause the blade to vibrate and to be attracted to core. If the hacksaw blade is attracted or vibrates, the armature, which is short-circuited, must be replaced or repaired.

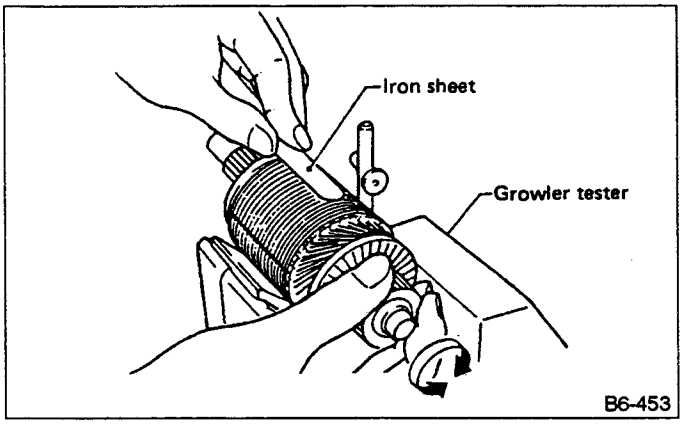


Fig. 17

5) Armature ground test
Using circuit tester, touch one probe to the commutator segment and the other to shaft. There should be no continuity. If there is a continuity, armature is grounded. Replace armature if it is grounded.

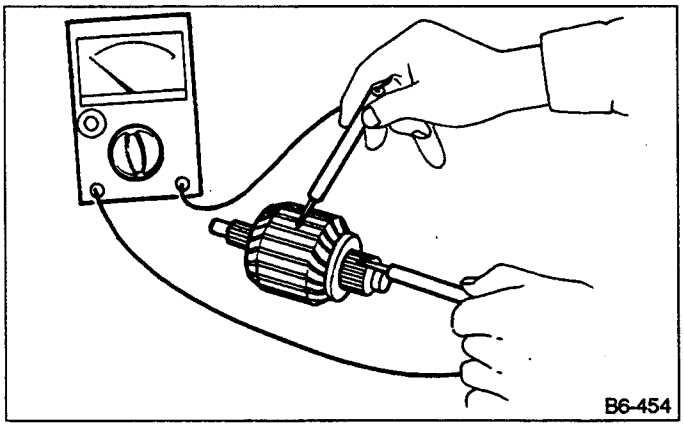


Fig. 18

2. YOKE
Make sure pole is set in position.

3. OVERRUNNING CLUTCH
Inspect teeth of pinion for wear and damage. Replace if it damaged. Rotate pinion in direction of rotation (clockwise). It should rotate smoothly. But in opposite direction, it should be locked.

Do not clean overrunning clutch with oil to prevent grease from flowing out.

4. BRUSH AND BRUSH HOLDER
1) Brush length
Measure the brush length and replace if it exceeds the service limit.
Replace if abnormal wear or cracks are noticed.

Brush length:
Standard **17.0 mm (0.669 in)**
Service limit **11.5 mm (0.453 in)**

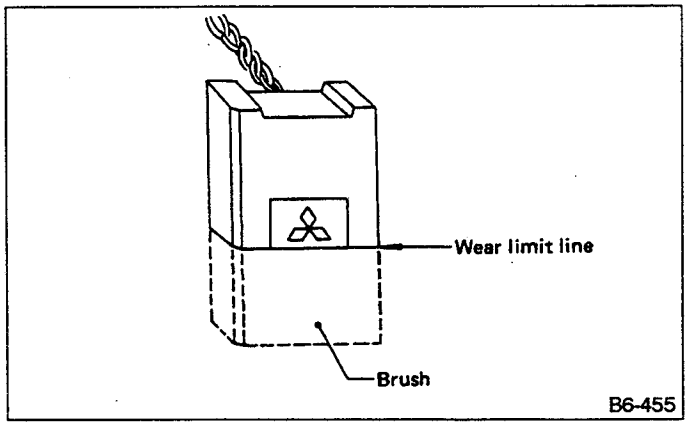


Fig. 19

2) Brush movement
Be sure brush moves smoothly inside brush holder.
3) Insulation resistance of brush holder
Be sure there is no continuity between brush holder and its plate.

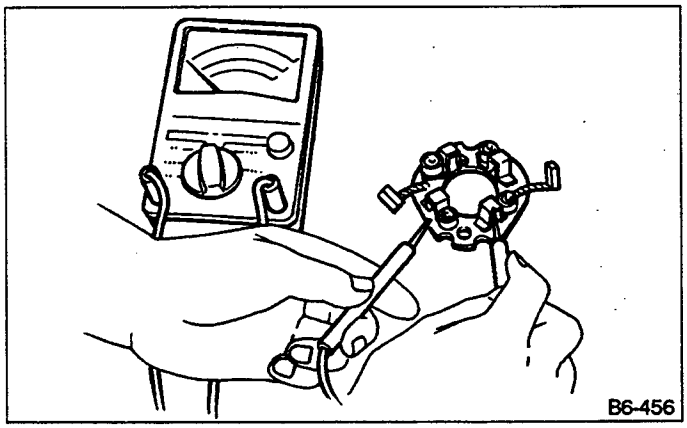


Fig. 20

4) Brush spring force
Measure brush spring force with a spring scale. If it is less than the service limit, replace brush spring.

Brush spring force:
Standard
18.6 N (1.9 kg, 4.2 lb) (when new)
Service limit
6.9 N (0.7 kg, 1.5 lb)

5. SWITCH ASSEMBLY

Be sure there is continuity between terminals S and M, and between terminal S and body ground. Use a circuit tester (set in "ohm").
Also check to be sure there is no continuity between terminal M and B.

Terminal	
S — M	Continuity
S — Body ground	Continuity
M — B	No continuity

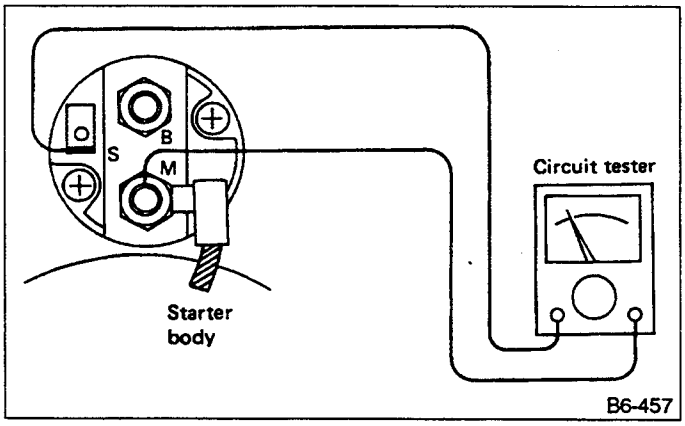


Fig. 21

D: ASSEMBLY

Assembly is in the reverse order of disassembly procedures. Observe the following:
1) Carefully assemble all parts in the order of assembly and occasionally inspect nothing has been overlooked.
2) Apply grease to the following parts during assembly.
- Front bracket sleeve bearing
- Armature shaft gear
- Outer periphery of plunger
- Mating surface of plunger and lever
- Gear shaft splines
- Mating surface of lever and clutch
- Ball at the armature shaft end
- Internal and planetary gears

3) After assembling parts correctly, check to be sure starter operates properly.

2. Alternator

A: DISASSEMBLY

1) Heat the bearing box to 50 to 60°C (122 to 140°F) with a 100 W-soldering iron and remove the four through bolts. Then insert the tip of a flat-head screwdriver into the gap between the stator core and front bracket. Pry then apart to disassemble.

Be careful not to lose the spring fitted in the periphery of the rear bearing.

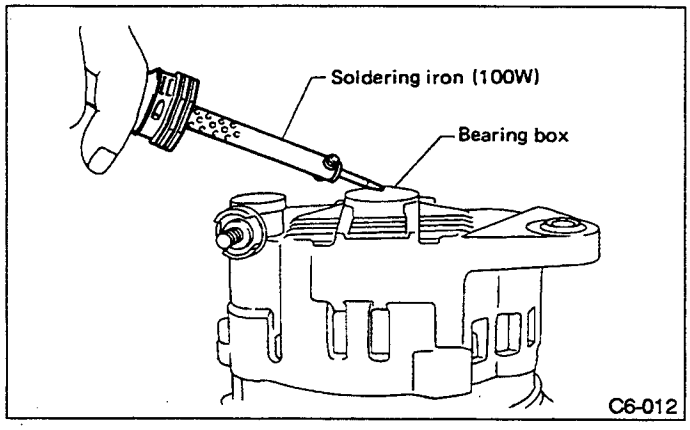


Fig. 22

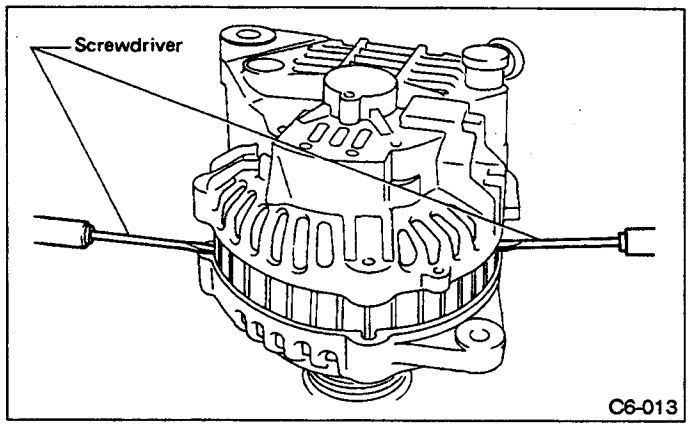


Fig. 23

2) Hold rotor with a vise and remove pully nut.
When holding rotor with vise, insert aluminum plates or wood pieces on the contact surfaces of the vise to prevent rotor from damage.

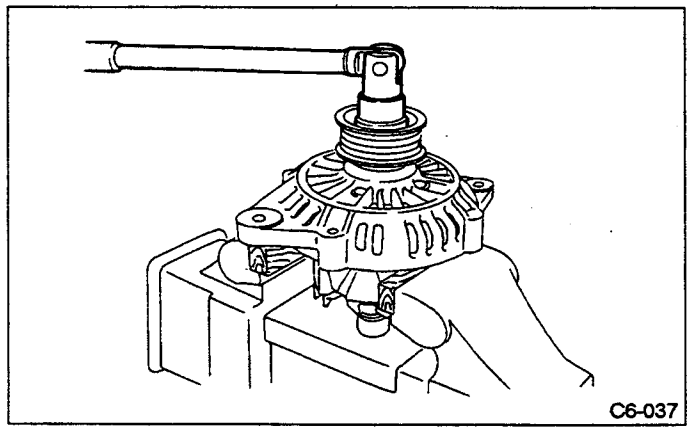


Fig. 24

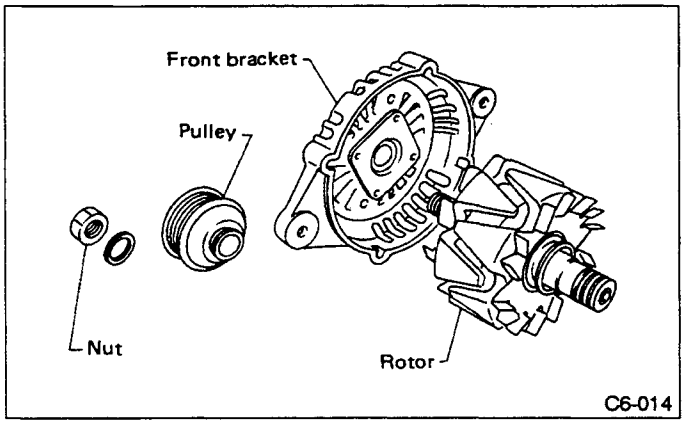


Fig. 25

3) Unsolder connection between rectifier and stator coil to remove stator coil.
Finish the work rapidly (less than three seconds) because the rectifier cannot withstand heat very well.

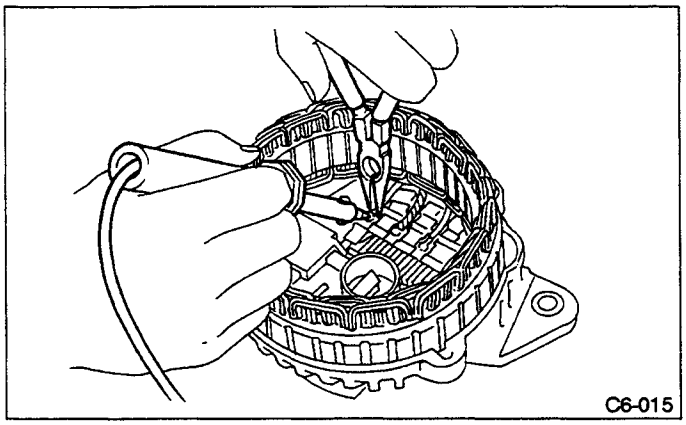


Fig. 26

4) Remove screws which secure IC regulator to rear cover, and unsolder connection between IC regulator and rectifier to remove IC regulator.

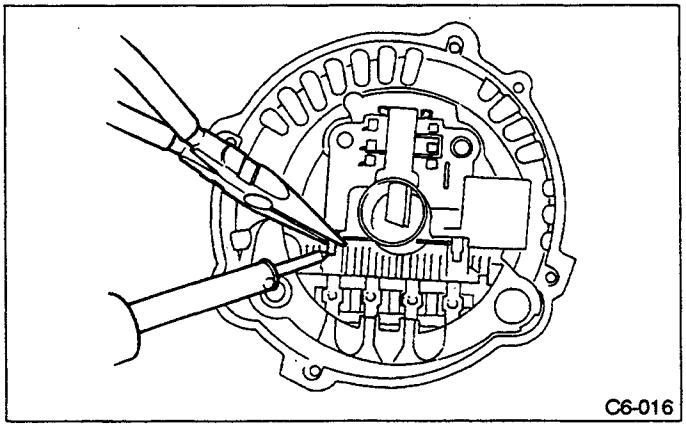


Fig. 27

5) Remove the brushes by unsoldering at the pigtails.

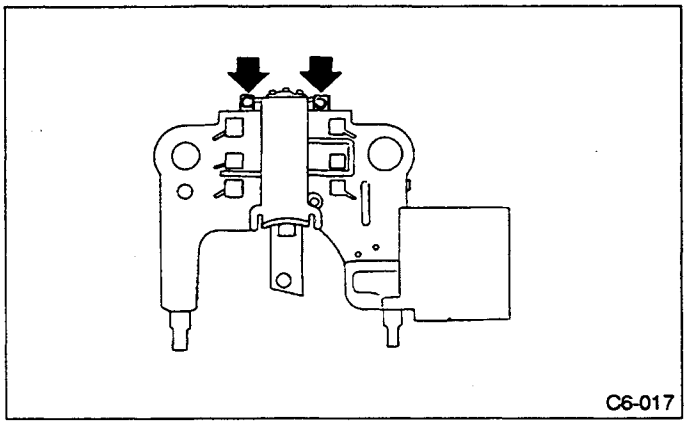


Fig. 28

6) Remove the nut and insulating bushing at terminal B. Remove rectifier.

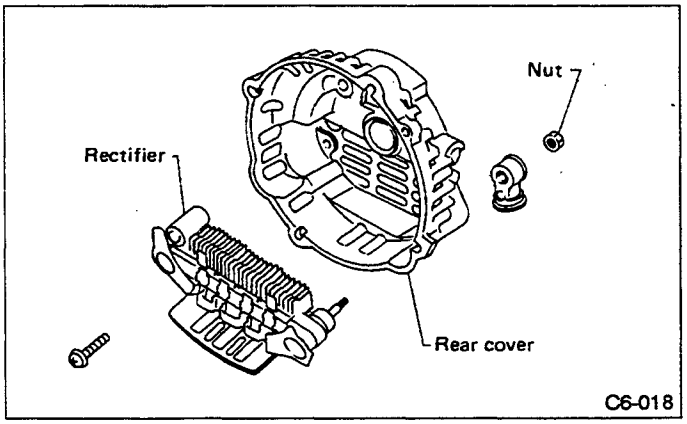


Fig. 29

B: INSPECTION AND REPAIR

1. DIODE

Never use a megger tester (measuring use for high voltage) or any other similar measure for this test; otherwise, the diodes may be damaged.

1) Checking positive diode

Check for continuity between the diode lead and the positive side heat sink. The positive diode is in good condition if continuity exists only in the direction from the diode lead to the heat sink.

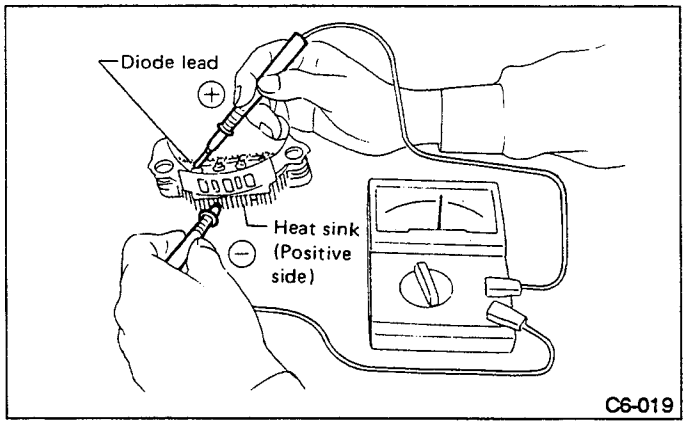


Fig. 30

2) Checking negative diode

Check for continuity between the negative side heat sink and diode lead. The negative diode is in good condition if continuity exists only in the direction from the heat sink to the diode lead.

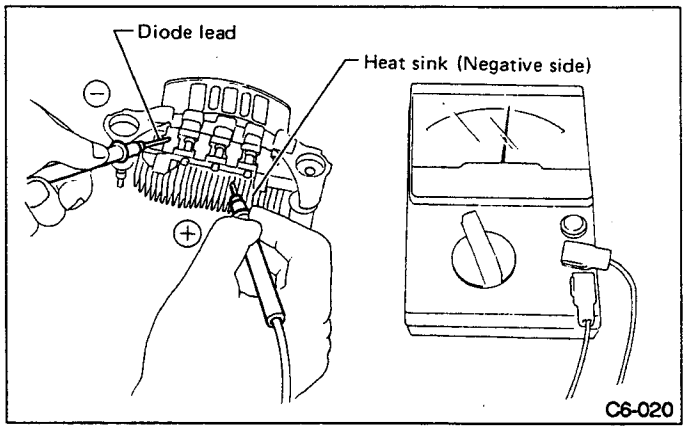


Fig. 31

3) Checking trio diode

Check the trio diode using a circuit tester. It is in good condition if continuity exists only in one direction.

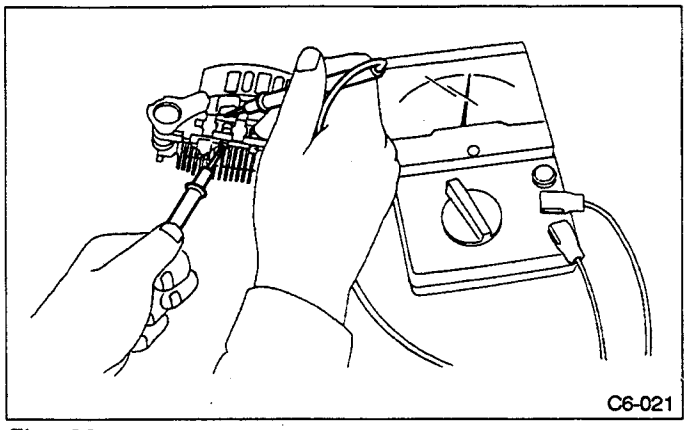


Fig. 32

2. ROTOR

1) Slip ring surface

Inspect slip rings for contamination or any roughness of the sliding surface. Repair slip ring surface using a lathe or sandpaper.

2) Slip ring outer diameter

Measure slip ring outer diameter. If slip ring is worn replace rotor ASSY.

Slip ring outer diameter:
Standard
22.7 mm (0.894 in)
Limit
22.1 mm (0.870 in)

3) Continuity test

Check resistance between slip rings using circuit tester. If the resistance is not within specification, replace rotor ASSY.

Specified resistance:
Approx. 3 Ω

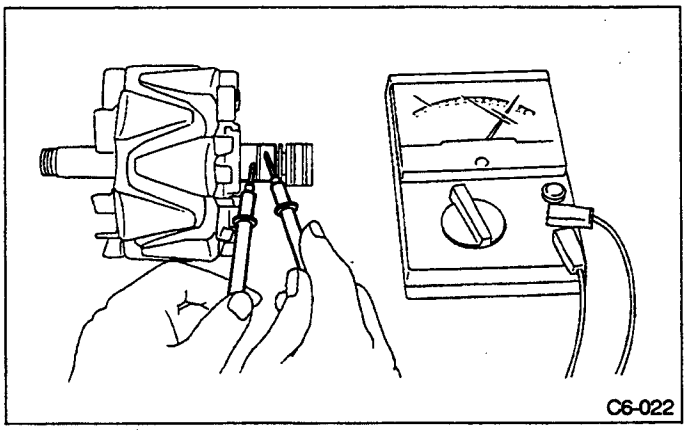


Fig. 33

4) Insulation test
Check continuity between slip ring and rotor core or shaft. If continuity exists, the rotor coil is short-circuited, and so replace rotor ASSY.

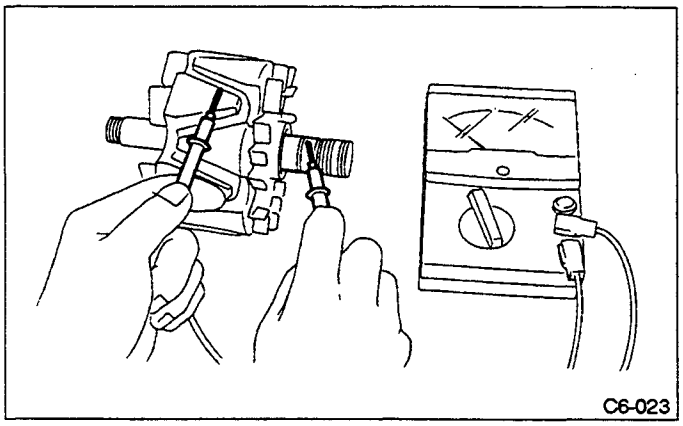


Fig. 34

5) Ball bearing (rear side)
(1) Check rear ball bearing. Replace it if it is noisy of if rotor does not turn smoothly.
(2) The rear bearing can be removed by using common bearing puller.

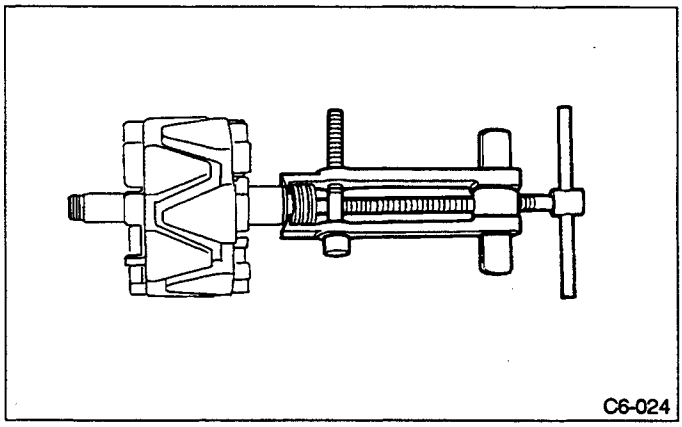


Fig. 35

3. STATOR

1) Continuity test
Inspect stator coil for continuity between each end of the lead wires. If there is no continuity between individual lead wires, the lead wire is broken, and so replace stator ASSY.

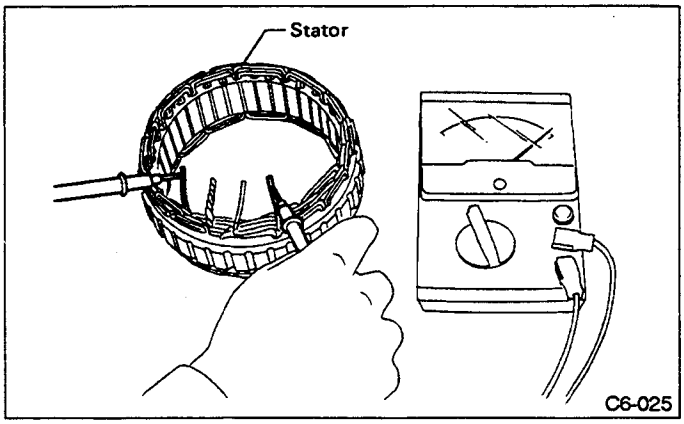


Fig. 36

2) Insulation test
Inspect stator coil for continuity between stator core and each end of the lead wire. If there is continuity, the stator coil is short-circuited, and so replace stator ASSY.

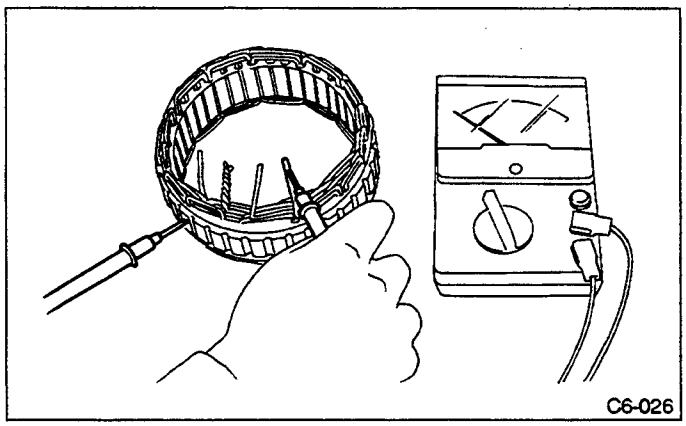


Fig. 37

4. BRUSH

1) Measure the length of each brush. If wear exceeds the wear limit, replace the brush. Each brush has the wear limit mark on it.

Brush length:
Standard
21.5 mm (0.846 in)
Wear limit
8.0 mm (0.315 in)

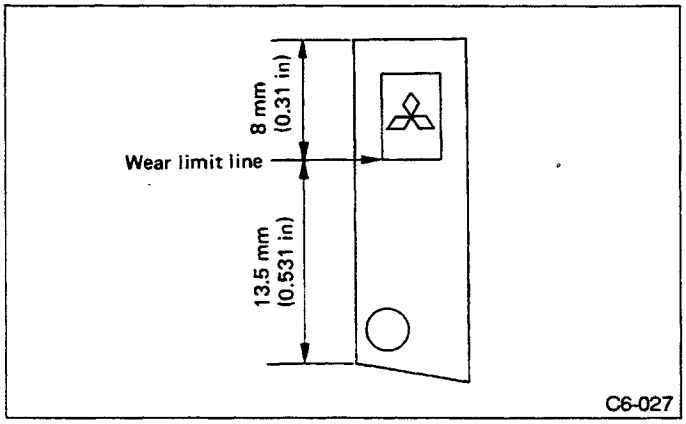


Fig. 38

2) Checking brush spring for proper pressure
Using a spring pressure indicator, push the brush into the brush holder until its tip protrudes 2 mm (0.08 in). Then measure the pressure of the brush spring. If the pressure is less than 1.765 N (180 g, 6.35 oz), replace the brush spring with a new one. The new spring must have a pressure of 3.334 to 4.119 N (340 to 420 g, 11.99 to 14.81 oz).

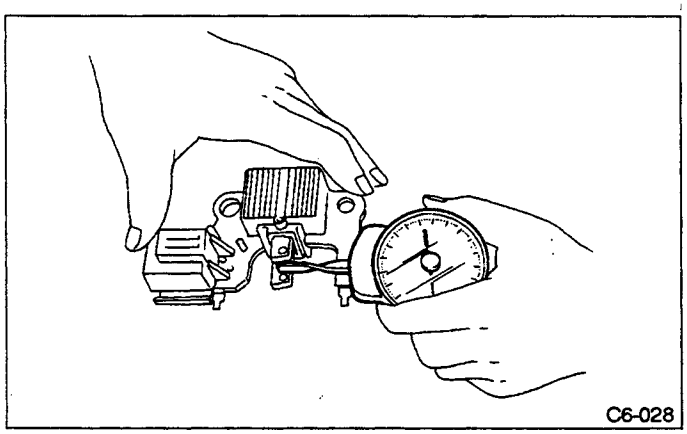


Fig. 39

5. BEARING (front side)

1) Check front ball bearing. If resistance is felt while rotating, or if abnormal noise is heard, replace the ball bearing.
2) Replacing front bearing
   (1) Remove front bearing retainer.
   (2) Closely install a fit jig on the bearing inner race. Press the bearing down out of front bracket with a hand press or vise. A socket wrench can serve as the jig.

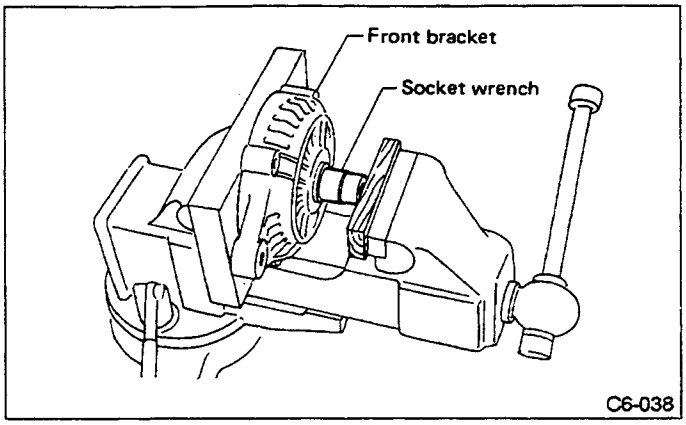


Fig. 40

(3) Set a new bearing and closely install a fit jig on the bearing outer race. Press the bearing down into place with a hand press or vise. A socket wrench can serve as the jig.

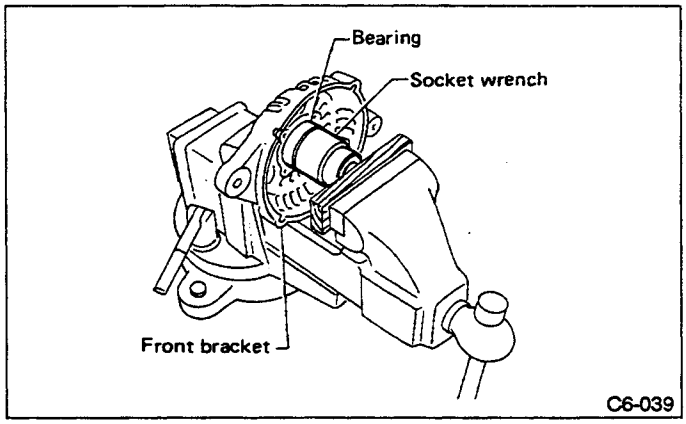


Fig. 41

(4) Install front bearing retainer.

C: ASSEMBLY

To assemble, reverse order of disassembly.
1) The rear bearing has an eccentric groove on its periphery. Fit the lock spring into this groove so that the projecting part is in the deepest portion of the groove. This will reduce spring projection, making reassembly easy. Also, it assures greater locking effect, since the spring will be free from undue force during reassembly. The deepest portion of the groove has chamfered edges for easy identification.

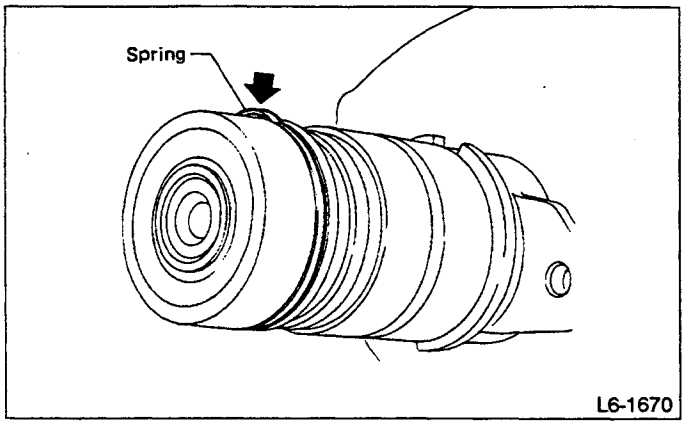


Fig. 42

2) Pulling up brush
Before assembling, press the brush down into the brush holder with your finger and secure in that position by passing a [2 mm (0.08 in) dia. length 4 to 5 cm (1.6 to 2.0 in)] wire through the hole shown in the figure.
Be sure to remove the wire after reassembly.

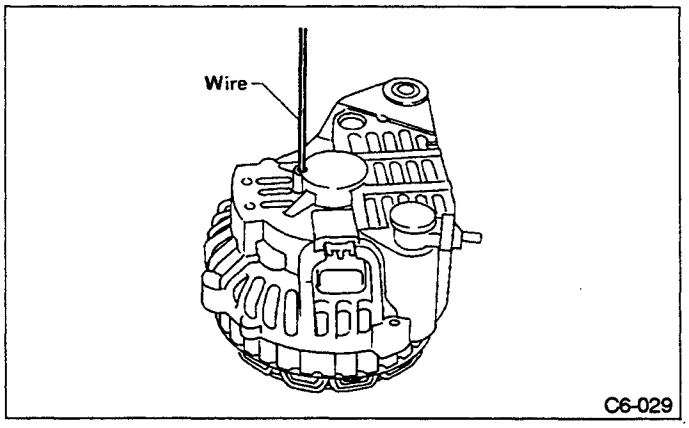


Fig. 43

3) Heat the rear bracket [50 to 60°C (122 to 140°F)] and press the rear bearing into the rear bracket. Then lubricate the rear bracket.
4) After reassembly, turn the pulley by hand to check that the rotor turns smoothly.

3. Ignition Coil

A: REMOVAL AND INSTALLATION

1) Disconnect battery cables from positive and negative terminals.
2) Remove battery.
3) Remove air cleaner case.
4) Disconnect ignition coil harness connector.
5) Loosen bolts which attach ignition coil to cylinder head completely.
Grip the bolt head with pliers and pull. The ignition coil is removed in this procedure.

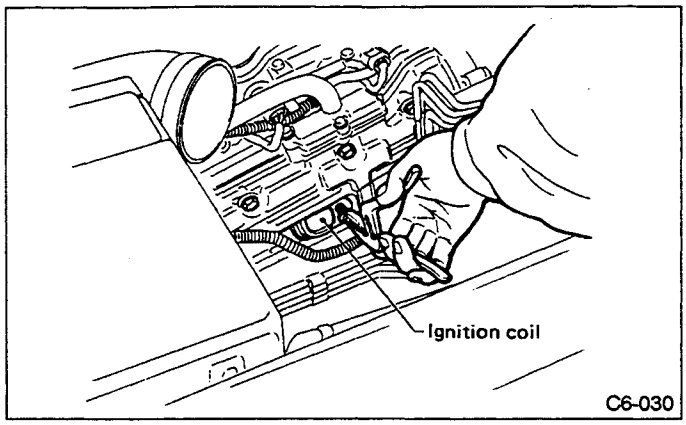


Fig. 44

6) Installation is in the reverse order of removal.

Tightening torque (Ignition Coil):
17.2 — 20.1 N•m (1.75 — 2.05 kg-m,12.7 — 14.8 ft-lb)

Be sure to connect wires to their proper positions. Failure to do so will damage unit.

B: INSPECTION

1. PRIMARY COIL

1) Using accurate tester, measure the primary coil resistance.
If the resistance is extremely low, this indicates the presence of a short-circuit.

Specified resistance:
[Primary side]
0.68 — 0.83 Ω

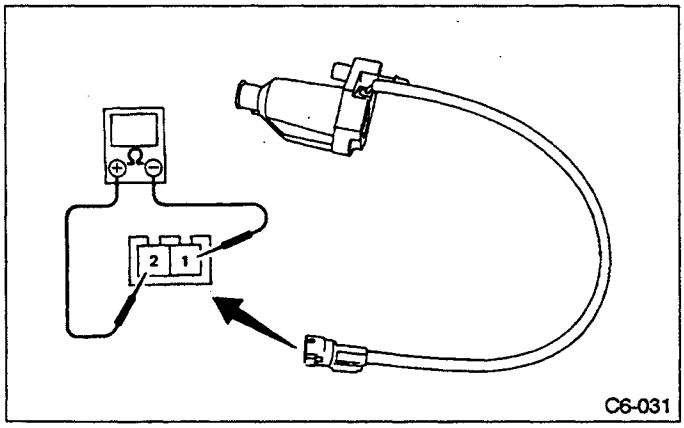


Fig. 45

2. SECONDARY COIL

Since diodes are built into the coil's secondary side, coil's resistance can not be measured. Therefore, inspect secondary side using the method described below.

1) Connect a 12-volt power supply and ammeter in series between primary and secondary terminals of ignition coil, as shown in figure, and measure current value.

Use a digital ammeter since only a very low current flows through terminals.

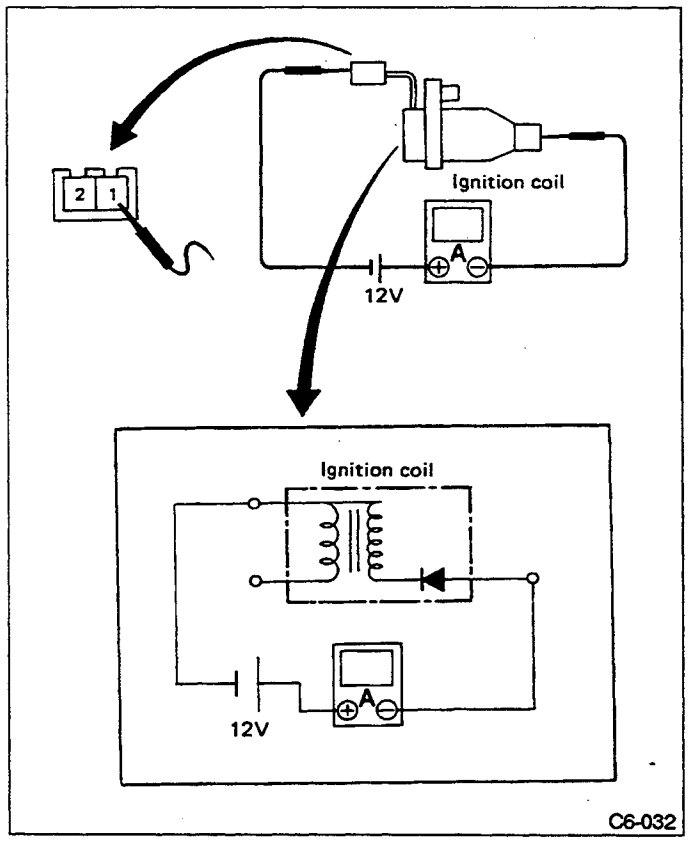


Fig. 46

Specified current value:
Approximately: 0.32 mA

2) If a digital ammeter is not available, use method described below.

(1) Disconnect all fuel injector connectors.

(2) Remove ignition coil to be checked from cylinder head.

(3) Install good spark plug to ignition coil.

(4) Make sure all ignition coil connectors are connected.

(5) Contact metal section of spark plug to cylinder head. Turn ignition switch to "START" to make sure spark occurs between spark plug electrodes.

(6) If spark does not occur, check primary coil condition. If primary coil is satisfactory, secondary coil is faulty.

Before checking secondary coil using "spark" method described above, make sure the other ignition systems are in good condition.

4. Spark Plug

A: REMOVAL AND INSTALLATION

1) Remove ignition coil from cylinder head. 〈Ref. to 3 "Ignition Coil" [W3A0].〉

2) Remove spark plug using spark plug wrench.

3) When installing spark plugs on cylinder head, use spark plug wrench.

Spark plug
NGK:
PFR6B-11, PFR6G-11
NIPPONDENSO:
PK20PR-11

Tightening torque (Spark plug):
20 — 29 N•m (2 — 3 kg-m, 14 — 22 ft-lb)

The above torque should be only applied to new spark plugs without oil on their threads.
In case their threads are lubricated, the torque should be reduced by approximately 1/3 of the specified torque in order to avoid their over-stressing.

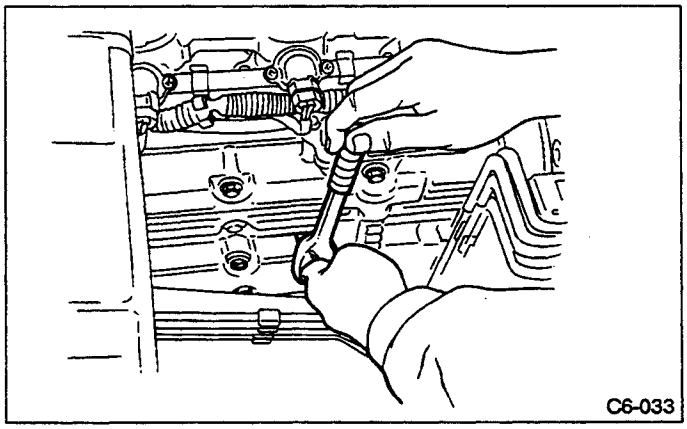


Fig. 47

4) Install ignition coil.

B: INSPECTION

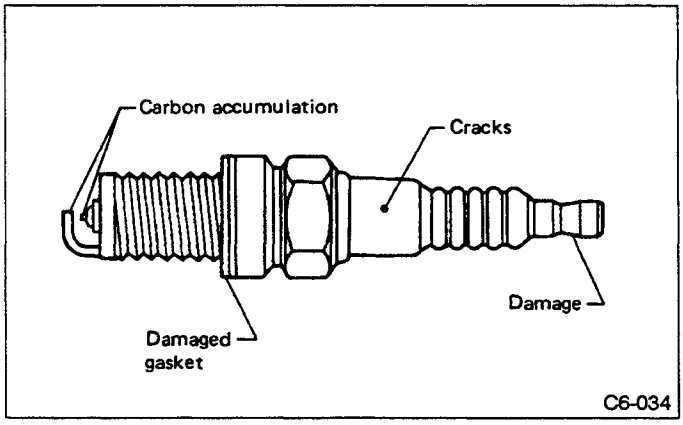


Fig. 48

Check electrode and inner and outer porcelain of plugs, noting the type of deposits.

1) Normal

Brown to grayish-tan deposits indicate correct spark plug heat range.

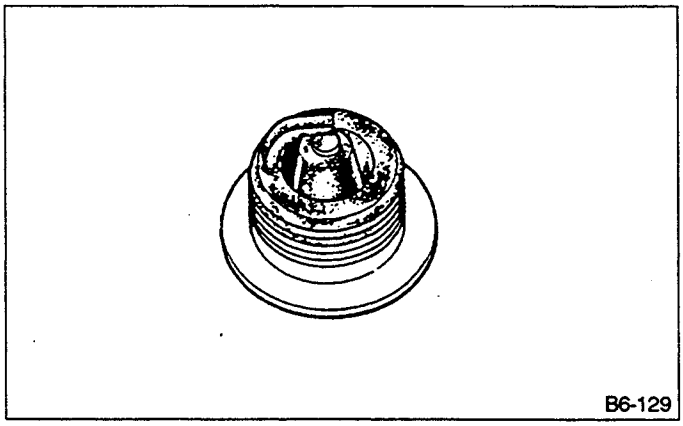


Fig. 49

2) Carbon fouled

Dry fluffy carbon deposits on insulator and electrode are mostly caused by slow speed driving in city, weak ignition, too rich fuel mixture, dirty air cleaner, etc.
It is advisable to replace with plugs having hotter heat range.

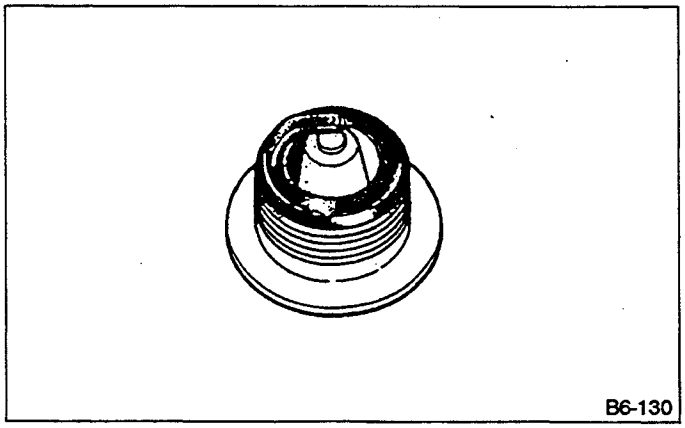


Fig. 50

3) Oil fouled

Wet black deposits show excessive oil entrance into combustion chamber through worn rings and pistons or excessive clearance between valve guides and stems. If same condition remains after repair, use a hotter plug.

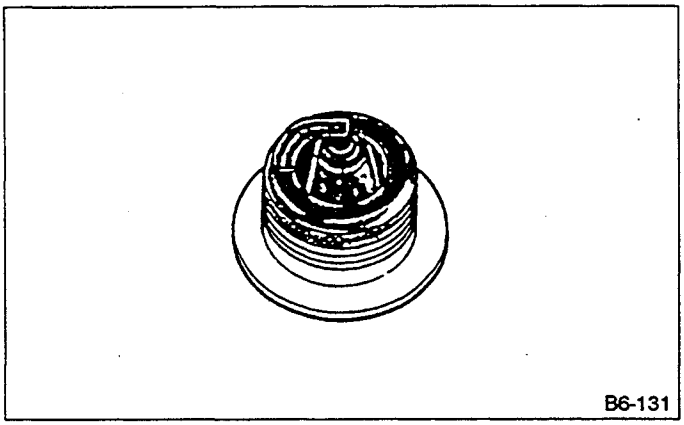


Fig. 51

4) Overheating

White or light gray insulator with black or gray brown spots and bluish burnt electrodes indicate engine overheating. Moreover, the appearance results from incorrect ignition timing, loose spark plugs, wrong selection of fuel, hotter range plug, etc. It is advisable to replace with plugs having colder heat range.

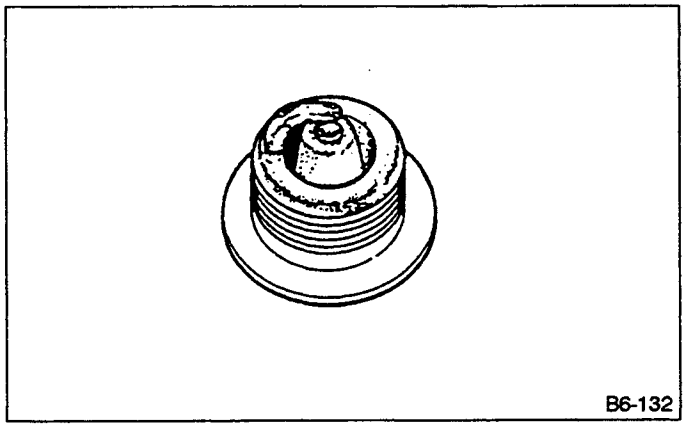


Fig. 52

C: CLEANING AND REGAPPING

Do not clean spark plug or adjust plug gap as this may damage platinum tip of electrode. However, if carbon accumulates excessively on electrodes due to "poor" sparks, use plug cleaner under the following conditions:

Plug cleaner usage condition:
- **Air pressure**
  - **588 kPa (6.0 kg/cm^2, 85 psi) or less**
- **Time required**
  - **20 sec. or less**

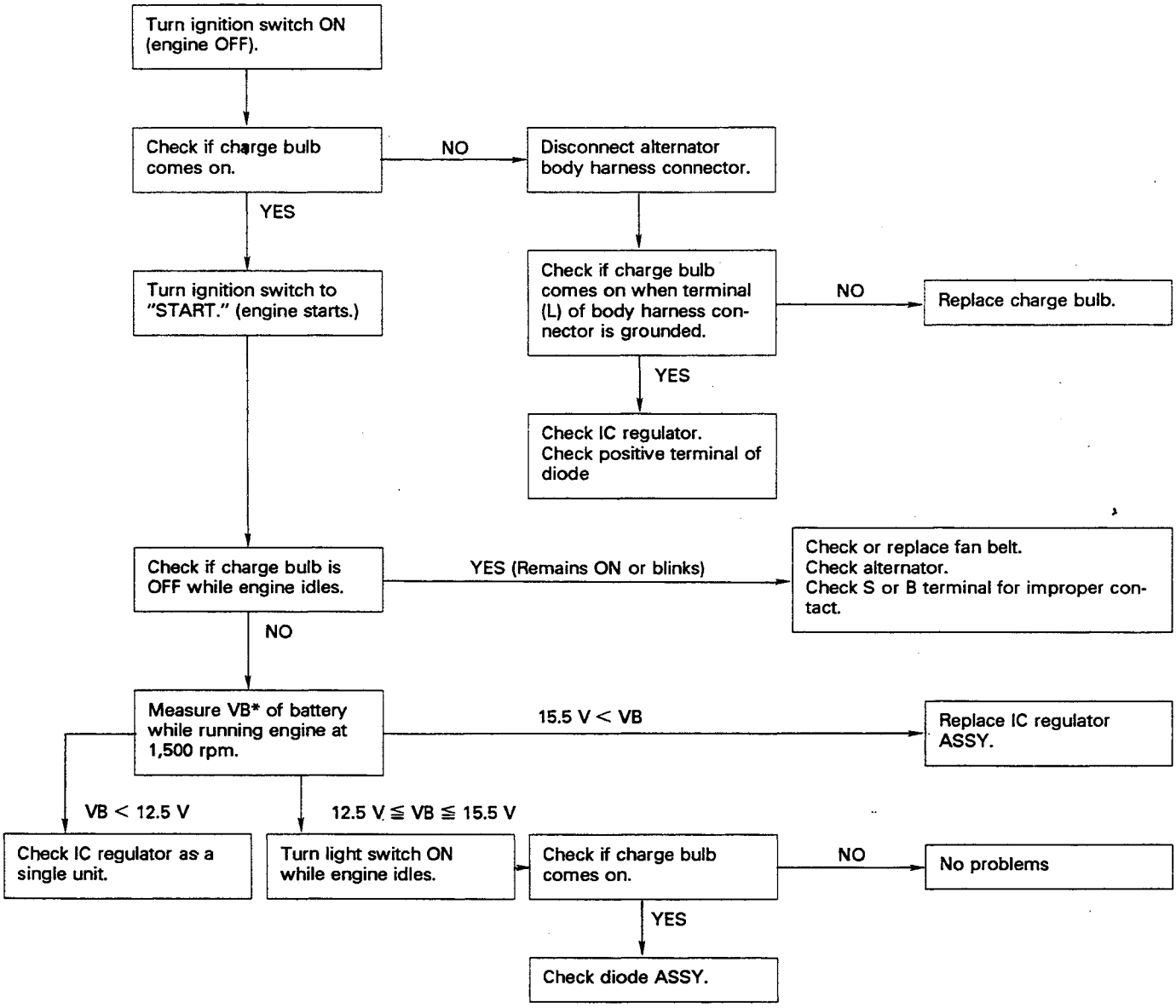
Never use wire brush when cleaning.

T TROUBLESHOOTING

1. Starter

Trouble		Probable cause
Starter does not start.	Magnet switch does not operate (no clicks are heard).	Magnet switch poor contact or discontinuity of pull-in coil circuit Improper sliding of magnet switch plunger
	Magnet switch operates (clicks are issued).	Poor contact of magnet switch's main contact point
		Layer short of armature Contaminants on armature commutator High armature mica.
		Improper grounding of yoke field coil
		Insufficient carbon brush length
		Insufficient brush spring pressure
Starter starts but does not crank engine	Failure of pinion gear to engage ring gear	Worn pinion teeth
		Improper sliding of overrunning clutch
		Improper adjustment of stud bolt
	Clutch slippage	Faulty clutch roller spring
Starter starts but engine cranks too slowly.		Poor contact of magnet switch's main contact point
		Layer short of armature
		Discontinuity, burning or wear of armature commutator
		Poor grounding of yoke field coil
		Insufficient brush length
		Insufficient brush spring pressure
		Abnormal brush wear
Starter overruns		Magnet switch coil is a layer short.

2. Alternator



*: Terminal voltage