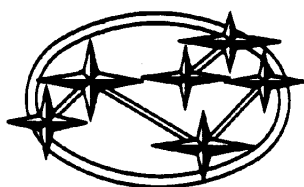


SUBARU

1988



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MECHANISM AND FUNCTION

Alternator (IC Regulator)

The internal circuitry of the IC regulator is very complicated. It consists of the following circuits.

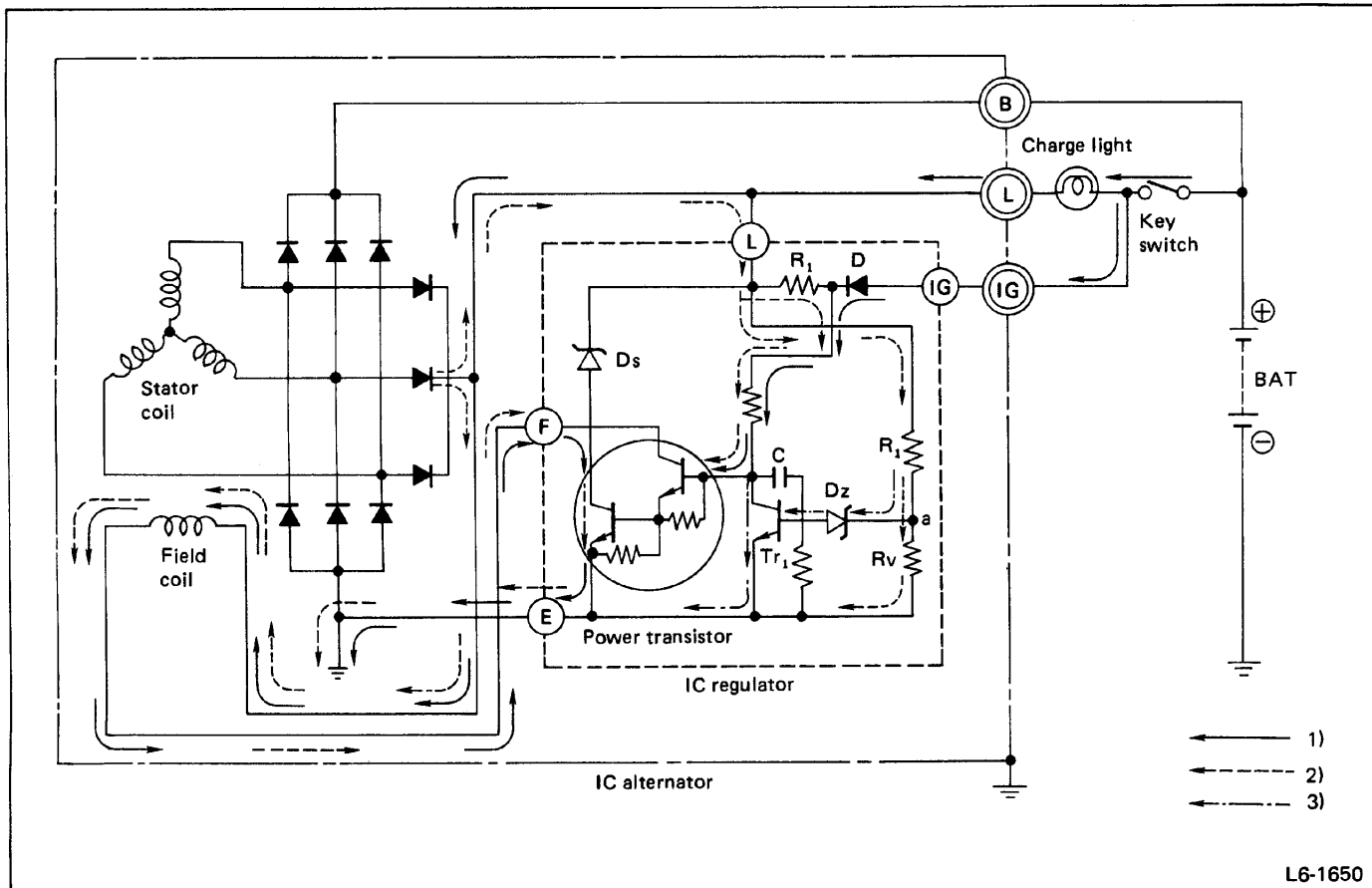


Fig. 1

1) Ignition switch ON (When engine is stopped)

When the ignition switch is turned "ON", the charge light comes on and electric current (less than 0.5A) flows through the field coil.

If the charge light does not come on when the switch is turned "ON", it may be due to a burned-out charge light, a break in the field coil, a defective IC regulator, or improper contact or wear of the brushes.

2) When the IC alternator produces voltage (below regulation voltage)

When the IC alternator starts to generate, the charge light goes out because the voltage at both ends of the light is equal. On the other hand, field current is supplied from the diode. When voltage at connection (a) of Rv-R1 (the voltage-dividing resistors which divide the voltage at the voltage detection terminal (L)) is low, no current flows in Zener diode Dz and

transistor Tr₁ is off. Therefore, the power transistor is on, allowing field current to flow.

Even in this condition, if the voltage at terminal (B) exceeds battery voltage, charging current flows to the battery.

3) When the IC alternator produces voltage (above regulation voltage)

As the condition in 2) continues, voltage at terminal (L) builds up. Therefore, voltage at connection (a) increases. When this voltage exceeds the voltage at which the Zener diode Dz conducts, current flows through Dz and the transistor Tr₁. The voltage at terminal (L) at this time is called regulation voltage (14.0 to 15.0V). In this condition, the power transistor is off because Tr₁ is on.

4) The alternator supplies electric current, repeating operations 2) and 3) to stabilize the voltage.

SPECIFICATIONS AND SERVICE DATA

SPECIFICATIONS

| Item | | 1800 cc model | | 2700 cc model | | |
|------------|-------------------------|----------------|---|--|---|--|
| Starter | Type | | Reduction type | | | |
| | Model | | [MT] MIT70381 | [AT] MIT74081 | [MT] MIT70381 | [AT] MIT74081 |
| | Manufacturer | | MITSUBISHI | | | |
| | Voltage and Output | | 12V - 1.0 kW | 12V - 1.4 kW | 12V - 1.0 kW | 12V - 1.4 kW |
| | Direction of rotation | | Counterclockwise (when observed from pinion) | | | |
| | Number of pinion teeth | | 8 | 9 | 8 | 9 |
| | No-load characteristics | Voltage | 11V | | | |
| | | Current | 90A or less | | | |
| | | Rotating speed | 3,000 rpm or more | 2,900 rpm or more | 3,000 rpm or more | 2,900 rpm or more |
| | Load characteristics | Voltage | 8V | | | |
| | | Current | 280A or less | 370A or less | 280A or less | 370A or less |
| | | Torque | 8.5 N·m (0.87 kg-m, 6.3 ft-lb) | 14 N·m (1.4 kg-m, 10 ft-lb) | 8.5 N·m (0.87 kg-m, 6.3 ft-lb) | 14 N·m (1.4 kg-m, 10 ft-lb) |
| | | Rotating speed | 980 rpm or more | 880 rpm or more | 980 rpm or more | 880 rpm or more |
| | Lock characteristics | Voltage | 4V | | | |
| | | Current | 780A or less | 980A or less | 780A or less | 980A or less |
| | | Torque | 18 N·m (1.8 kg-m, 13 ft-lb) or more | 25 N·m (2.6 kg-m, 19 ft-lb) or more | 18 N·m (1.8 kg-m, 13 ft-lb) or more | 25 N·m (2.6 kg-m, 19 ft-lb) or more |
| Alternator | Type | | Rotating-field three-phase type, Voltage regulator built-in type | | | |
| | Model | | LR165-704 | | A3T01691 | |
| | Regulator type | | TR1Z-219 | | A866X06272 | |
| | Manufacturer | | HITACHI | | MITSUBISHI | |
| | Voltage and Output | | 12V - 65A | | 12V - 90A | |
| | Polarity on ground side | | Negative | | | |
| | Rotating direction | | Clockwise (when observed from pulley side) | | | |
| | Armature connection | | 3-phase Y-type | | | |
| | Rectifying system | | Full wave rectification by eight self-contained silicone diodes | | | |
| | Output current | | 1,600 rpm - 22A or more 3,000 rpm - 53A or more 6,000 rpm - 63A or more | | 1,500 rpm - 27A or more 2,500 rpm - 62A or more 5,000 rpm - 83A or more | |
| | Regulated voltage | | 14.1 — 14.8V [20°C (68°F)] | | 14.2 — 14.8V [20°C (68°F)] | |

| Item | | 1800 cc model | 2700 cc model |
|---------------|---|---|---------------|
| Distributor | Type | Breakerless type with control unit | |
| | Model | D4P86-03 | D6P86-02 |
| | Manufacturer | HITACHI | |
| | Firing order | 1-3-2-4 | 1-6-3-2-5-4 |
| | Rotating direction | Counterclockwise | |
| | Cap insulation resistance | More than 50 MΩ | |
| | Rotor head insulation resistance | More than 50 MΩ | |
| Ignition coil | Type | E12-113 | |
| | Manufacturer | HITACHI | |
| | Primary coil resistance Ω | 0.84 – 1.02 | |
| | Secondary coil resistance Ω | 8,000 – 12,000 | |
| | Insulation resistance between primary terminal and case | More than 10 MΩ | |
| Spark plug | Type and Manufacturer | For U.S.A.: BPR6ES-11 (or BPR5ES-11, BPR7ES-11) NGK W20EPR-U11 (or W16EPR-U11, W22EPR-U11) . . . Nippondenso RN9YC-4 (or RN11YC-4) Champion For Canada: RN9YC-4 (or RN11YC-4) Champion | |
| | Thread size mm | 14, P = 1.25 | |
| | Spark gap mm (in) | 1.0 – 1.1 (0.039 – 0.043) | |

COMPONENT PARTS

Starter

MT: MIT70381

AT: MIT74081

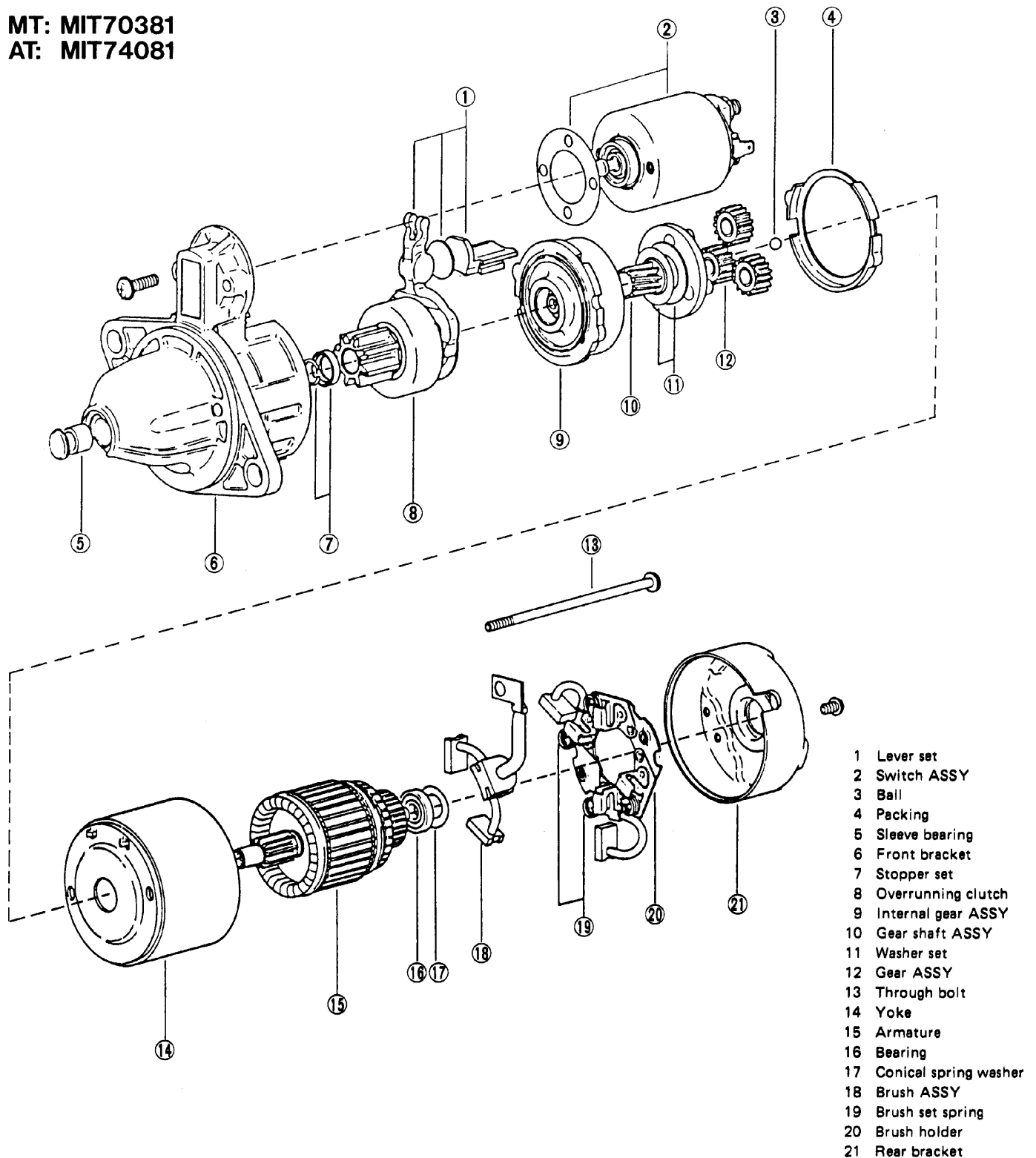


Fig. 2

L6-1456

Alternator

1800cc model

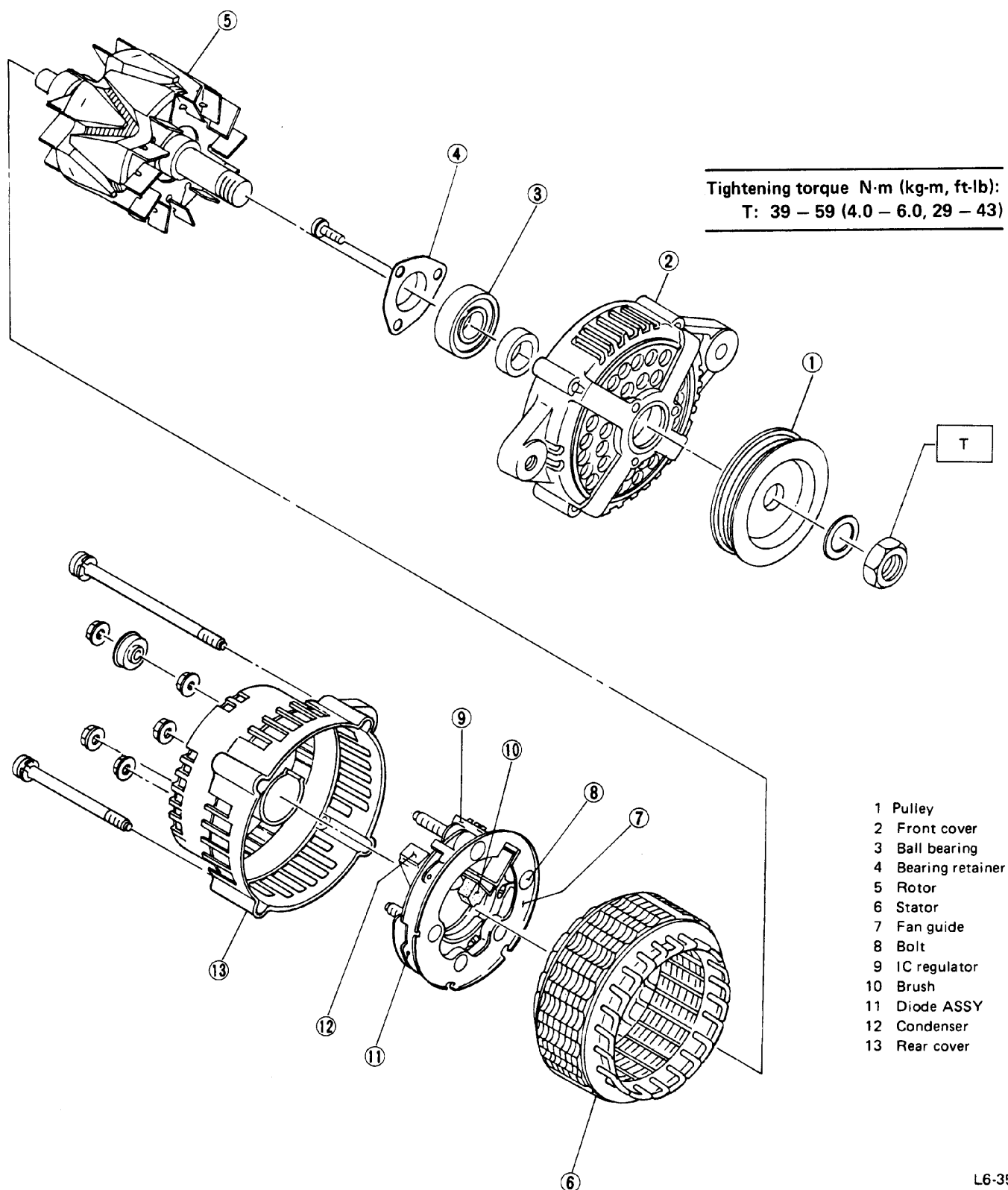


Fig. 3

L6-359

2700cc model

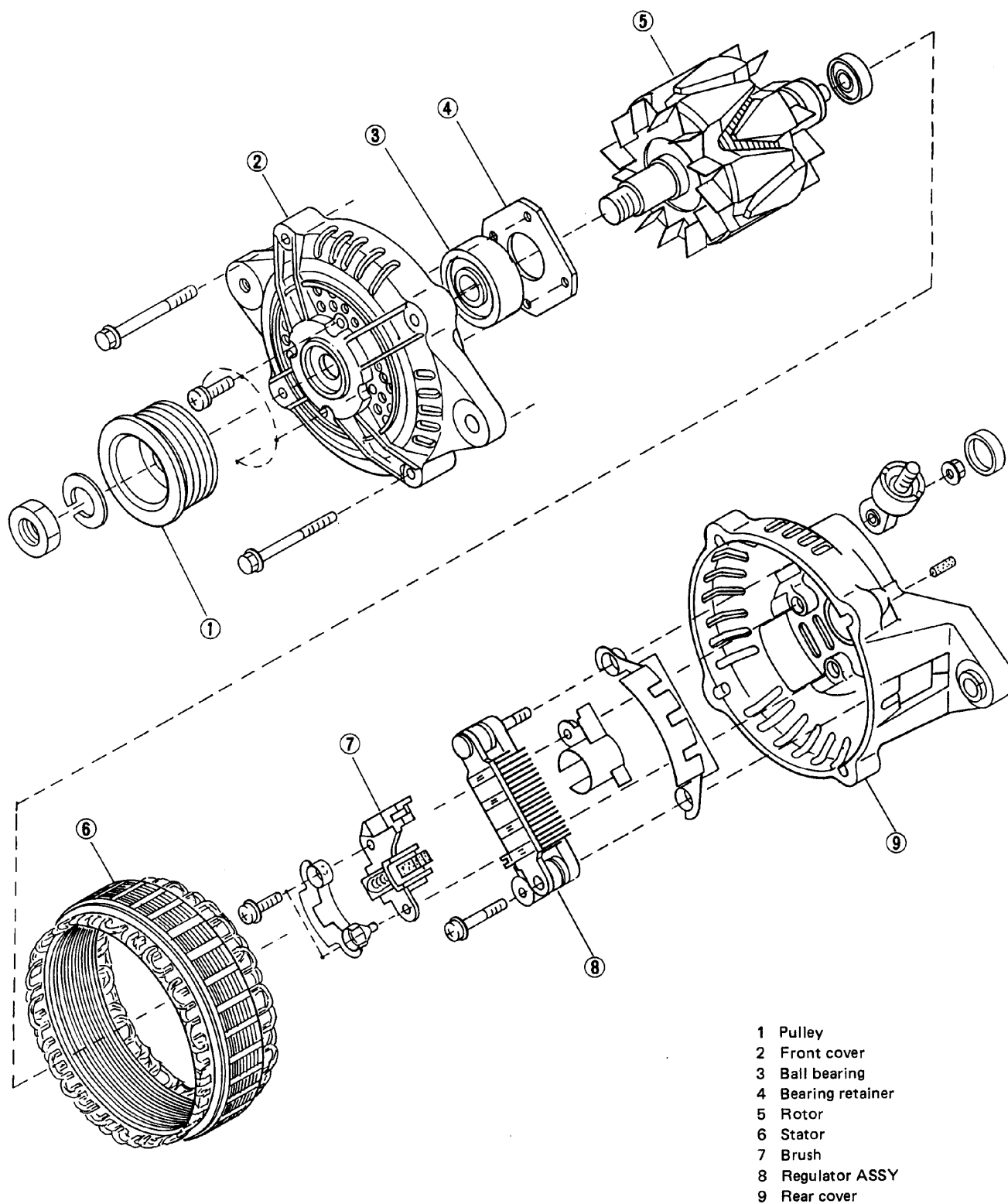
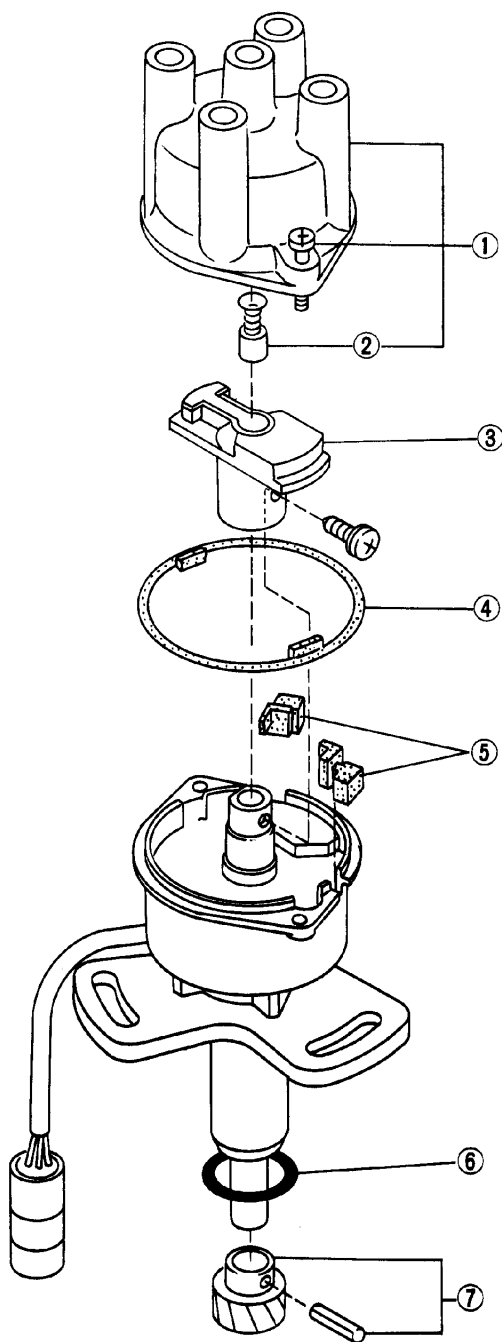


Fig. 4

L6-1651

Distributor

1800cc model



- 1 Cap ASSY
- 2 Carbon point ASSY
- 3 Rotor head
- 4 Packing
- 5 Bush
- 6 O-ring
- 7 Pinion set

Fig. 5

2700cc model

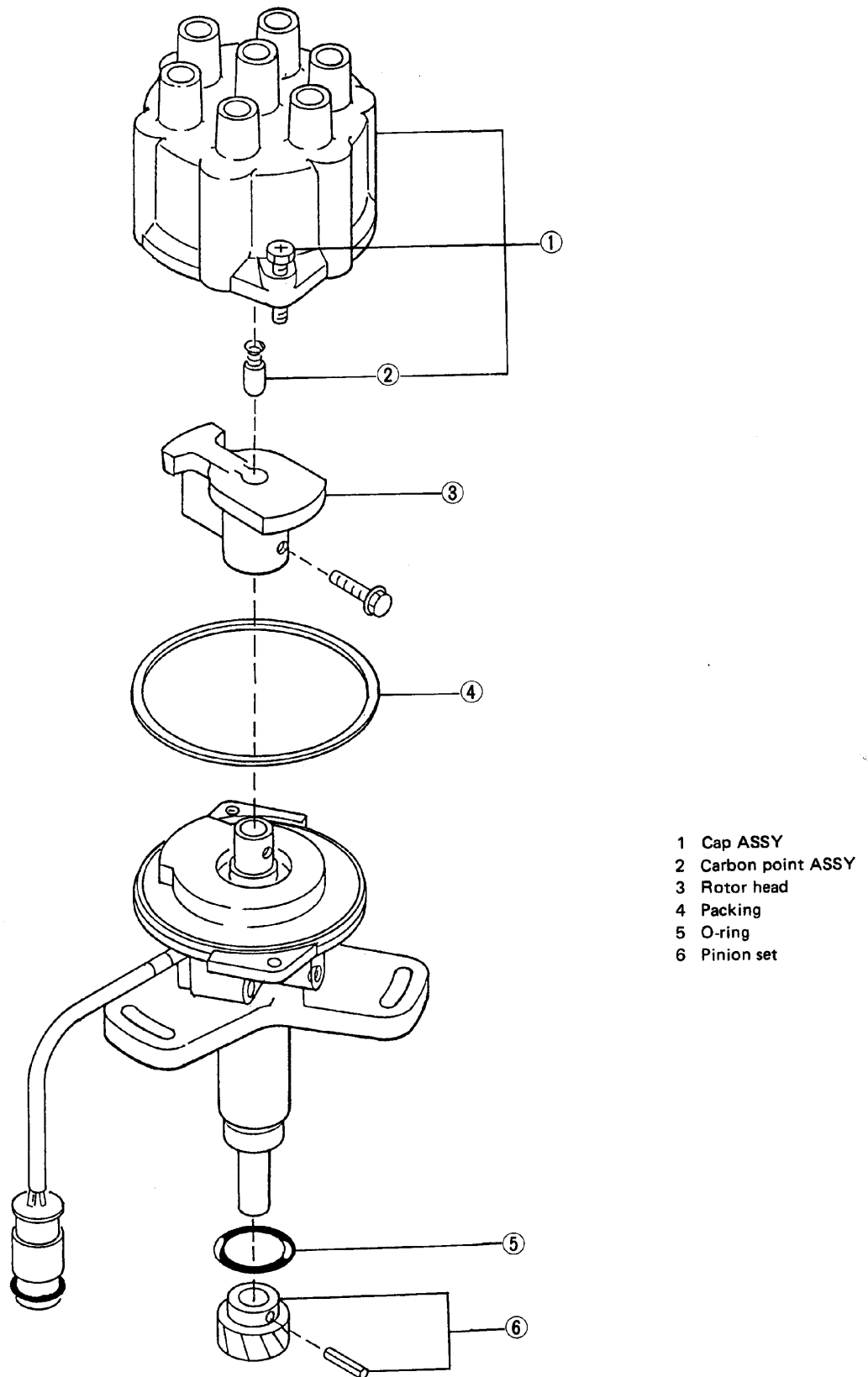


Fig. 6

L6-1652

SERVICE PROCEDURE

Starter

TEST

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.

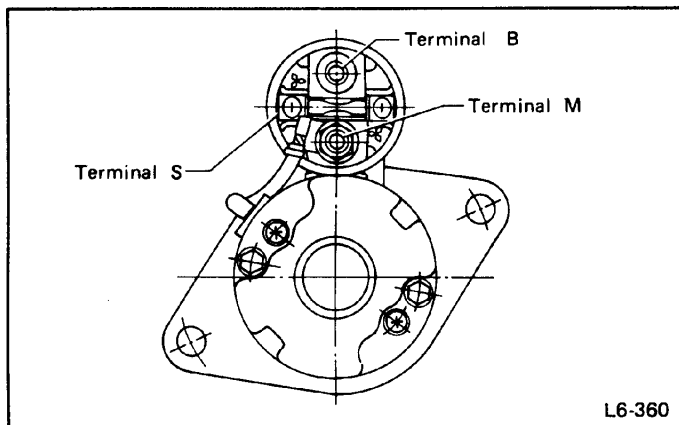


Fig. 7

L6-360

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)

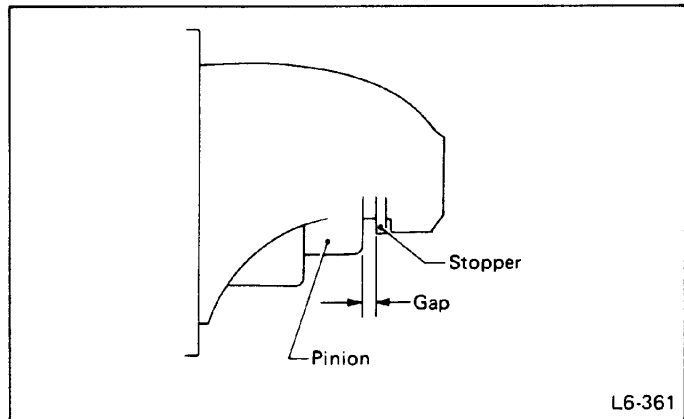


Fig. 8

L6-361

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.

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.

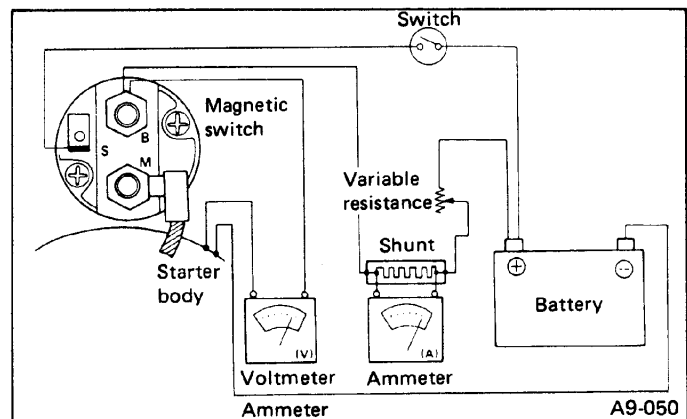


Fig. 9

A9-050

1) No-load test

With switch on, adjust the variable resistance to obtain 11V, take the ammeter reading and measure the starter speed. Compare these values with the specifications.

No-load test (Standard):**Voltage/Current**

11V/90A max

Rotating speed

MT 3,000 rpm min

AT 2,900 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**

MT 8V/8.5 N·m (0.87 kg-m, 6.3 ft-lb)

AT 8V/14 N·m (1.4 kg-m, 10 ft-lb)

Current/Speed

MT 280A max/980 rpm min

AT 370A max/880 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**

MT 4V/780A max

AT 4V/980A max

Torque

MT 18 N·m (1.8 kg-m, 13 ft-lb) min

AT 25 N·m (2.6 kg-m, 19 ft-lb) min

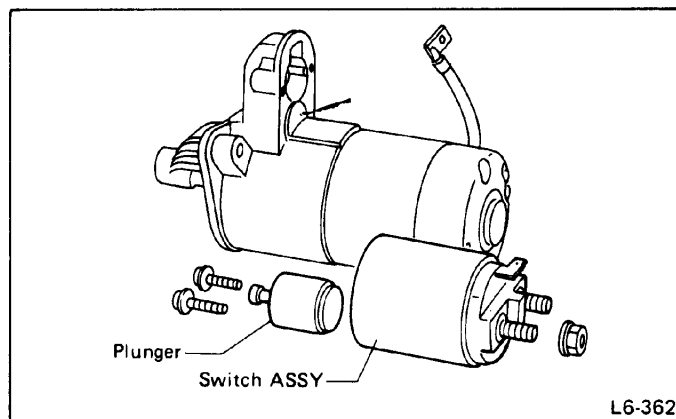


Fig. 10

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

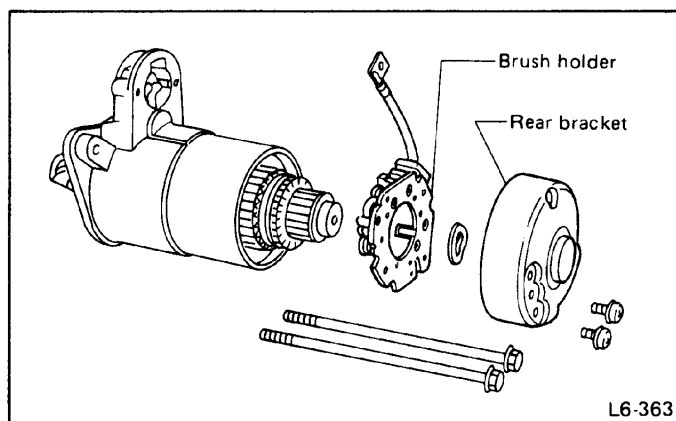


Fig. 11

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.

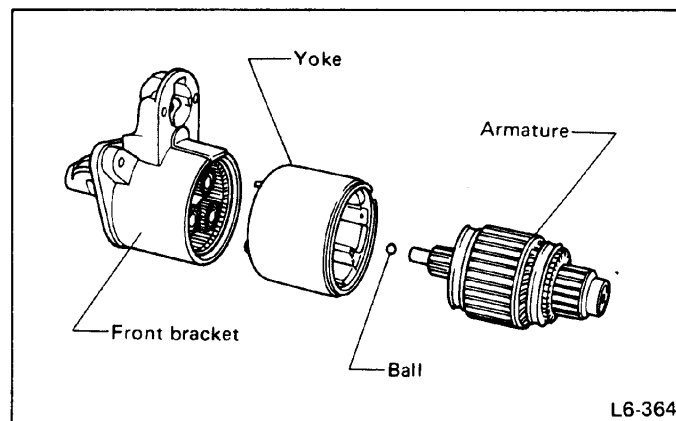


Fig. 12

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.

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

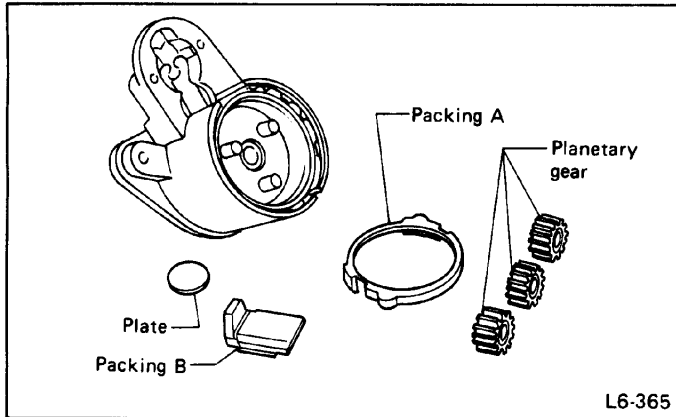


Fig. 13

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

Record the direction of lever before removing.

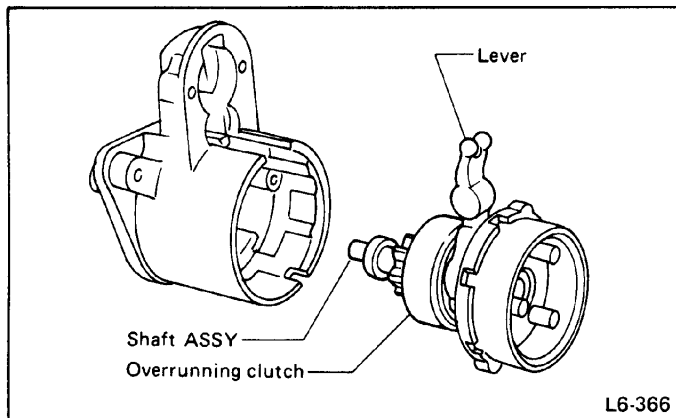


Fig. 14

- 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.

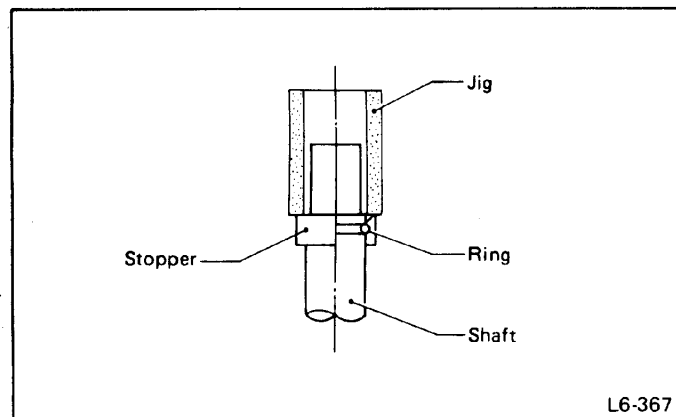


Fig. 15

INSPECTION

ARMATURE

- 1) Check commutator for any sign of burns or 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)

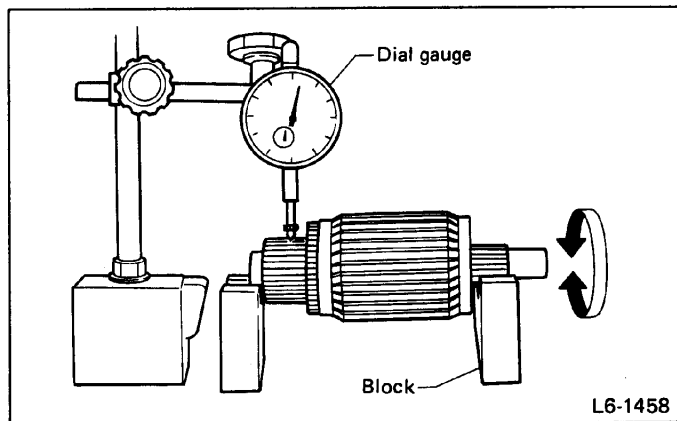


Fig. 16

- 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)

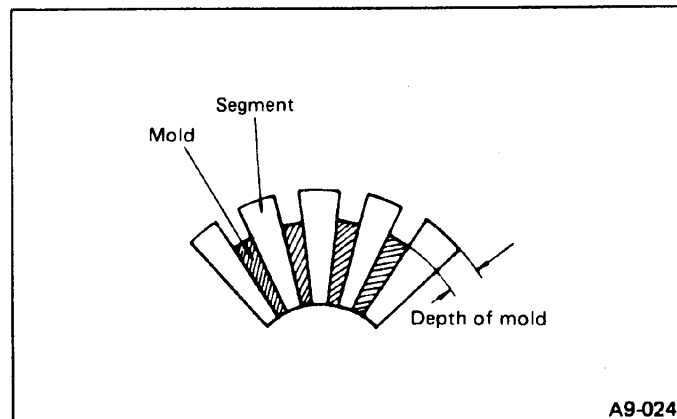
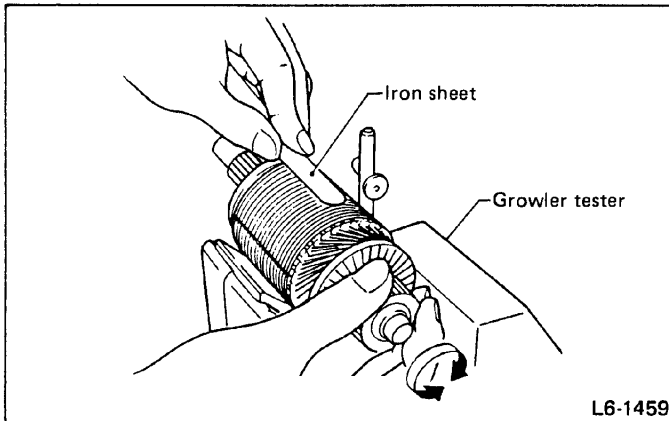


Fig. 17

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.

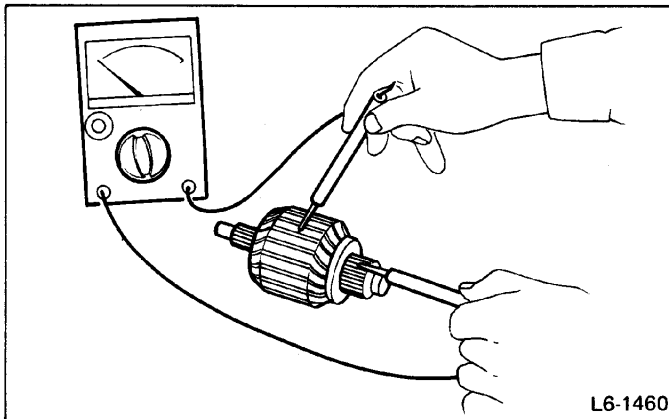


L6-1459

Fig. 18

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.



L6-1460

Fig. 19

YOKE

Make sure pole is set in position.

OVERRUNNING CLUTCH

Inspect teeth of pinion for wear and damage. Replace it if 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.

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:

MIT 70381

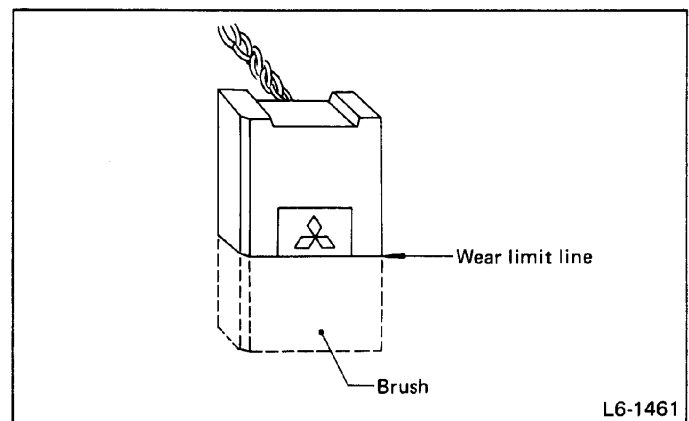
Standard 17.0 mm (0.669 in)

Service limit 11.5 mm (0.453 in)

MIT 74081

Standard 17.5 mm (0.689 in)

Service limit 12.0 mm (0.472 in)



L6-1461

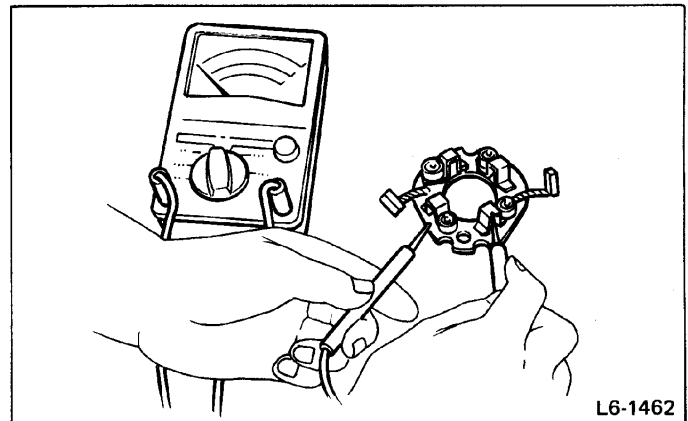
Fig. 20

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.



L6-1462

Fig. 21

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)

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 |

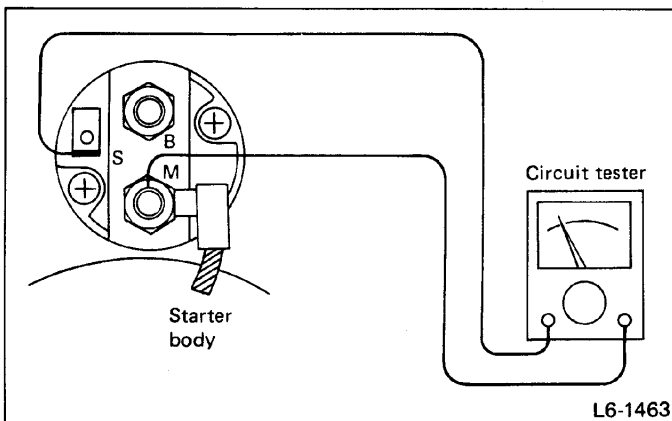


Fig. 22

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.

Alternator**1800cc model****TEST****Notes on alternator test:**

- a) The lead wires between alternator terminal B and battery positive terminal, and between alternator terminal L and battery negative terminal must be less than 2.5 m (8.2 ft) in length and greater than 8 mm² (0.012 sq in) in section area.
- b) The switch used in the circuit must have as small a contact resistance as possible.

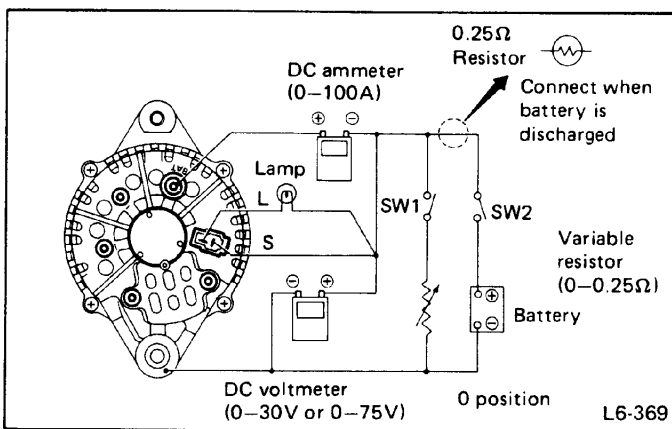


Fig. 23

Measuring regulated voltage

Open switch SW1 and close switch SW2 in the circuit shown above to raise the alternator speed to the rated speed of 6,000 rpm, and measure the voltage on the voltmeter.

The regulated voltage must be 14.1 to 14.8 V.

Measuring output current

Set the variable resistor to the 0Ω position, and close switches SW1 and SW2 to raise the alternator speed to the rated rpm. At this rpm, adjust the variable resistor so that the voltmeter reads 13.5 V, and read the indication on the ammeter.

| | |
|-----------|--------------|
| 1,600 rpm | 22 A or more |
| 3,000 rpm | 53 A or more |
| 6,000 rpm | 63 A or more |

DISASSEMBLY

1) Remove the through-bolt. Pressing the tip of a standard screwdriver into the clearance between the front cover and stator core, pry the alternator into two parts; front side (front cover and rotor) and rear side (rear cover and stator).

Use care not to damage the stator coil with the screwdriver.

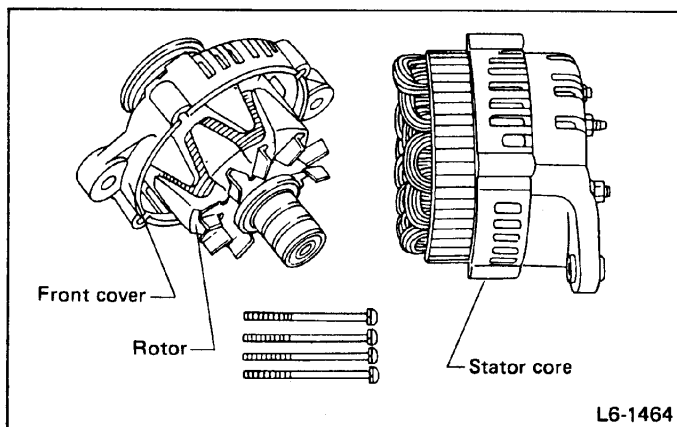


Fig. 24

2) Secure the rotor in a vise, and remove the pulley nut. The pulley, front cover and rotor can be separated.

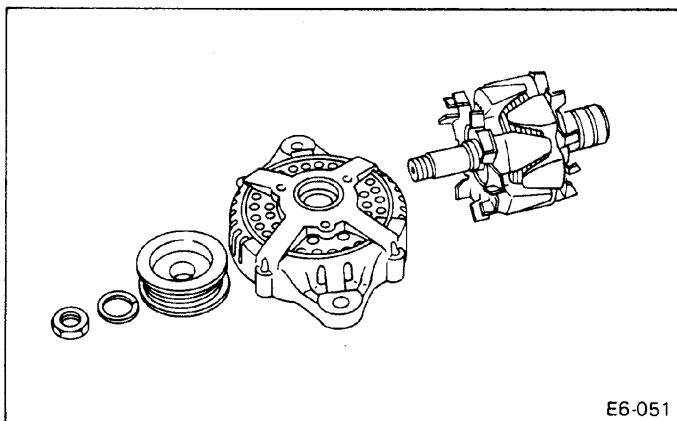


Fig. 25

3) Remove the screws securing the bearing retainer, and remove the bearing retainer, ball bearing and front cover.

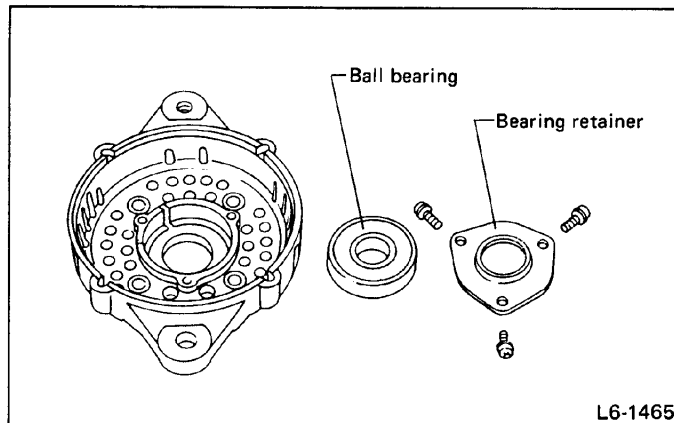


Fig. 26

4) Remove the nuts securing the BAT terminal, diode and brush holder. Separate the rear cover from the stator.

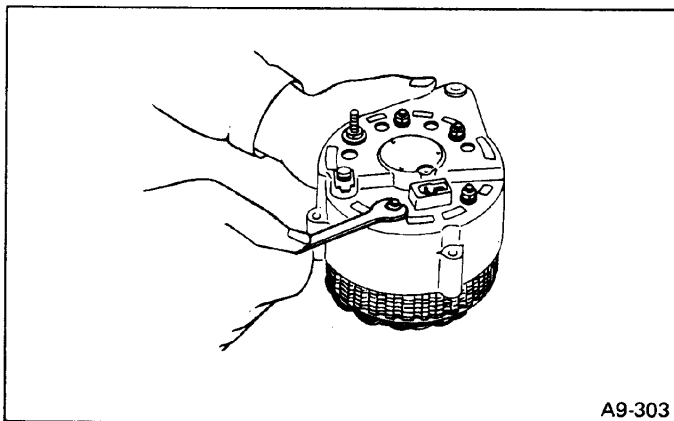


Fig. 27

5) Unsolder the diode ASSY and remove the stator.

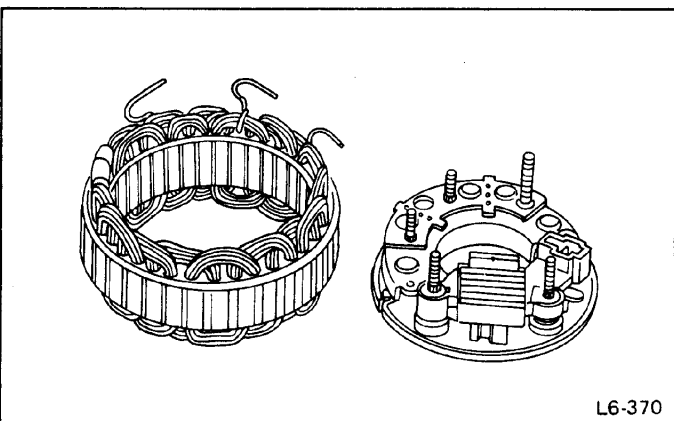


Fig. 28

- 6) Remove the nuts securing the fan guide, and remove the fan guide.

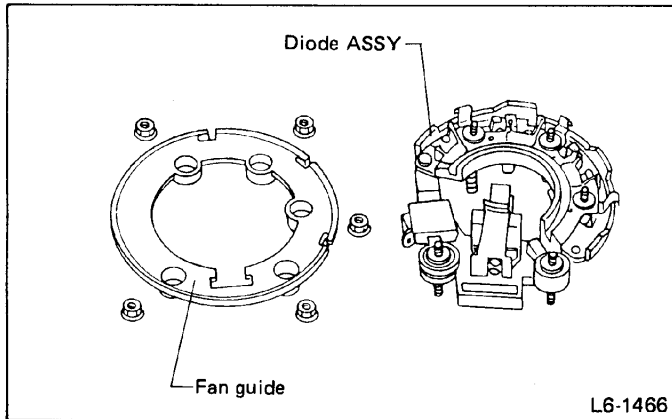


Fig. 29

- 7) (This procedure is unnecessary when the diode is normal.) Cut off rivet which holds diode ASSY to brush holder terminals with a drill. Unsolder terminal L and brush holder, and remove brush holder and IC regulator from diode ASSY as a unit.

- a) Brush holder and IC regulator are a one-piece type. Be careful not to apply shocks or load to cooling fin.
b) Do not remove rivet unless diode is replaced.

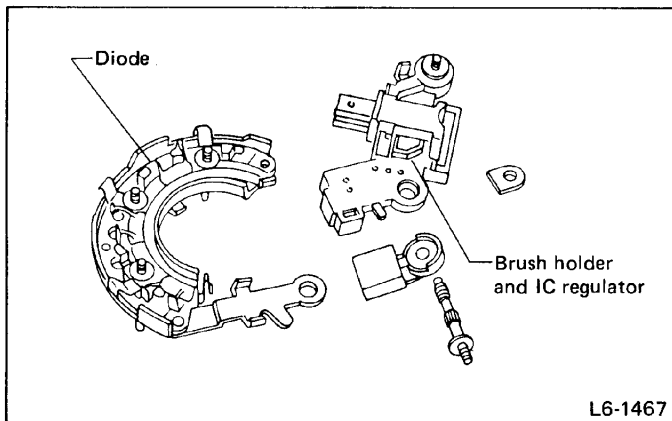


Fig. 30

INSPECTION AND REPAIR

DIODE

Checking positive side diodes.

| | Terminal | BAT (Positive side diode) | |
|-------------|-------------|---------------------------|---------------|
| | Tester lead | Positive ⊕ | Negative ⊖ |
| U V W | Positive ⊕ | — | No continuity |
| | Negative ⊖ | Continuity | — |

Checking negative side diodes

| | Terminal | E (Negative side diode) | |
|-------------|-------------|-------------------------|------------|
| | Tester lead | Positive ⊕ | Negative ⊖ |
| U V W | Positive ⊕ | — | Continuity |
| | Negative ⊖ | No continuity | — |

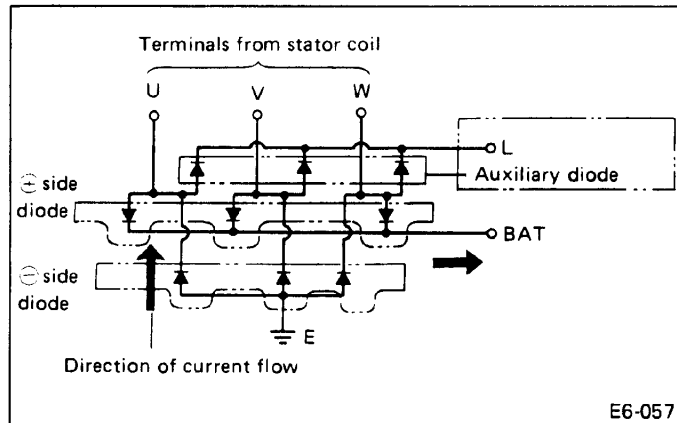


Fig. 31

The diode allows current to flow in only one direction as shown in the figure. If continuity is noted when connecting tester leads in the normal direction (for example, BAT and W), the diode is normal; if no continuity is noted, the diode is faulty. On the contrary, if tester leads are connected in the reverse direction, no continuity means a normal diode, while continuity means a faulty diode.

If any diode is proven faulty in the above check, replace the diode assembly. The auxiliary diode have no terminals, and must be checked for continuity by connecting tester leads to both terminals of this diode.

Never use a megger or other high voltage insulation tester for this test; otherwise, diodes may be damaged.

ROTOR

- 1) Slip ring wear limit

Measure the outer diameter of the slip ring. If worn more than 1 mm (0.04 in) from the standard dimension, replace the rotor assembly.

Outer diameter of slip ring:

Standard

27.0 mm (1.063 in)

Wear limit:

26.0 mm (1.024 in)

2) Checking slip ring surface

Check the slip ring surface for roughness or contamination with oil. If the surface is rough, smoothen with sandpaper (#500 – #600). If contaminated with oil, wipe with clean cloth moistened with alcohol.

3) Checking rotor coil for continuity

Check the rotor coil for continuity between slip rings using a circuit tester. If no continuity is detected, replace the rotor.

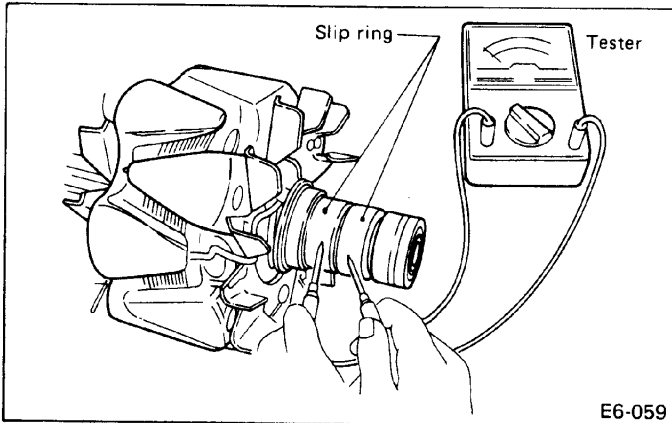


Fig. 32

4) Checking rotor coil for proper insulation

Check for continuity between the slip ring and rotor core or shaft using a circuit tester. If continuity is noted, the rotor coil is shortcircuited, and the rotor must be replaced with a new one.

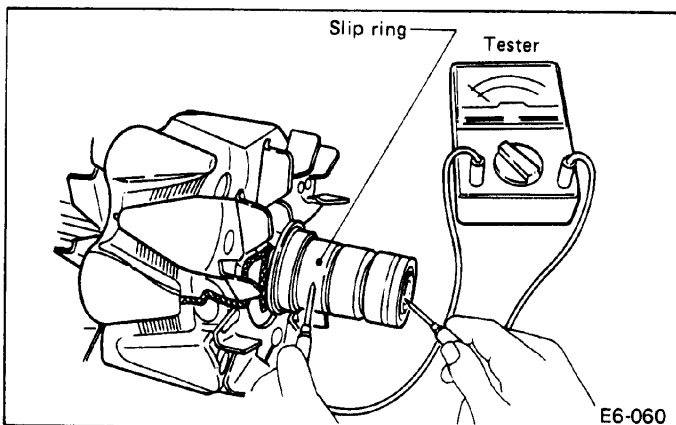


Fig. 33

5) Check the rear side ball bearing.

If resistance is felt while rotating, or if abnormal noise is heard, replace the ball bearing.

After separating the rotor, be sure to replace the rear side ball bearing.

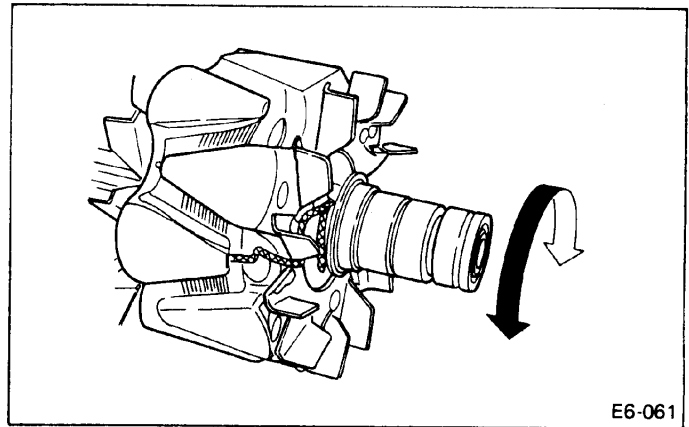


Fig. 34

STATOR

1) Checking stator coil for continuity

Check the stator coil for continuity between terminals using a circuit tester. If no continuity is noted, it indicates that the stator coil is disconnected, and the stator must be replaced.

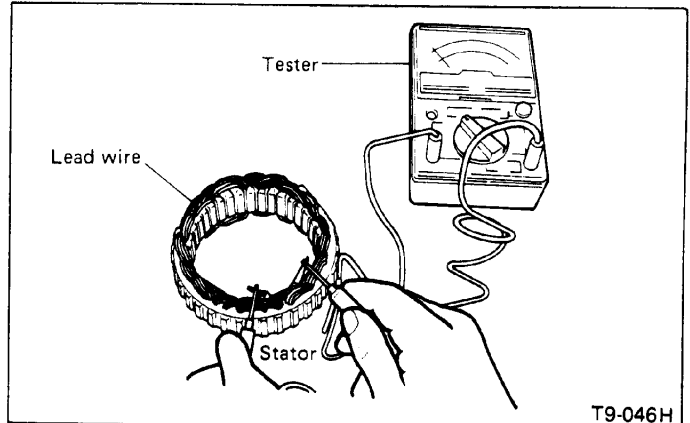


Fig. 35

2) Checking stator coil for proper insulation

Connect the circuit tester between any terminal of the stator coil and the stator core. If continuity is noted, it indicates that the stator coil is shortcircuited inside, and the stator must be replaced.

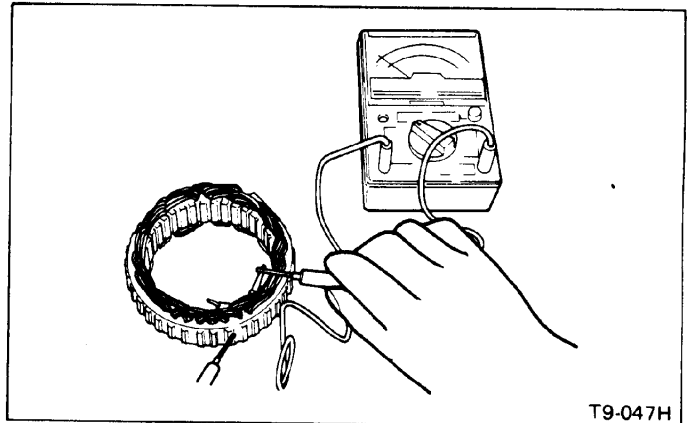


Fig. 36

BRUSHES

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

18 mm (0.71 in)

Wear limit

6.0 mm (0.236 in)

If the brush pigtail (lead wire) is soldered, use a soldering iron heated to 300 to 350°C (572 to 662°F) and paste without oxygen.

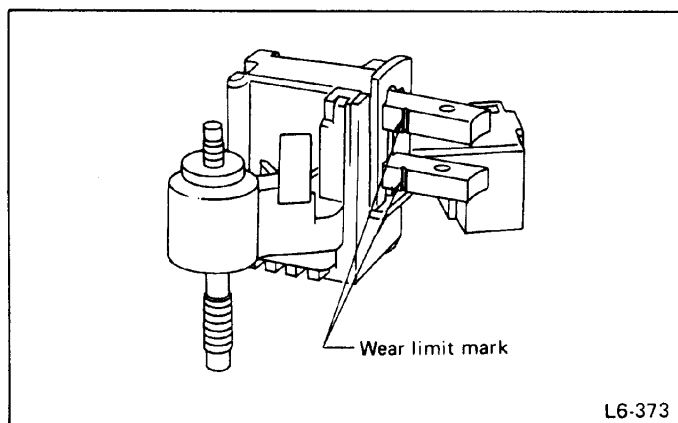


Fig. 37

IC REGULATOR

Connect a variable resistor, two 12-V batteries, a resistor and voltmeter as shown below.

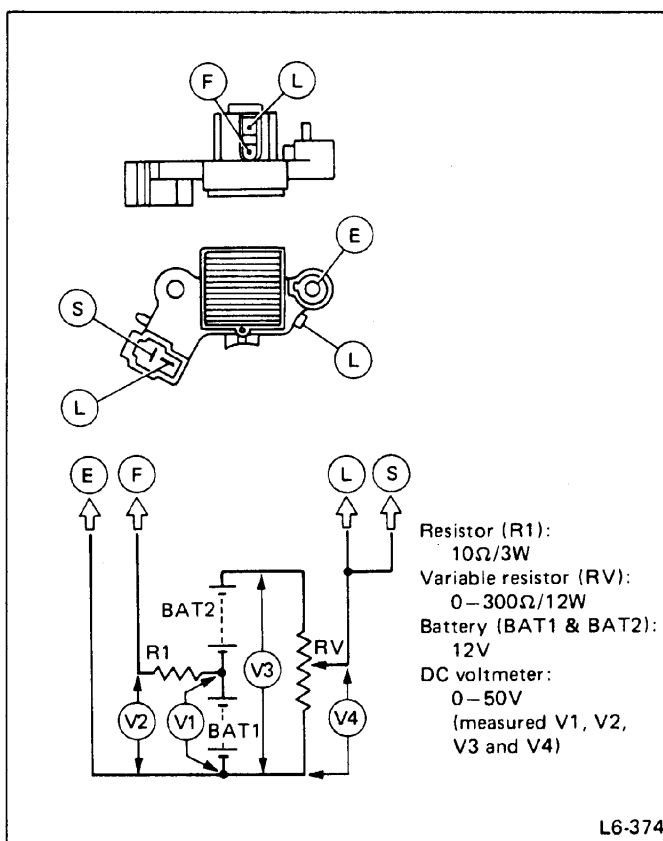


Fig. 38

Perform the following measurement:

- 1) Check V1 (voltage of BAT1). The voltage must be 10 to 13V.
- 2) Check V3 (voltage of BAT1 + BAT2). If a voltage of 20 to 26V is measured, both BAT1 and BAT2 are normal.
- 3) Measure V2 (voltage between terminals F and E) while gradually moving the variable resistor away from 0. Voltage V2 should change from below 2.0V to voltage V1 measured in step 1) above. If no change is observed, the regulator is faulty, and must be replaced with a new one.
- 4) Measure V4 (voltage between the intermediate tap of variable resistor and terminal E) with variable resistor RV fixed to see whether the voltage is within the specified range. If found within the range, the regulator is normal. If out of range, replace the regulator with a new one.

ASSEMBLY

To reassemble, reverse the disassembly procedure, noting the following points.

1) Use a high temperature solder for soldering the diode and stator coil leads, and the diode lead and brush holder.

Observe the following working conditions:

Soldering iron temperature : 300 to 380°C (572 to 716°F)

Soldering time : Within 5 seconds

Solder : Pb-Sn (5-1) solder

2) Assembling of front side and rear side

(1) Whenever the alternator has been disassembled, be sure to replace the rear side ball bearing.

(2) The rear side bearing has a ring inserted into the offset groove of the outer race, and a part of the ring is projected to the outside of the outer race. When reassembling, rotate the ring so that this projection is minimized. If any fault is found on the rear cover bearing portion, replace the rear cover.

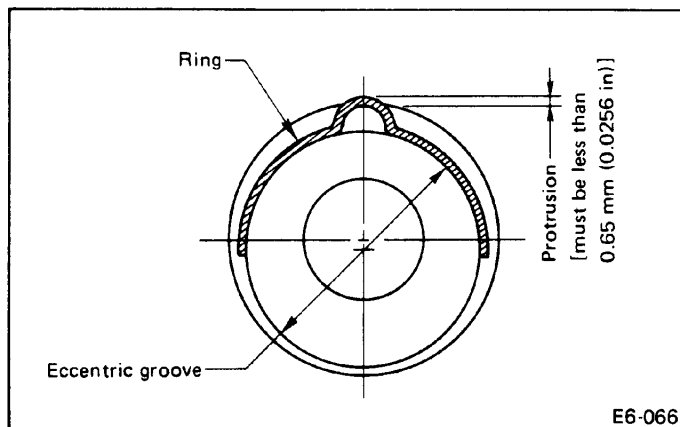


Fig. 39

(3) Insert a pin from outside the rear cover to push each brush into the brush holder.

After completely reassembled, be sure to remove the pin.

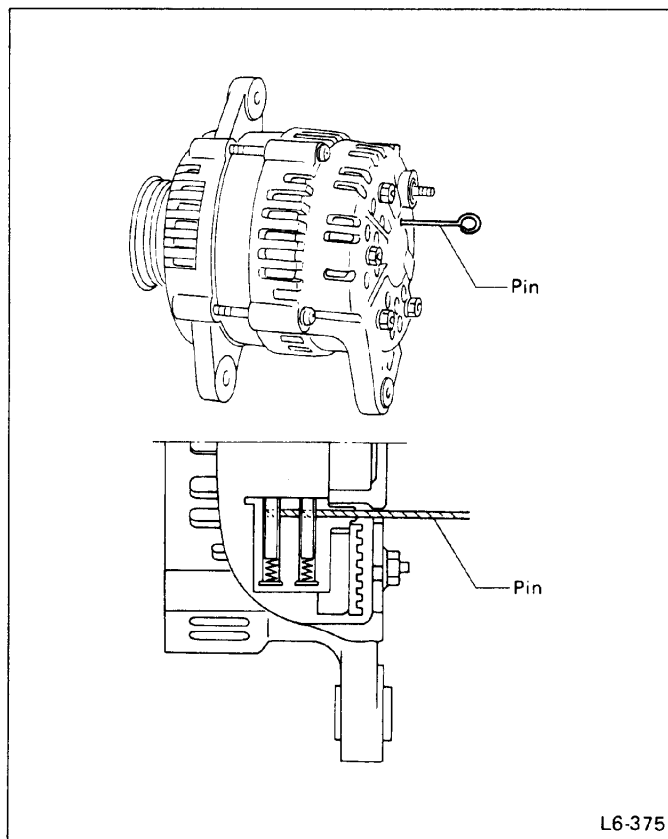


Fig. 40

2700cc model

DISASSEMBLY

1) Heat the bearing box to 50 to 60°C (122 to 140°F) with a 100 W-soldering iron and remove the three 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.

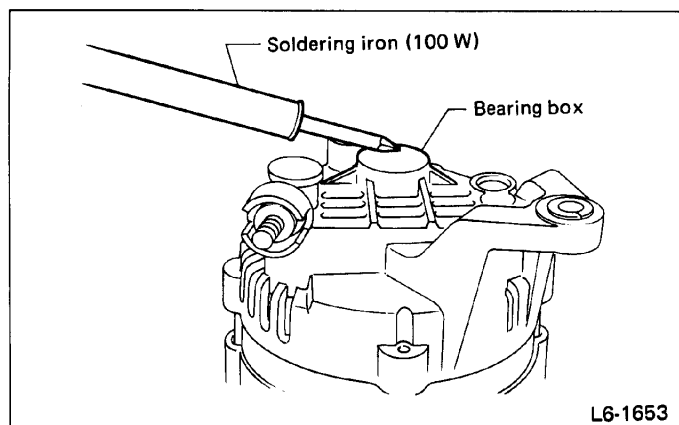


Fig. 41

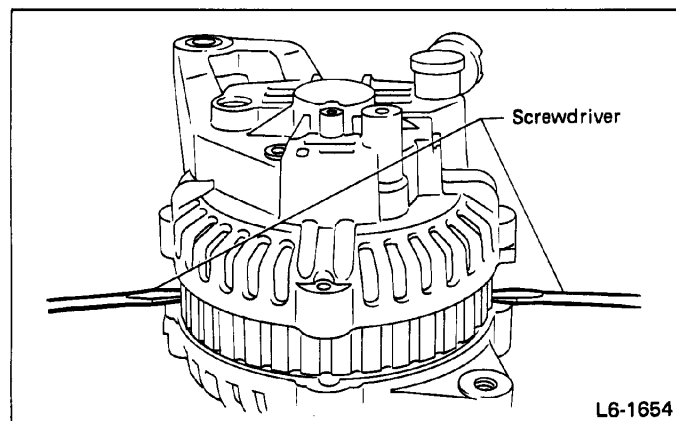


Fig. 42

2) Remove the pulley nut. The pulley rotor and front bracket can be separated.

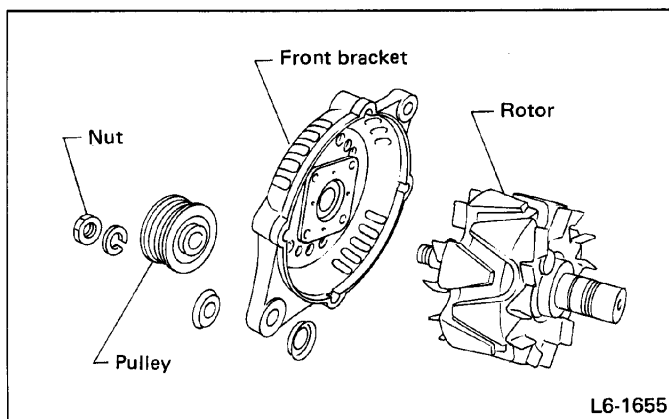


Fig. 43

3) Remove the nut and insulating bushing at terminal B. Remove the screws fastening the rectifier and the brush holders to separate the stator from the rear bracket.

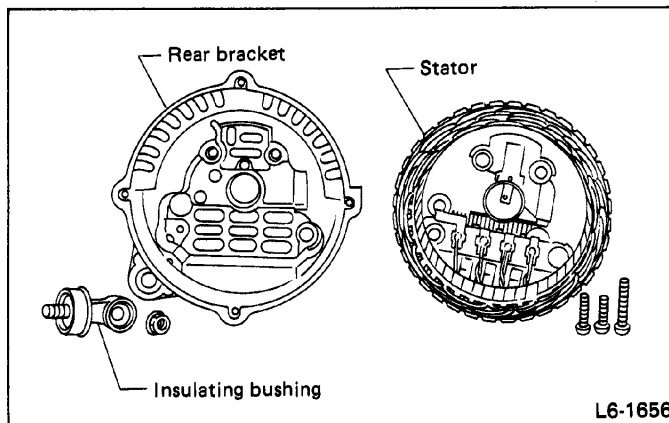


Fig. 44

4) Remove the IC regulator.

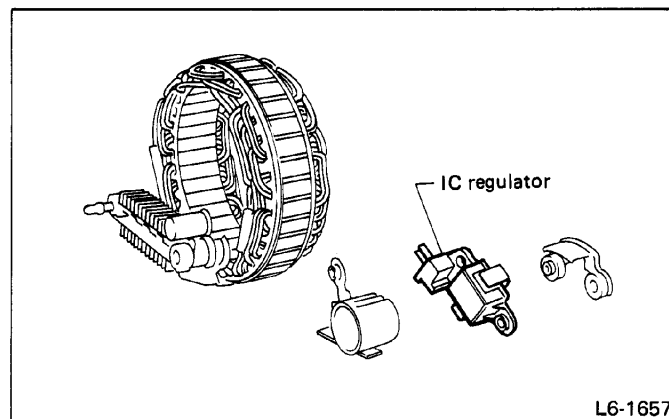


Fig. 45

- 5) Unsolder the rectifier and remove the stator.

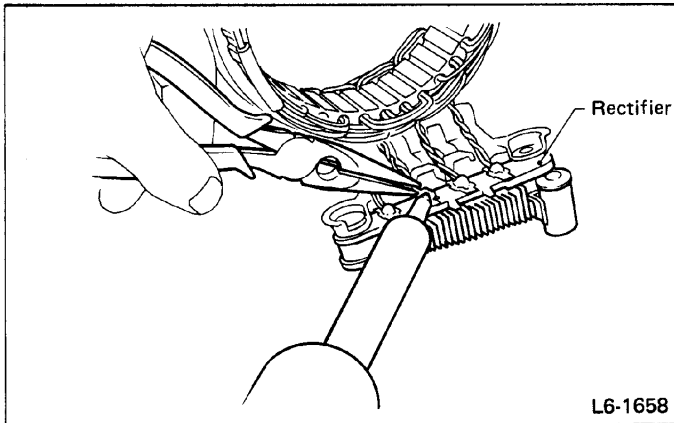


Fig. 46

- 6) Remove the brushes by unsoldering at the pigtails.

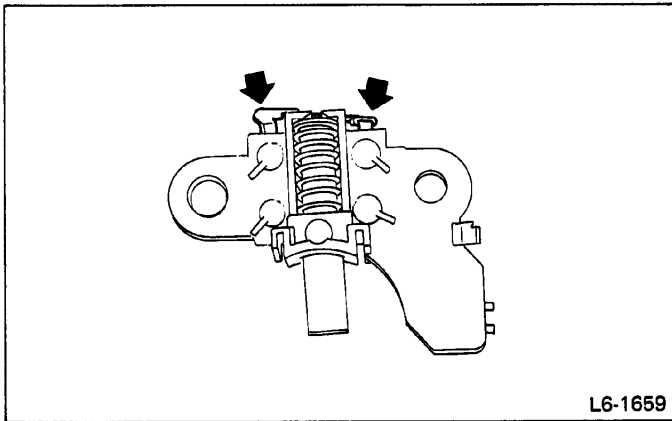


Fig. 47

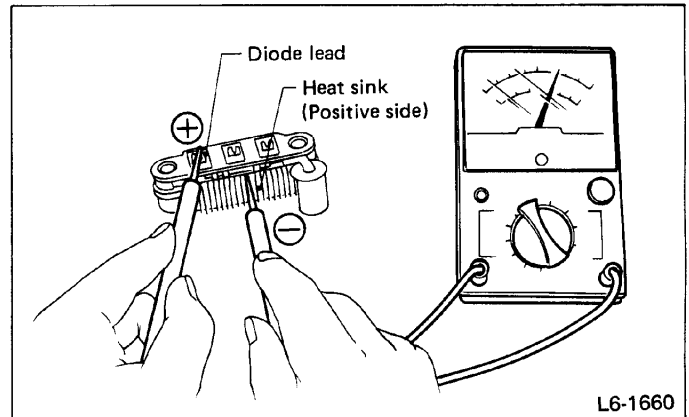


Fig. 48

- 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.

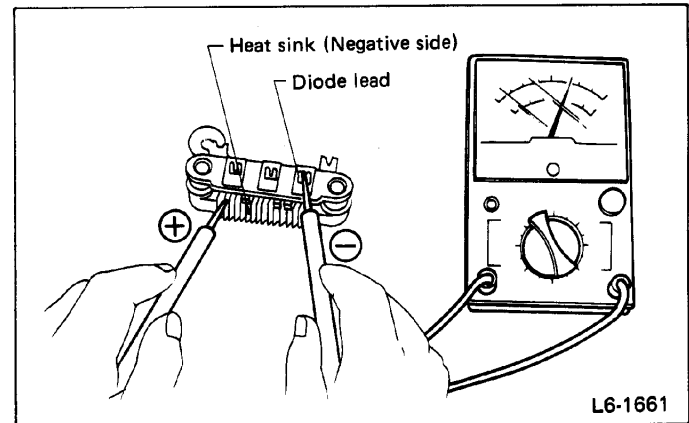


Fig. 49

- 3) Checking trio diode

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

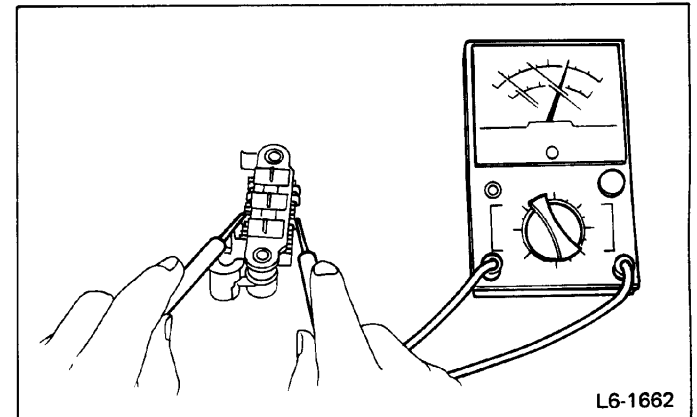


Fig. 50

INSPECTION AND REPAIR

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

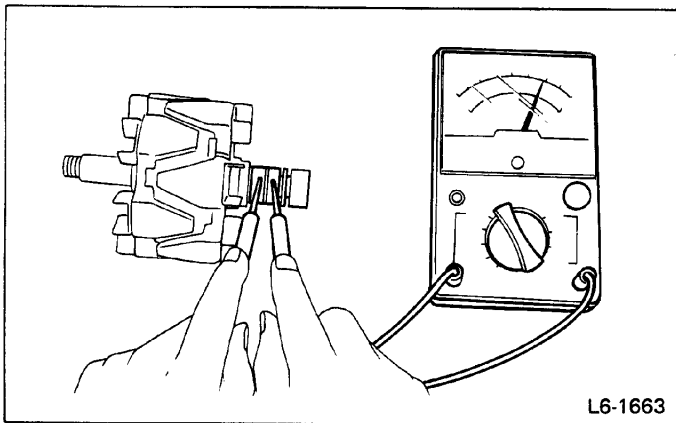
Check for continuity between the diode lead and the positive side heat sink. The positive diode is in good condition if continuity exists only in the direction from the diode lead to the heat sink.

ROTOR**1) Checking slip ring surface**

Repair the slip ring surface, if rough, with a lathe or fine sand-paper.

2) Checking rotor coil for continuity

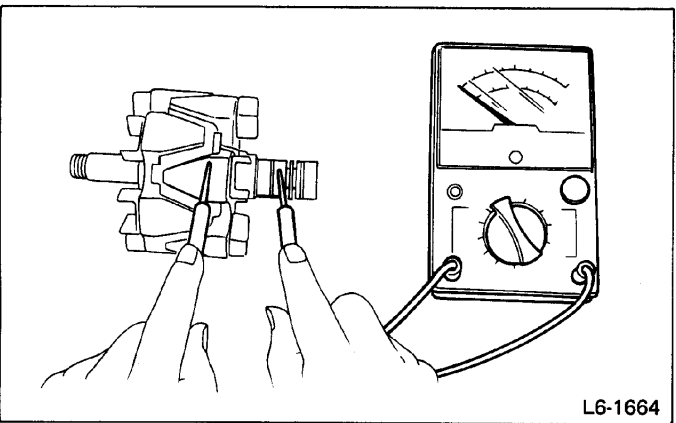
Check the resistance between the slip rings with a circuit tester. It should be somewhere between 3.0 and 3.5Ω. If the resistance is not within this range, replace rotor with a new one.



L6-1663

Fig. 51**3) Checking rotor coil for proper insulation**

Check for continuity between the slip ring and rotor core using a circuit tester. If continuity is noted, the rotor coil is shortcircuited, and the rotor must be replaced with a new one.



L6-1664

Fig. 52**BEARING**

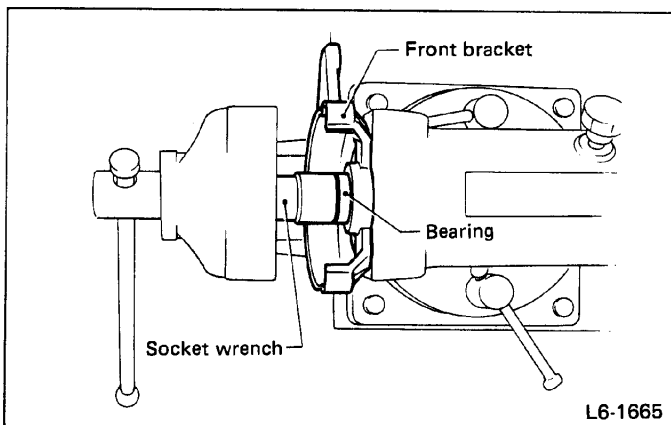
Check front and rear ball bearings.

If resistance is felt while rotating, or if abnormal noise is heard, replace the ball bearing.

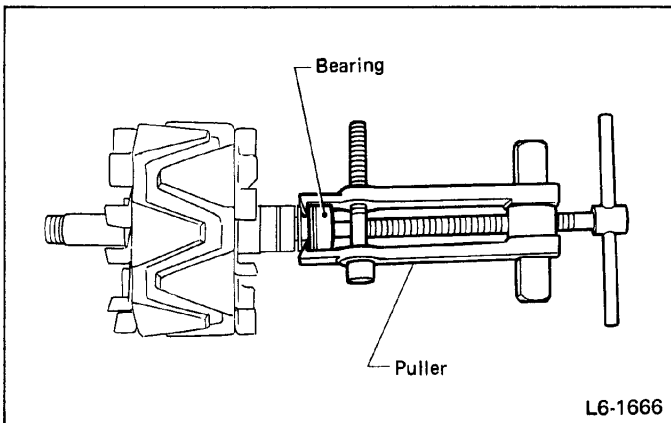
After separating the rotor, be sure to replace front and rear ball bearings.

1) Replacing front bearing

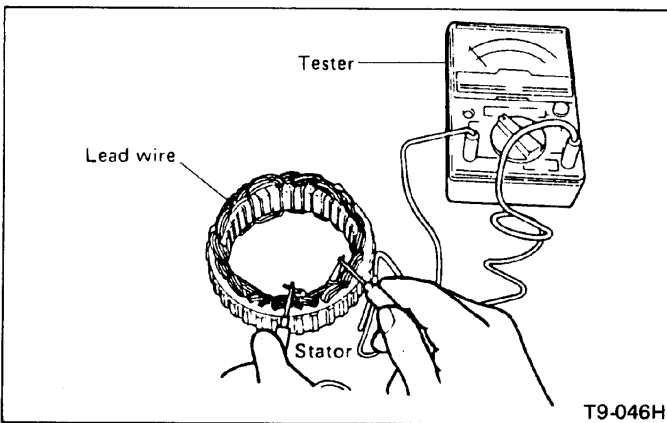
Install closely fit jig on the bearing outer race. Press the bearing down into place with a hand press or vise. A socket wrench can serve as the jig.

**Fig. 53****2) Replacing rear bearing**

The rear bearing can be removed by using a common bearing puller. When installing a new one, press-fit so that its peripheral groove is on the slip ring side.

**Fig. 54****STATOR****1) Checking stator coil for continuity**

Check the stator coil for continuity between terminals using a circuit tester. If no continuity is noted, it indicates that the stator coil is disconnected, and the stator must be replaced.

**Fig. 55**

2) Checking stator coil for proper insulation

Connect the circuit tester between any terminal of the stator coil and the stator core. If continuity is noted, it indicates that the stator coil is shortcircuited inside, and the stator must be replaced.

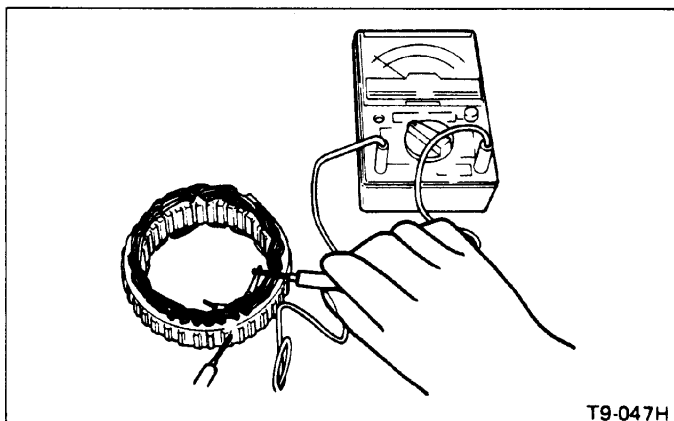


Fig. 56

T9-047H

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 2.059 N (210 g, 7.41 oz), replace the brush spring. The new spring must have a pressure of 2.942 to 3.923 N (300 to 400 g, 10.58 to 14.11 oz).

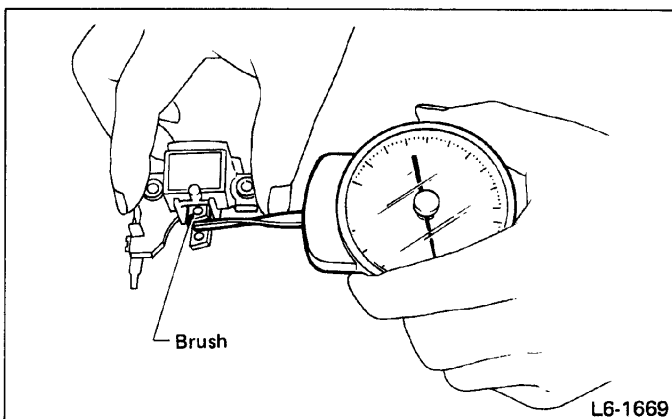


Fig. 58

L6-1669

BRUSHES

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

16.5 mm (0.650 in)

Wear limit

8.0 mm (0.31 in)

If the brush pigtail (lead wire) is soldered, use a soldering iron heated to 300 to 350°C (572 to 662°F) and paste without oxygen.

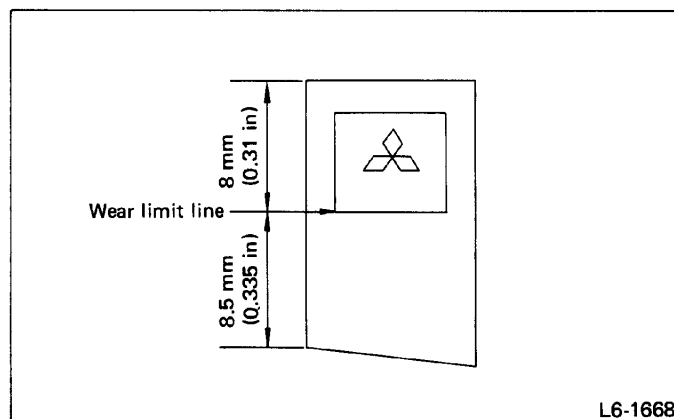


Fig. 57

L6-1668

ASSEMBLY

To reassemble, reverse the disassembly procedure, noting the following points.

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.

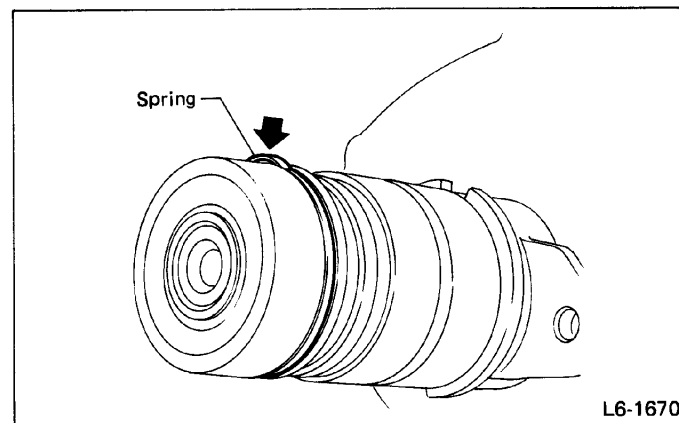


Fig. 59

L6-1670

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.

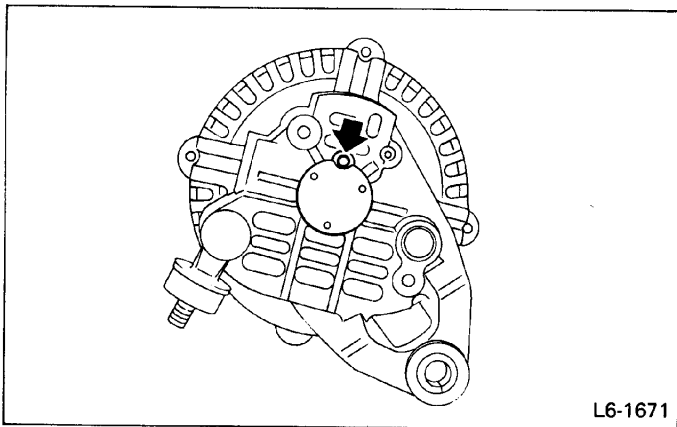


Fig. 60

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.

Distributor

DESCRIPTION

This distributor is equipped with a photoelectric crank-angle sensor which transmits a crank-angle signal and a cylinder-identification signal to the MPFI control unit.

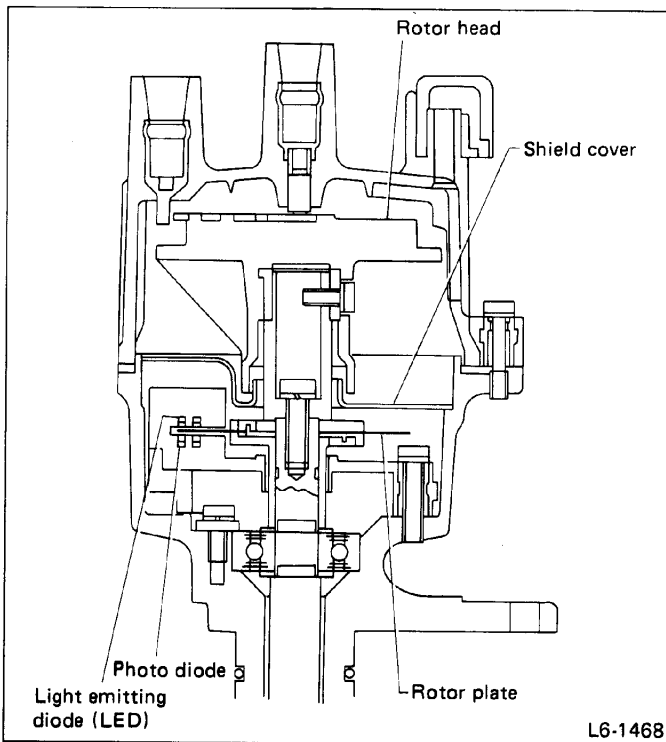


Fig. 61

A signal processing unit, which is built into the distributor housing, consists of LED and a photodiode. The rotor plate, located between the LED and the photodiode, is secured to the rotor shaft.

The rotor plate has four slits along its periphery through which 90° signals (in terms of distributor angle) are transmitted for cylinder detection. In addition, there are three hundred and sixty slits through which 1° signals (in terms of distributor angle) are transmitted for crank-angle detection. Directly above the rotor plate is the LED and below it is the photodiode.

When the ignition switch is turned "ON", the LED emits light to the photodiode. The rotor plate turns as the engine starts. The light emitted from the LED is then repeatedly interrupted and transmitted through the slits by rotation of the rotor plate. The "on-off" light signals (for cylinder detection and crank-angle detection) are then converted into output signals which are transmitted to the MPFI control unit.

The MPFI control unit determines optimum ignition timing in response to these output signals and engine operating conditions and transmits an ignition signal to the ignition coil.

This type of distributor is not equipped with a centrifugal advance angle and a vacuum advance angle device.

DISASSEMBLY

- 1) Detach cap and dust cover as a unit.
- 2) Remove carbon point from cap.
- 3) Remove rotor head securing screw and detach rotor head from rotor shaft.
- 4) Remove O-ring from housing.
- 5) Drive roll pin out of shaft and pinion.
- 6) Remove pinion from shaft.

Further disassembly of parts is prohibited.

INSPECTION

- 1) Carbon point
Measure the length of carbon point in cap. Replace if it is less than service limit.

Standard length:
12 mm (0.47 in)
Service limit:
10 mm (0.39 in)

- 2) Cap and rotor head
Measure insulation resistance using a megger. Replace if it is less than the specified value.

Insulation resistance:
More than 50 M Ω

ASSEMBLY

ASSY is in the reverse order of disassembly. Observe the following:

- 1) Use new roll pin when installing pinion.
- 2) Install pinion so that its alignment mark is aligned with the mark on the housing when the cutout section of rotor shaft faces the 1st cylinder mark on the cap.

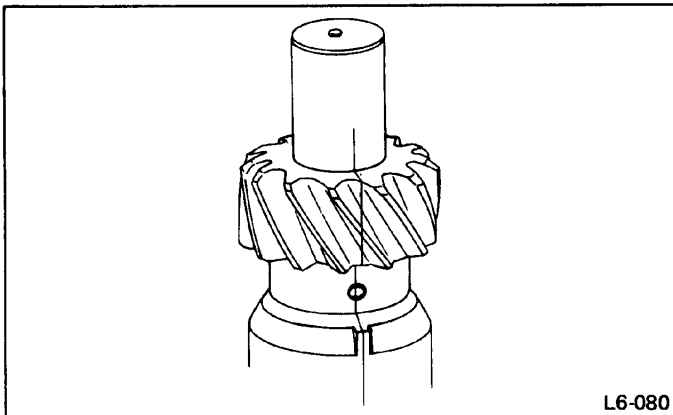


Fig. 62

Ignition Coil

The E12-113 ignition coil is equipped with a power transistor igniter. The power transistor amplifies the ignition signal transmitted from the MPFI control unit. The amplified signal is used to make and break the current flowing through the primary winding of the ignition coil.

REMOVAL AND INSTALLATION

- 1) Disconnect battery negative (-) terminals.
- 2) Disconnect wires from ignition coil.
- 3) Remove ignition coil.
- 4) To install, reverse the order of removal.

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

INSPECTION

Using accurate tester, inspect the following items, and replace if defective.

- 1) Primary resistance
- 2) Secondary coil resistance

If the resistance is extremely low, this indicates the presence of a short-circuit.

- 3) Insulation between primary terminal and case: 10 M Ω or more.

- 4) If engine does not run due to faulty ignition system, check ignition system as follows:

Check for cracked distributor rotor or cap and corroded terminals.

Visually inspect high tension wire for condition. Check spark plugs and adjust gaps as necessary. Replace spark plug which is not suitable for further use.

If the above checks cannot correct the problem, check entire ignition system with oscilloscope or circuit tester in accordance with the troubleshooting charts. (See chapter 6-3)

Spark Plug

DESCRIPTION

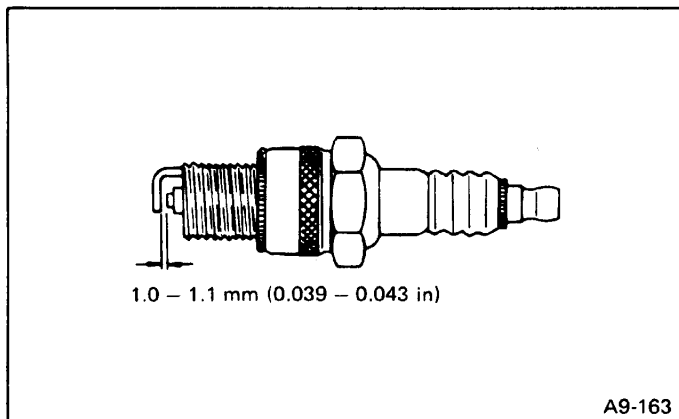


Fig. 63

The spark plugs are project type, having 14 mm (0.551 in) threads and 1.0 to 1.1 mm (0.039 to 0.043 in) gap.

All spark plugs installed on an engine, must be of the same heat range.

| Applicable model | Spark plug |
|------------------|---|
| U.S.A. | NGK: BPR6ES-11 (or BPR5ES-11, BPR7ES-11) NIPPONDENSO: W20EPR-U11 (or W16EPR-U11, W22EPR-U11) CHAMPION: RN9YC-4 (or RN11YC-4) |
| Canada | CHAMPION: RN9YC-4 (or RN11YC-4) |

REMOVAL AND INSTALLATION

- 1) Remove spark plug cords by pulling boot, not cord itself.
- 2) Remove spark plugs.
- 3) When installing spark plugs on cylinder head, use spark plug wrench.

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.

- 4) Connect spark plug cords.

INSPECTION

Check electrodes and inner and outer porcelains of plugs, noting the type of deposits and the degree of electrode erosion.

- 1) Normal

Brown to grayish-tan deposits and slight electrode wear indicate correct spark plug heat range.

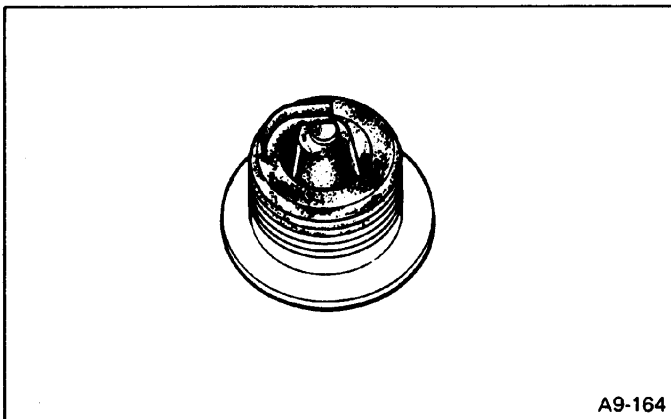


Fig. 64

- 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.

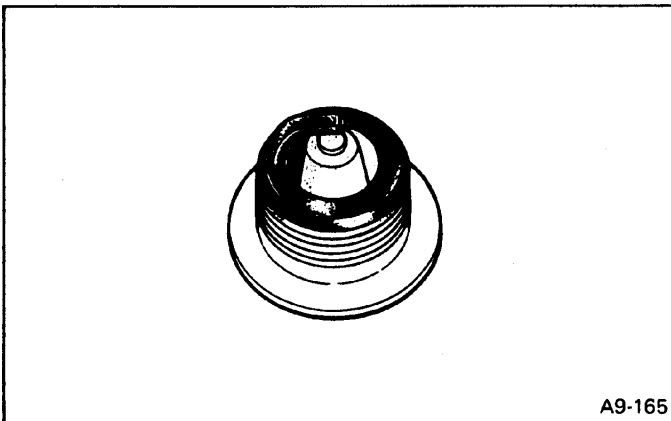
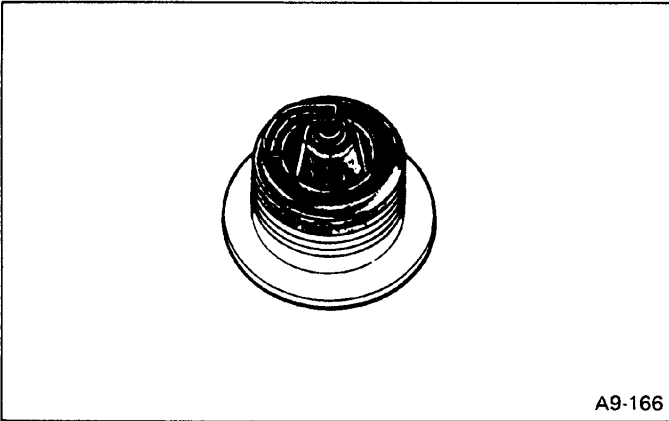


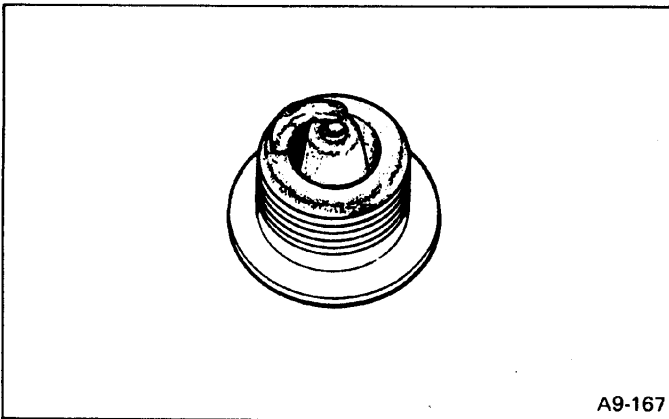
Fig. 65

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. 66***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. 67***CLEANING AND REGAPPING**

Clean spark plugs in a sand blast type cleaner.

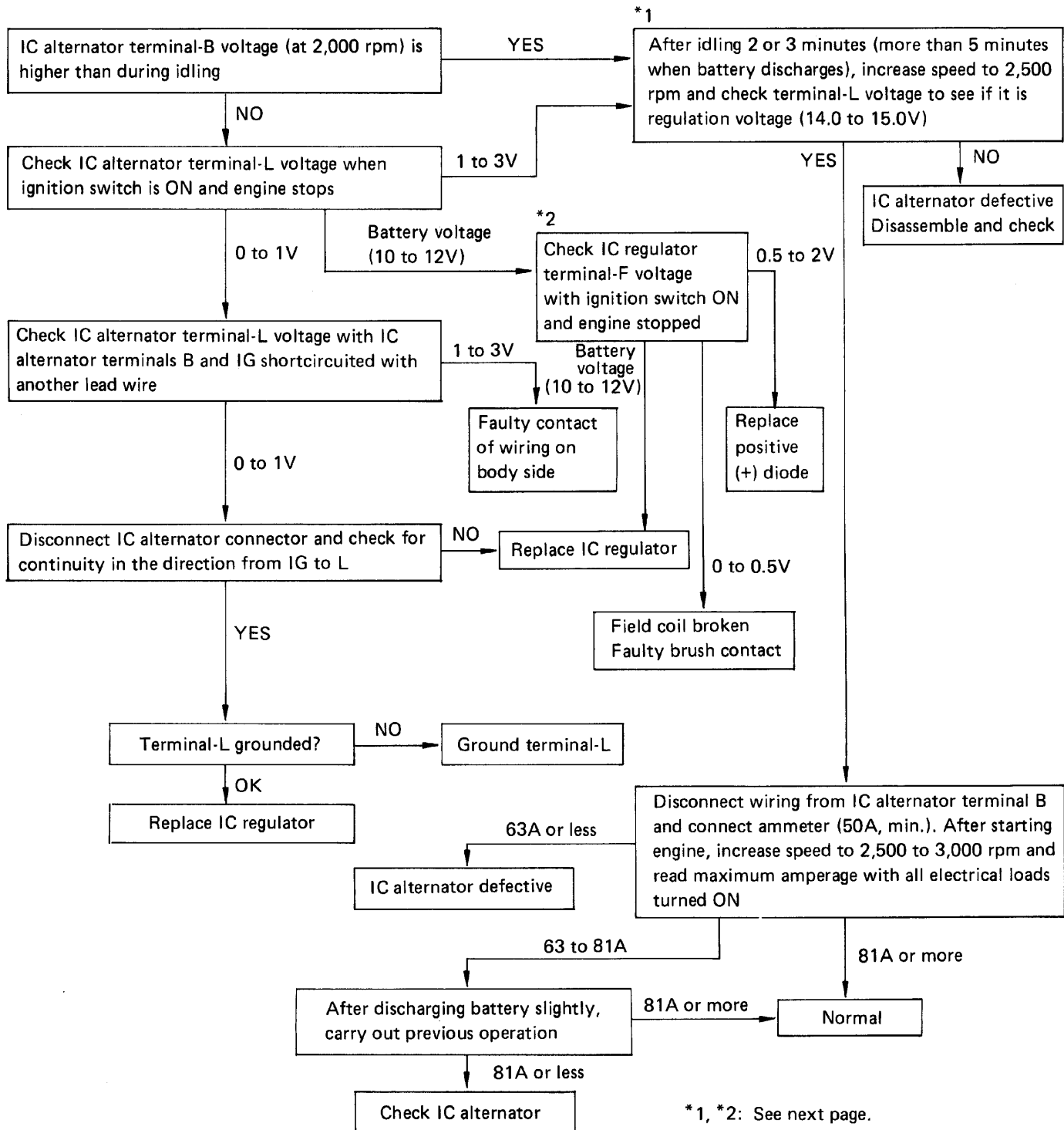
Avoid excessive blasting. Clean and remove carbon or oxide deposits, but do not wear away porcelain.

If deposits are too stubborn, discard plugs.

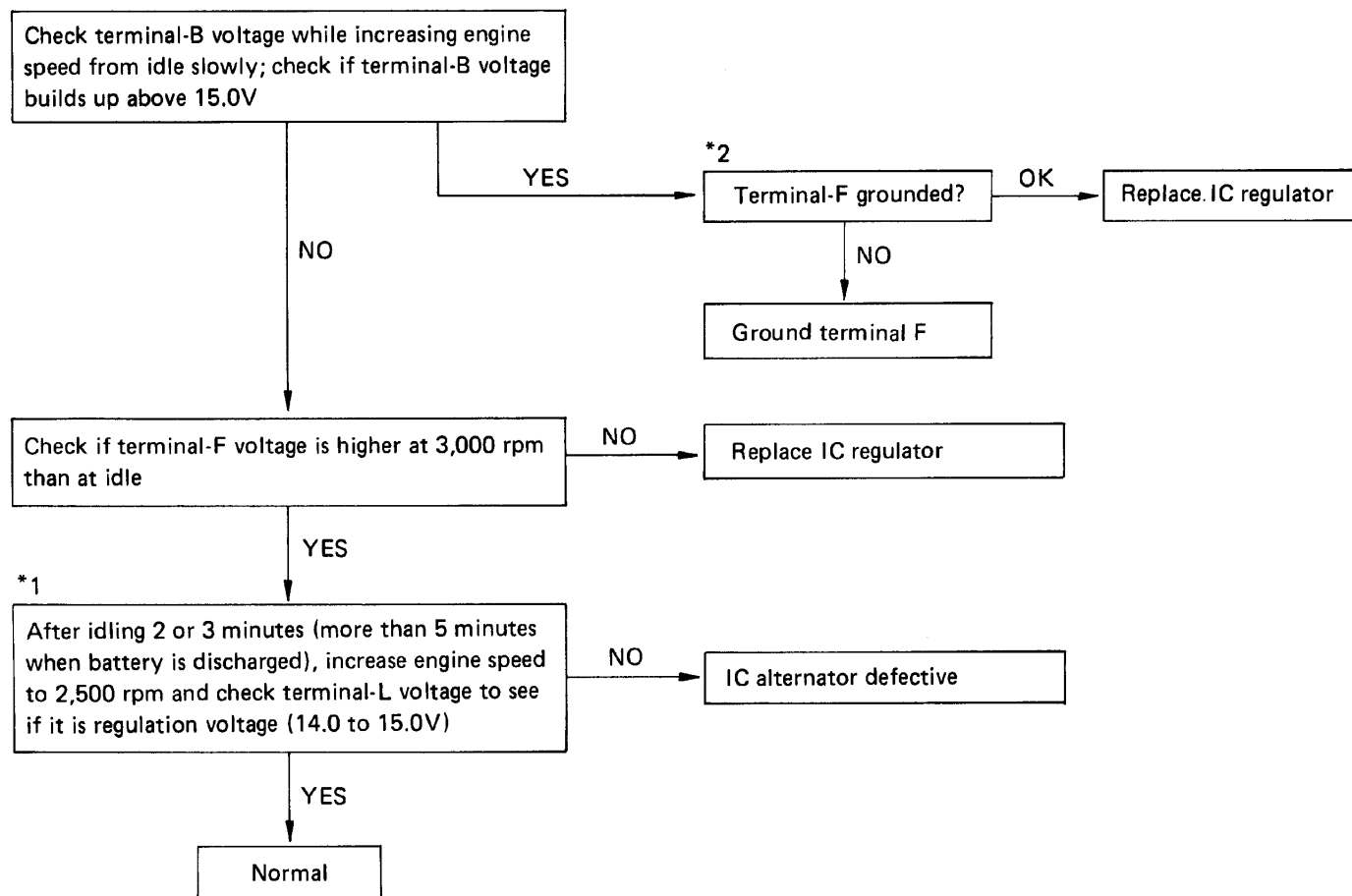
After cleaning spark plugs, recondition firing surface of electrodes with file. Then correct the spark plug gap to 1.0 to 1.1 mm (0.039 to 0.043 in) using a gap gauge.

TROUBLESHOOTING (ON THE CAR)**ALTERNATOR (2700 cc model)**

1. Rotational speed refers to the number of engine revolutions.
2. General inspections such as belt tightness and connector contact should be completed before troubleshooting.
3. Replace the battery with a good one for accurate inspection.

BATTERY OVER-DISCHARGES

*1, *2: See next page.

BATTERY OVERCHARGES

*1 When checking this, be sure to turn off the lights and all other electrical loads.

*2 To check the voltage at terminal F, insert the contact bar straight through the access hole. This will allow the contact bar to hit only terminal F. Even if the bar comes into contact with the rear bracket during insertion, no damage will result as long as it is released.

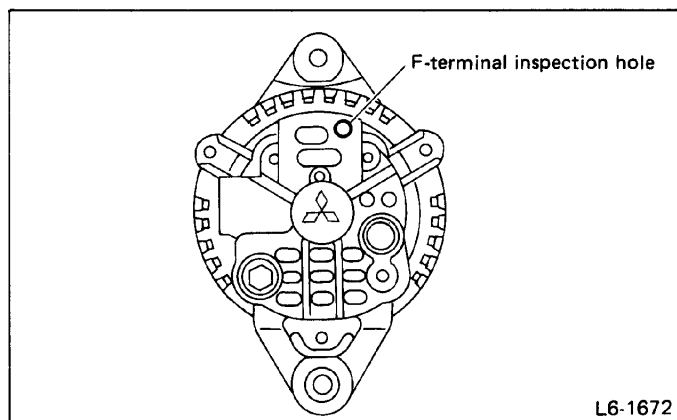


Fig. 68