

SECTION 10

CHARGING SYSTEM

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10-I. ALTERNATOR

GENERAL DESCRIPTION

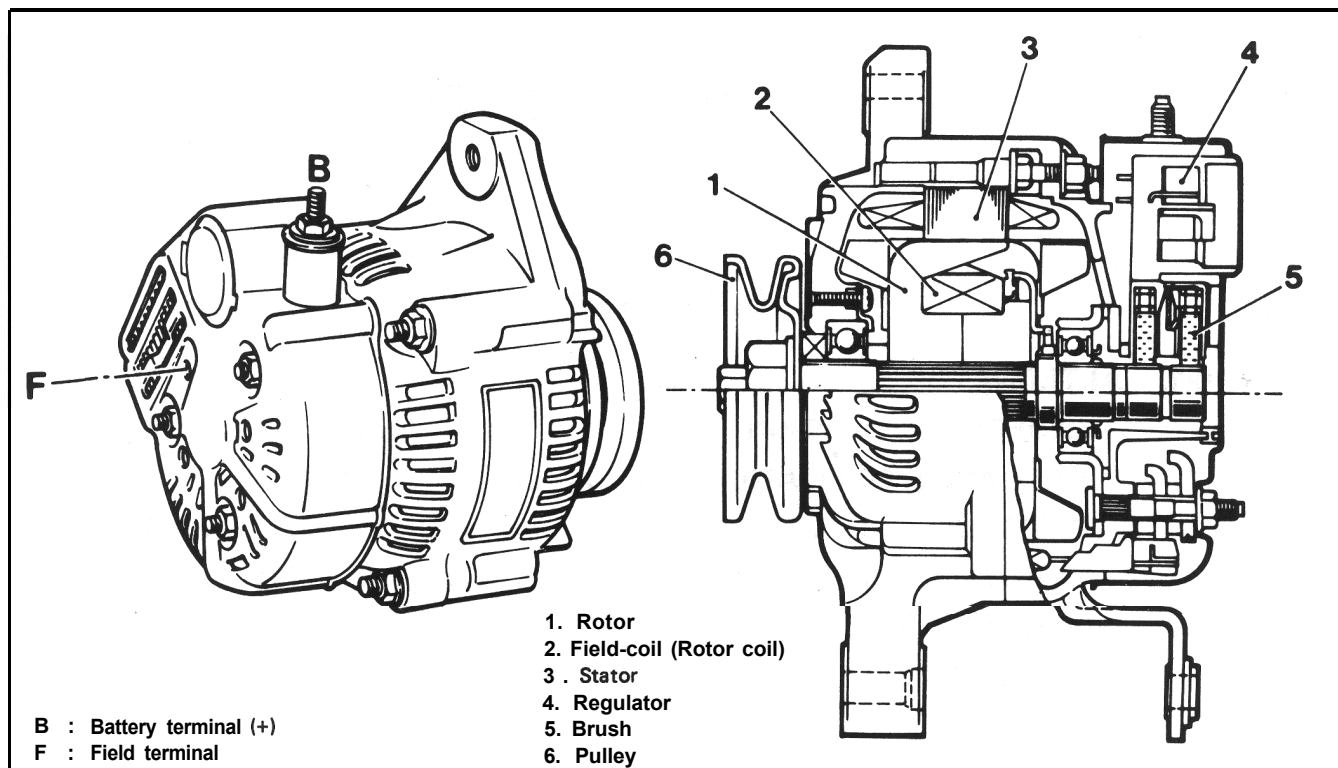


fig. 10-1

The basic charging system is the IC integral regulator charging system. The internal components are connected electrically as shown below,

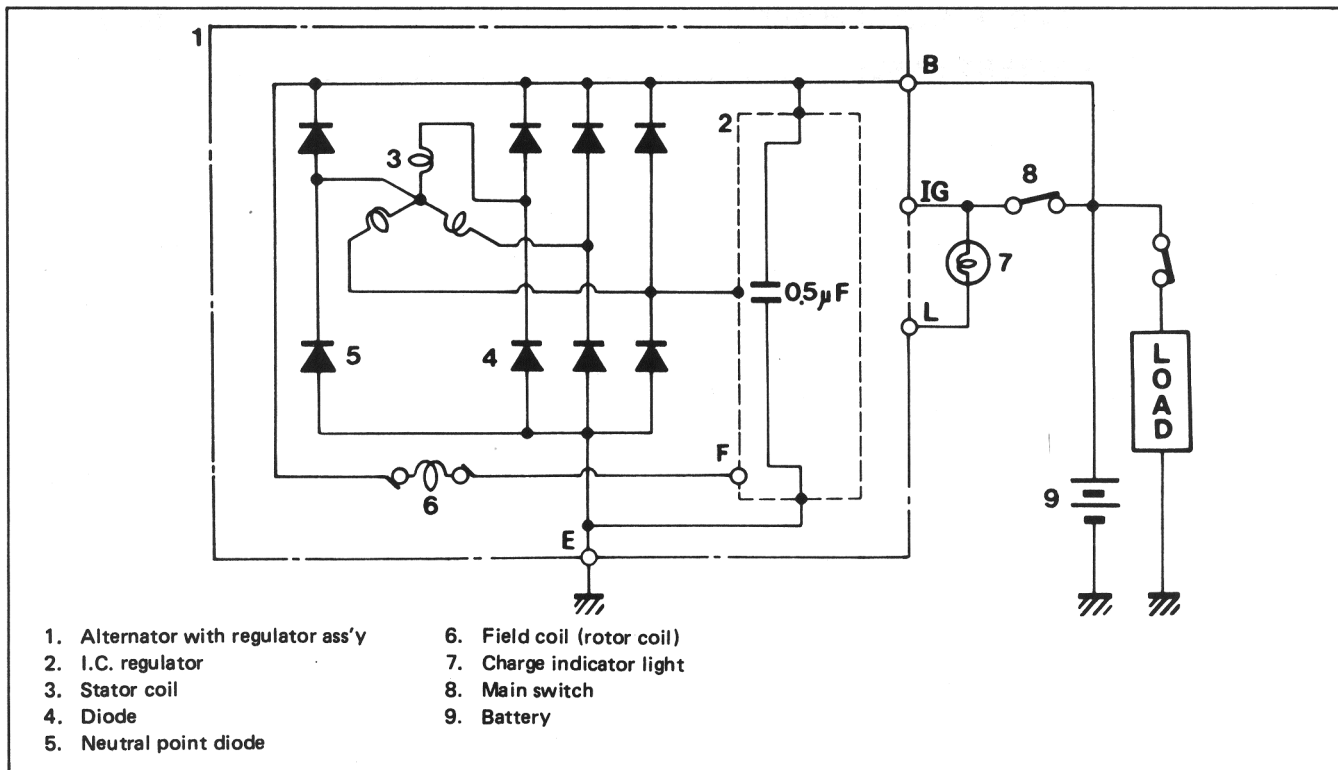


Fig. 10-2

The alternator features a solid state regulator that is mounted inside the alternator. All regulator components are enclosed into a solid mold, and this unit along with the brush holder assembly is attached to the slip ring end frame. The regulator voltage setting cannot be adjusted.

The alternator rotor bearings contain enough grease to eliminate the need for periodic lubrication. Two brushes carry current through the two slip rings to the field coil mounted on the rotor, and under normal conditions will provide long period of attention-free service.

The stator windings are assembled on the inside of a laminated core that forms part of the alternator frame. A rectifier bridge connected to the stator windings contains six diodes, and electrically changes the stator A.C. voltages to a D.C. voltage which appears at the generator output terminal.

The neutral diodes serve to convert the voltage fluctuation at the neutral point to direct current for increasing the alternator output.

A condenser mounted in the end frame protects the diodes from high voltages and suppresses radio noise.

DATA AND SPECIFICATION

Nominal operating voltage	12 volts
Max. alternator output	45A
Polarity	Negative ground
No-load alternator speed	1,110 rpm (r/min)
Regulated voltage	14.5 ± 0.3 V
Direction of rotation	Clockwise as viewed from pulley side
Maximum permissible alternator speed	15,000 rpm (r/min)
Working temperature range	-30 ~ 90°C (-22 ~ 194°F)
Rectification	Full wave rectification

Noisy Alternator

Noise from the alternator may be caused by a loose drive pulley, loose mounting bolts, worn or dirty bearings, defective diode, or defective stator.

DIAGNOSIS

A charging circuit wiring diagram for alternator connection is shown above. To avoid damage, always follow these precautions:

- 1) Do not mistake the polarities of IG terminal and L terminal.
- 2) Do not create short circuit between IG and L terminals. Always connect these terminals through a lamp.
- 3) Do not connect any load between L and E.

Trouble in the charging system will show up as one or more of the following conditions:

- a. Faulty indicator lamp operation.
- b. An undercharged battery as evidenced by slow cranking or indicator clear with red dot.
- c. An overcharged battery as evidenced by excessive spewing of electrolyte from the vents.

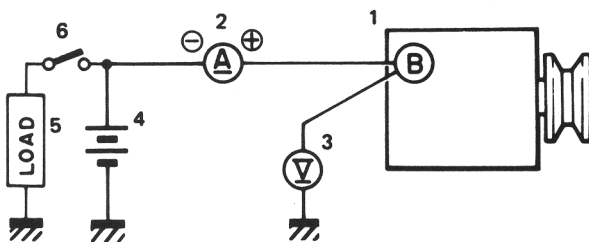
A. Faulty Indicator Lamp Operation

Problem	Possible cause	Correcti on
Charge light does not light with ignition ON and engine off	Fuse blown Light burned out Wiring connection loose IC regulator faulty	Check fuse Replace light Tighten loose connections Replace IC regulator
Charge light does not go out with engine running (battery requires frequent re-charging)	Drive belt loose or worn Battery cables loose, corroded or worn IC regulator or alternator faulty Wiring faulty	Adjust or replace drive belt Repair or replace cables Check charging system Repair wiring

B. Undercharged Battery

This condition, as shown by slow cranking or indicator clear with red dot, can be caused by one or more of the following conditions even though the indicator lamp may be operating normally. The following procedures also apply to cars with a voltmeter.

- 1) Insure that the undercharged condition has not been caused by accessories left on for extended period.
- 2) Check drive belt for proper tension.
- 3) If a battery defect is suspected, refer to latter part of this section, p. 10-10 ~ p. 10-11.
- 4) Inspect wiring for defects. Check all connections for tightness and cleanliness, including slip connectors at alternator and bulkhead, and battery cable connections at battery, starter and ignition ground cable.
- 5) Connect voltmeter and ammeter as shown in the diagram below.



1. Generator
2. Ammeter
3. Volt meter
4. Battery
5. Load
6. Switch

Fig. 10-3

a. Voltmeter

Set between alternator (B) terminal and ground.

b. Ammeter

Set between alternator (B) terminal and battery (+) terminal.

6) Current and voltage measurements

a. No-load check

Run engine from idling up to 2,000 r/min (rpm) and read meters.

Standard current	10 A maximum
Standard voltage	14.2 – 14.8 V (at 25° C, 77° F)

NOTE:

Consideration should be taken that the voltage will vary somewhat with regulator case temperature.

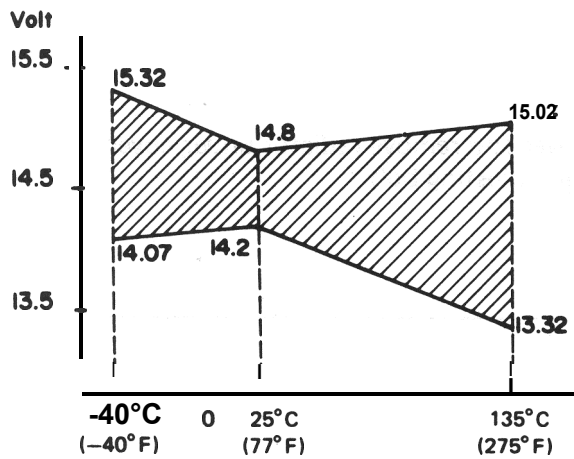


Fig. 10-4

If voltage is higher than standard value, replace IC regulator.

If voltage is below standard value, check IC regulator and alternator as follows:

Ground F terminal and start engine. Then measure voltage at B terminal.

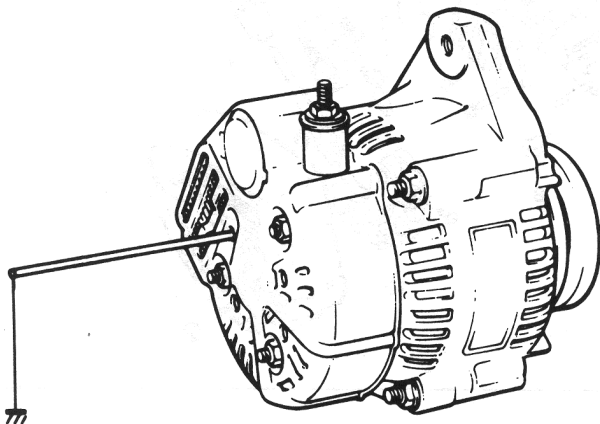


Fig. 10-5 Grounding terminal "F"

If voltage is above standard value, replace IC regulator.

If voltage is below standard value, check alternator.

b. Load check

Run engine at 2,000 r/min (rpm) and turn on headlamps and heater motor.

Measure current and if less than 20A, repair alternator.

C. Overcharged Battery

- 1) If an obvious overcharge condition exists as evidenced by excessive spewing of electrolyte, proceed to **DISASSEMBLY** under **ALTERNATOR SERVICE** on p.10-6 and check field windings for grounds and shorts. If defective, replace rotor.

ALTERNATOR SERVICE

REMOVAL

- 1) Remove battery (-) terminal.
- 2) Disconnect alternator lead wires (coupler & white lead wire).
- 3) Unclamp brake pipe from pipe clamp on radiator under cover and remove radiator under cover.
- 4) Remove alternator mounting bolts and alternator drive belt adjusting bolt.
- 5) Take down alternator.

DIASSEMBLY

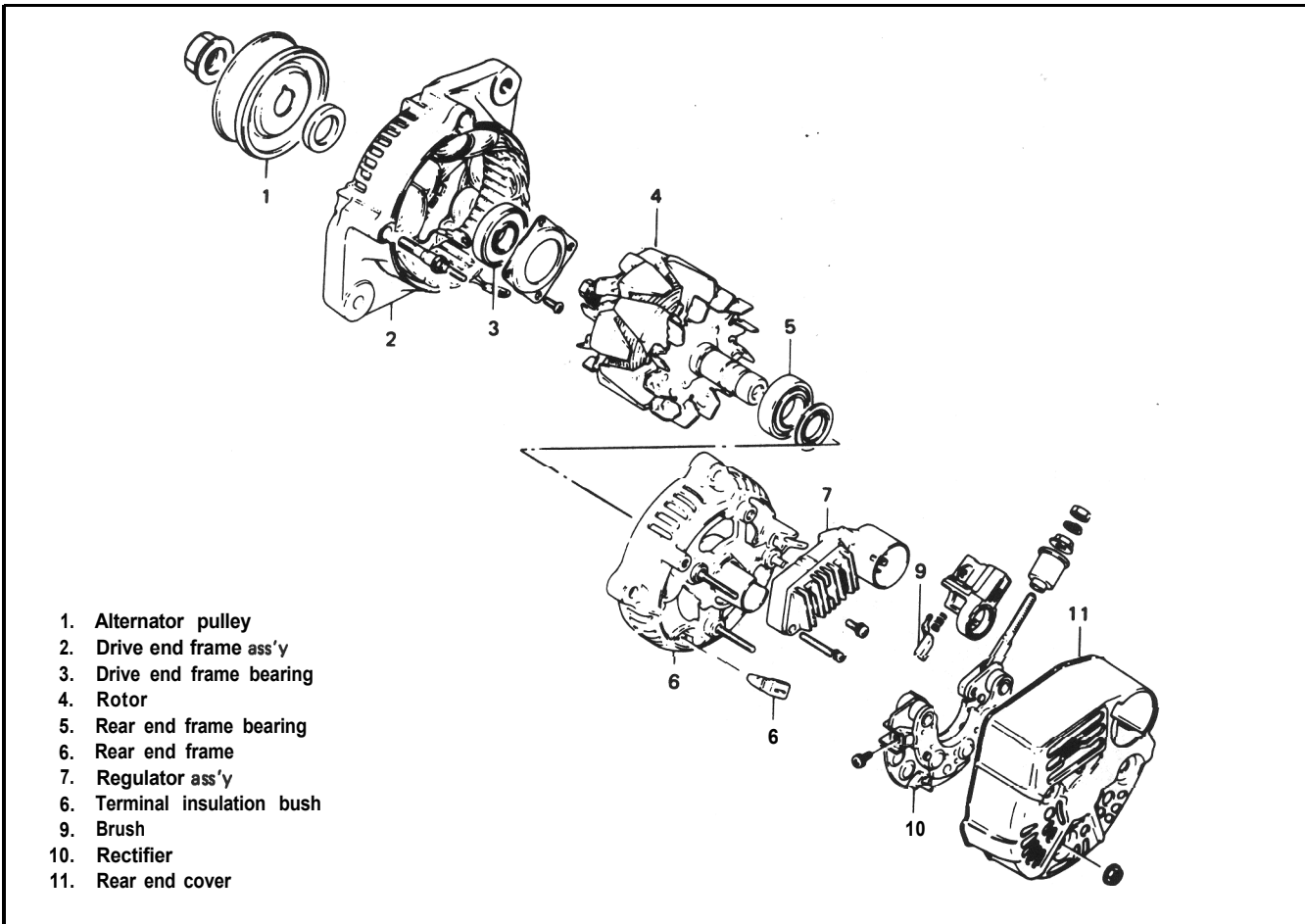
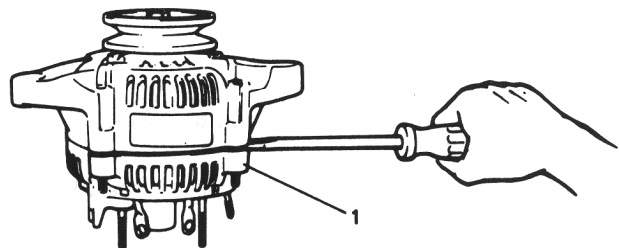


Fig. 10-6

- 1) Remove nut and take off B terminal insulator bushing.
- 2) Remove 3 nuts and take off rear end cover.
- 3) Remove 2 regulator mounting screws and 3 brush holder screws and take off regulator and brush holder.
- 4) Remove 4 stator coil terminal screws.
- 5) Remove rectifier holder together with I.C. regulator.
- 6) Remove 4 nuts and take off rear end frame,



1. Rear end frame

Fig. 10-7

7) Loosen alternator pulley nut and take off pulley.

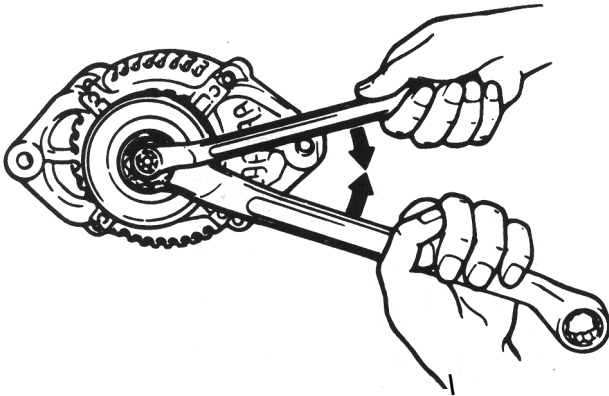


Fig. 108

8) Remove rotor from drive end frame.

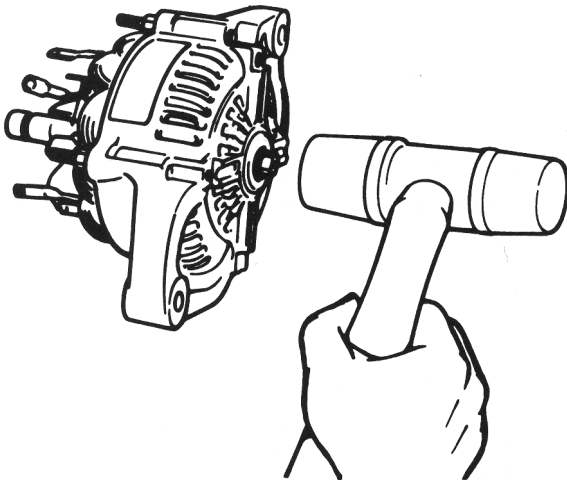
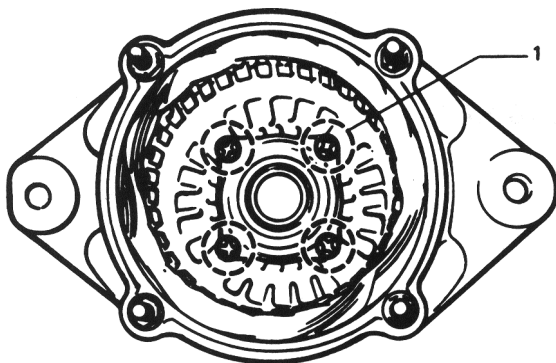


Fig. 109

9) When removing front end bearing, remove 4 4-mm bearing retainer screws.



1. Bearing retainer fitting screw

Fig. 1010

10) When removing rear bearing, use bearing puller.

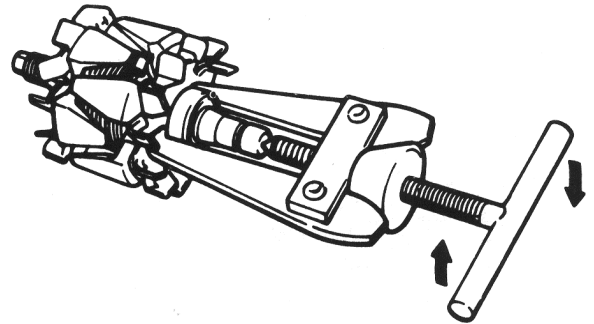


Fig. 10- 11

INSPECTION

Rotor

- 1) Check rotor for no open circuits
Using an ohmmeter, check for continuity between slip rings.

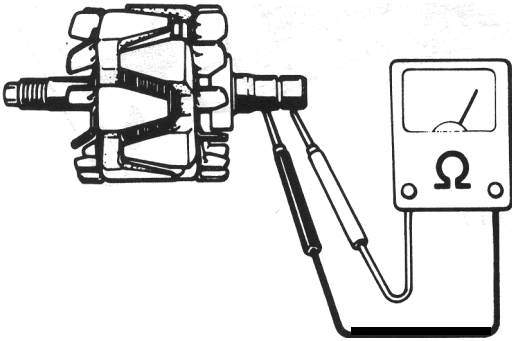


Fig. 10-12

Standard resistance	2.8 – 3.0 Ω
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If there is no continuity, replace rotor.

- 2) Check rotor for no grounds.
Using an ohmmeter, check that there is no continuity between slip ring and rotor.
If there is continuity, replace rotor.

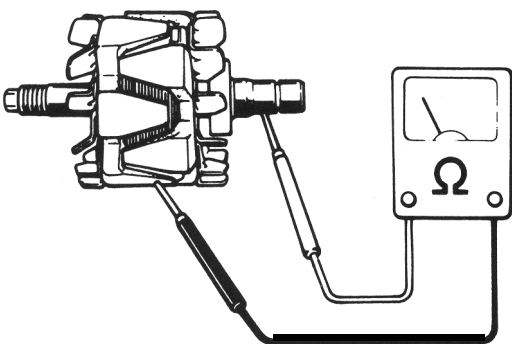


Fig. 10-13

- 3) Inspect slip rings
Check slip rings for roughness or scoring. If rough or scored, replace rotor.

Stator

- 1) Check stator for no open circuits
Using an ohmmeter, check all leads for continuity. If there is no continuity, replace stator.

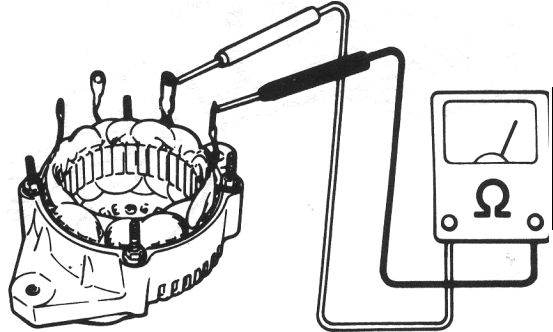


Fig. 1014

- 2) Check stator for no grounds
Using an ohmmeter, check that there is no continuity between coil leads and stator core.
If there is continuity, replace rotor.

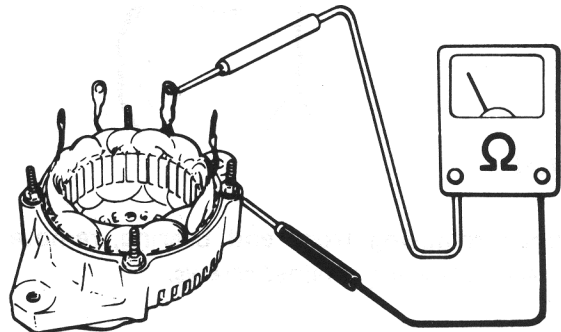


Fig. 1015

Brush and Brush holder

Check each brush for wear by measuring its length as shown. If brush is found worn down to service limit, replace brush with holder.

Brush length	Standard	Service limit
	11 mm (0.43 in)	5 mm (0.20 in)

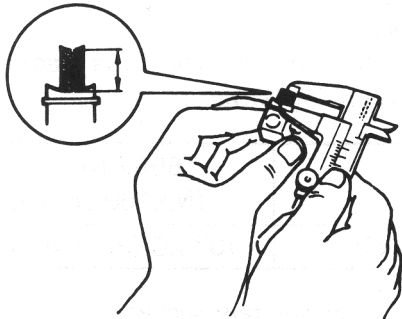


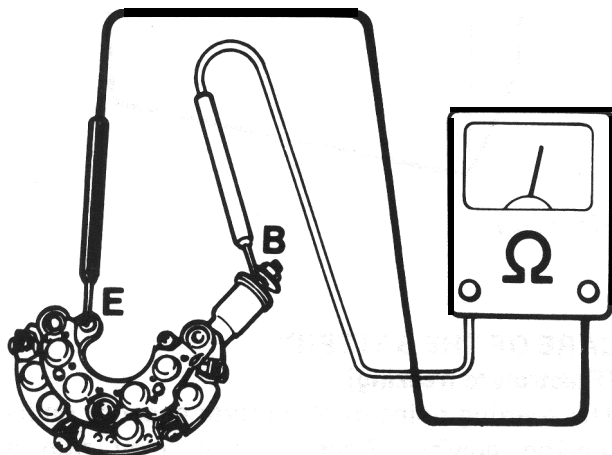
Fig. 10-16

Rectifier

Using an ohmmeter, check continuity between "B" terminal and ground.

Put one tester lead to terminal "B" and the other lead to ground; then swap two leads. Of two tester indications, one should be about 10 ohms, meaning continuity, and the other should be infinity (non continuity).

If not, replace rectifier assembly.



B : Battery terminal
E : Earth

Fig. 10-17

Condenser

Check condenser capacity in regulator.

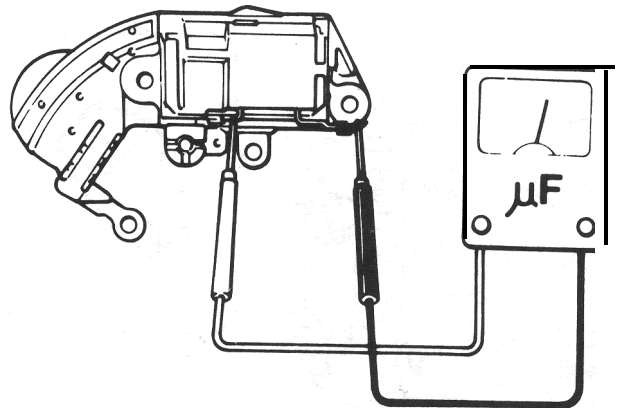


Fig. 10-18

Condenser capacity	0.5 μ F
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ASSEMBLY

Reverse disassembly procedure, using care on following points.

- 1) Use a press when forcing bearing into rotor shaft or drive end frame.

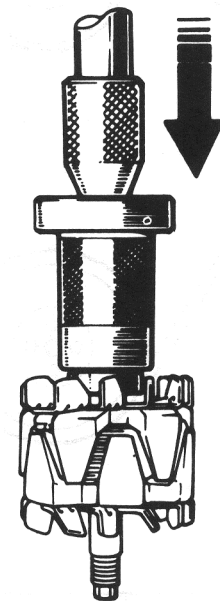
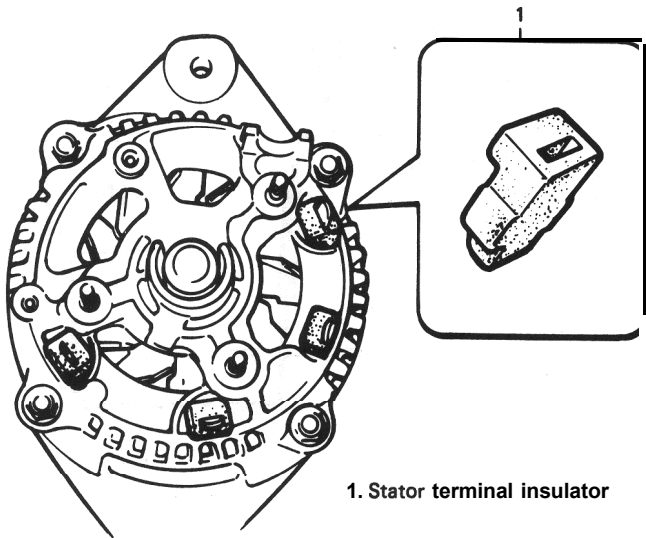


Fig. 10-19

- 2) Alternator pulley tightening torque.

Tightening torque		
50-65 N·m	5.0 – 6.5 kpm	37 - 47 lb-ft

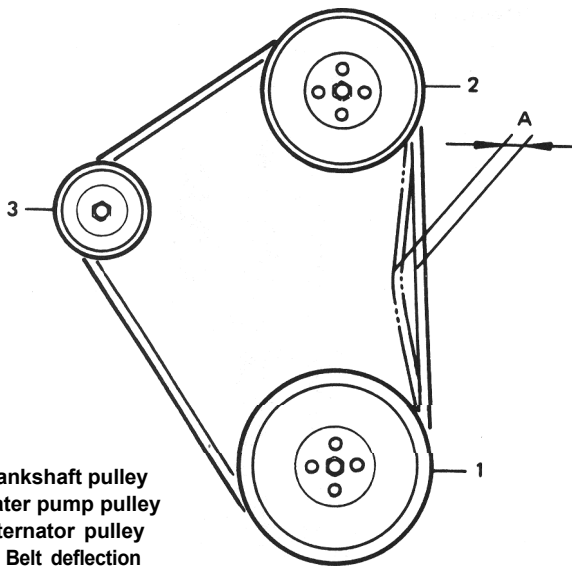
3) Make sure to assemble stator terminal insulator properly.



1. Stator terminal insulator

Fig. 10-20

4) Alternator V belt tension.



- 1. Crankshaft pulley
- 2. Water pump pulley
- 3. Alternator pulley
- A : Belt deflection

Fig. 10-21

Drive belt deflection (Under 10 kg thumb pressure)	6 – 9 mm (0.24 – 0.35 in)
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NOTE:

Clamp brake pipe with pipe clamp on radiator under cover after installing radiator under cover.

10-2. BATTERY

GENERAL DESCRIPTION

The battery has three major functions in the electrical system. First, it is a source of electrical energy for cranking the engine. Second it acts as a voltage stabilizer for the electrical system. And third, it can, for a limited time, provide energy when the electrical load exceeds the output of the generator.

Each new car shipped from the factory is fitted with following battery.

Model	55B24R (S) (NX100-S6 (S))
Rated capacity	1 3 7 kC (38 Ah)/5HR

This battery is completely sealed, except for six small vent holes in the top. These vent holes allows the small amount of gas produced in the battery to escape. This sealed battery has a built-in temperature compensated indicator in the top of the battery.

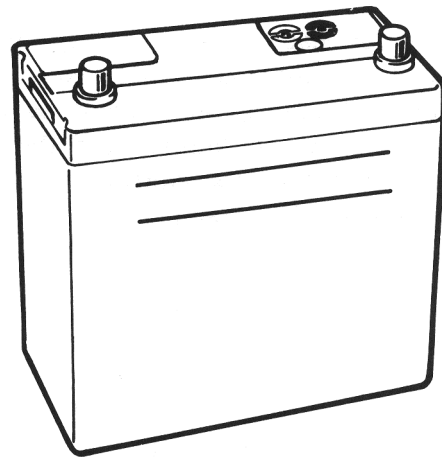


Fig. 10-22

CARE OF THE BATTERY

[Electrolyte freezing]

The freezing point of electrolyte depends on its specific gravity. Since freezing may ruin a battery, it should be protected against freezing by keeping it in a fully charged condition.

[Carrier and hold-down]

The battery carrier and hold-down clamp should be clean and free from corrosion before installing the battery. The carrier should be in good condition so that it will support the battery securely and keep it level.

Make certain there are no parts in carrier before installing the battery.

To prevent the battery from shaking in its carrier, the hold-down bolts should be tight but not over tightened.

[Visual inspection]

Check for obvious damage, such as cracked or broken case or cover, that could permit loss of electrolyte. If obvious damage is noted, replace the battery. Determine cause of damage and correct as needed.

Check the battery terminal and cords for corrosion. If any, it should be cleaned.

[Built-in indicator]

This sealed battery has a built-in temperature compensated indicator in the top of the battery. This indicator is to be used with the following diagnostic procedure. When observing the indicator, make sure that the battery has a clean top. A light may be needed in some poorly-lit areas.

Under normal operation, two indications can be seen

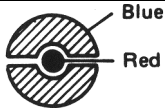

1		OK
2		CHARGING NECESSARY

Fig. 10-23

• **Clear with Red Dot**

This means the discharging battery. In this case, charge the battery until the indicator will be blue with red dot. The charging and electrical systems should also be checked at this time. If any defective is found, correct it. While charging it, if the battery feels hot 52°C (125° F), or if violent gassing or spewing of electrolyte through the vent hole occurs, discontinue charging or reduce charging rate.

[Jump starting in case of emergency with auxiliary (booster) battery]

NOTE:

- Do not push or tow the vehicle to start. Damage to the emission system and/or to other parts of the vehicle may result.
- Both booster and discharged battery should be treated carefully when using jumper cables. Follow the procedure outlined below, being careful not to cause sparks:

CAUTION:

- Departure from these conditions or the procedure below could result in: (1) Serious personal injury (particularly to eyes) or property damage from such causes as battery explosion, battery acid, or electrical burns; and/or (2) damage to electronic components of either vehicle.
- Never expose battery to open flame or electric spark-batteries generate a gas which is flammable and explosive.
- Remove rings, watches, and other jewelry. Wear approved eye protection.
- Do not allow battery fluid to contact eyes, skin, fabrics, or painted surfaces - fluid is a corrosive acid. Flush any contacted area with water immediately and thoroughly. Be careful that metal tools or jumper cables do not contact the positive battery terminal (or metal in contact with it) and any other metal on the car, because a short circuit could occur. Batteries should always be kept out of the reach of children.

- 1) Set parking brake and place transmission in neutral. Turn off the ignition, turn off lights and all other electrical loads.
- 2) Check electrolyte level. If level is below low level line, replace battery.

NOTE:

When jump starting an engine with charging equipment, be sure equipment used is 12-volt and negative ground. Do not use 24-volt charging equipment. Using each equipment can cause serious damage to the electrical system or electronic parts.

- 3) Attach the end of one jumper cable to the positive terminal of the booster battery and the other end of the same cable to the positive terminal of the discharged battery. Do not permit vehicles to touch each other as this could cause a ground connection and counteract the benefits of this procedure. (Use 12-volt battery only to jump start the engine).
- 4) Attach one end of the remaining negative cable to the negative terminal of the booster battery, and the other end to a solid engine ground (such as A/C compressor bracket or generator mounting bracket) at least 18 inches from the battery of the vehicle being started (DO NOT CONNECT DIRECTLY TO THE NEGATIVE TERMINAL OF THE DEAD BATTERY).
- 5) Start the engine of the vehicle that is providing the jump start and turn off electrical accessories. Then start the engine in the car with the discharged battery.
- 6) Reverse these directions exactly when removing the jumper cables. The negative cable must be disconnected from the engine that was jump started first.

REMOVE AND REPLACE

When handling a battery, the following safety precautions should be followed:

- 1) Hydrogen gas is produced by the battery. A flame or spark near the battery may cause the gas to ignite.
- 2) Battery fluid is highly acidic. Avoid spilling on clothing or other fabric. Any spilled electrolyte should be flushed with large quantity of water and cleaned immediately. To remove or replace a battery, always disconnect the negative cable first, then the positive cable.

BATTERY CABLES

Connect battery cables as shown in the figure below and make sure to properly tighten all terminals.

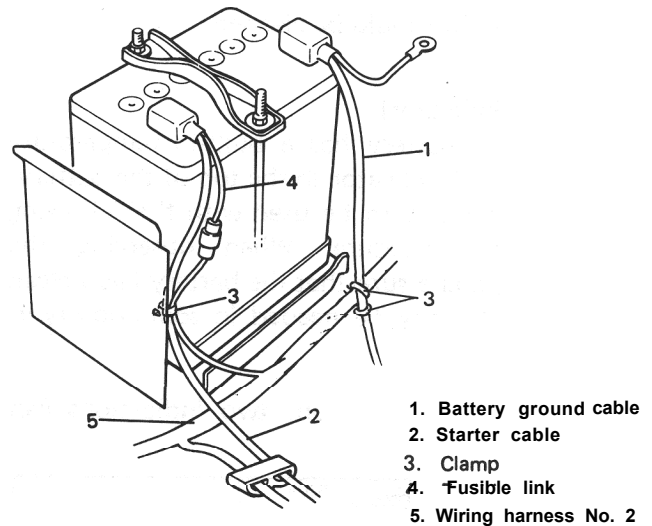


Fig. 10-24