

CHARGING SYSTEM

	Page
CHARGING SYSTEM CIRCUITS	9-2
ON-VEHICLE INSPECTION	9-3
ALTERNATOR (CONVENTIONAL TYPE)	9-8
ALTERNATOR (HEAVY DUTY TYPE)	9-20
ALTERNATOR REGULATOR	9-30

9-2 CHARGING SYSTEM — Charging System Circuits

CHARGING SYSTEM CIRCUITS

Fig. 9-1

12V TYPE

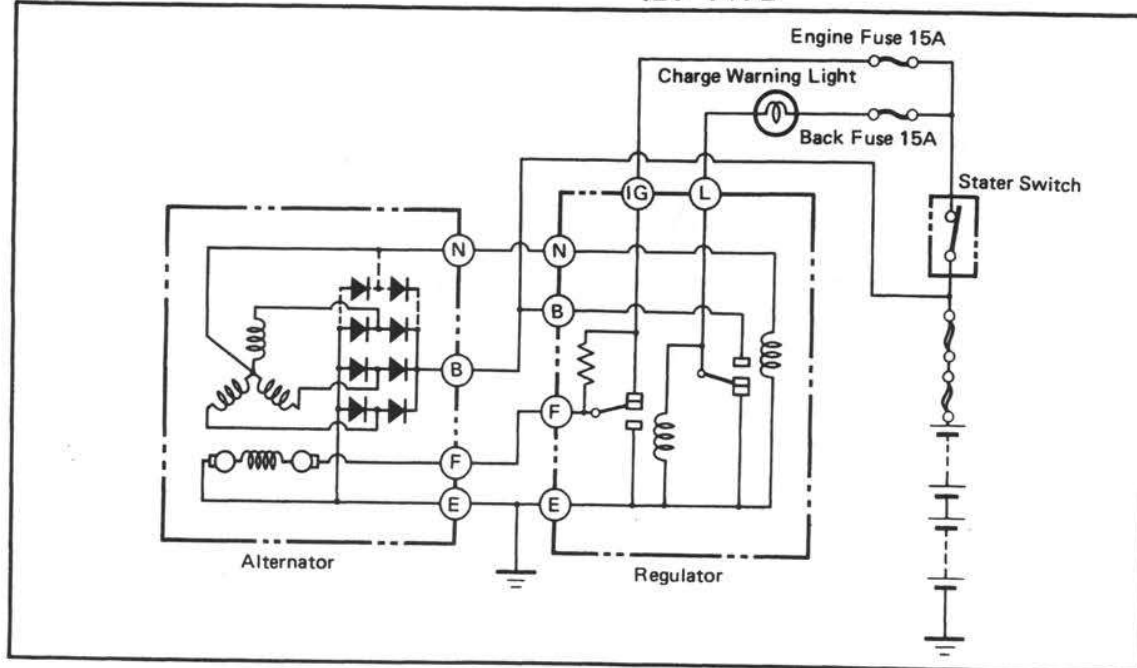
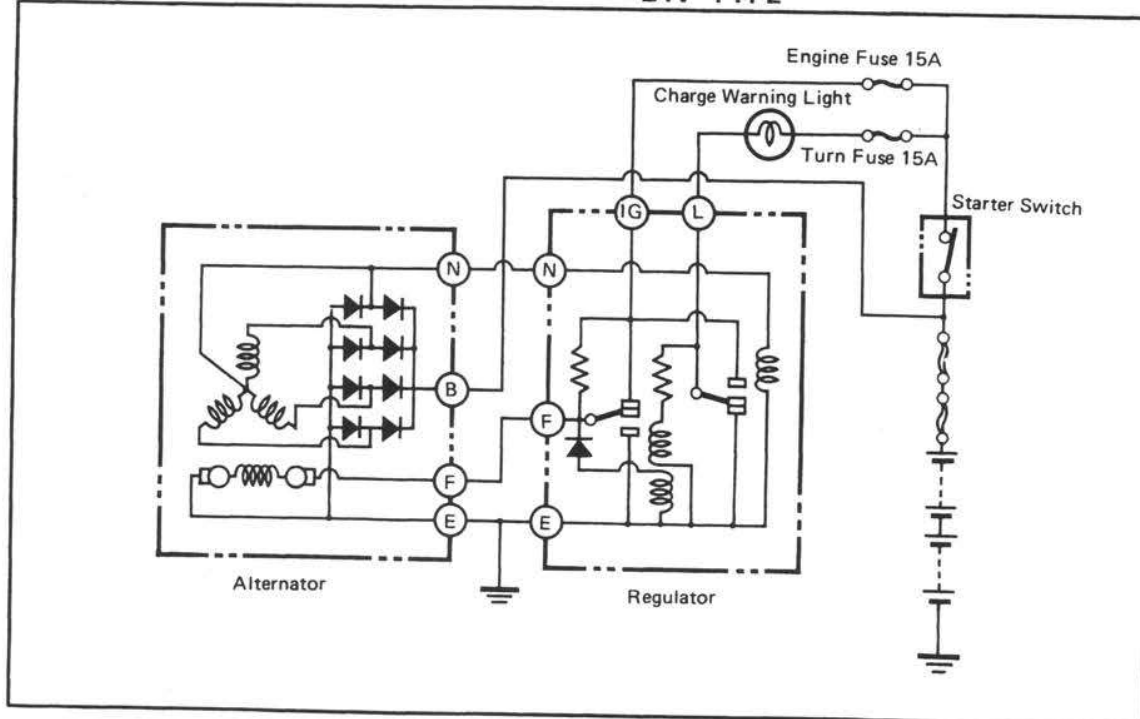


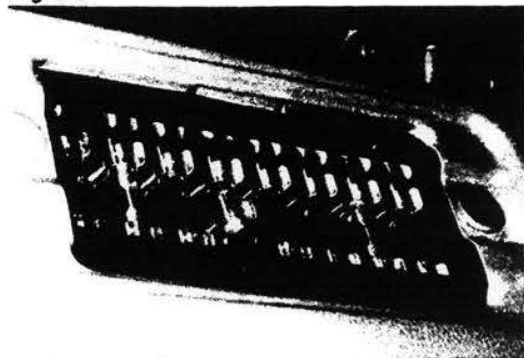
Fig. 9-2

24V TYPE

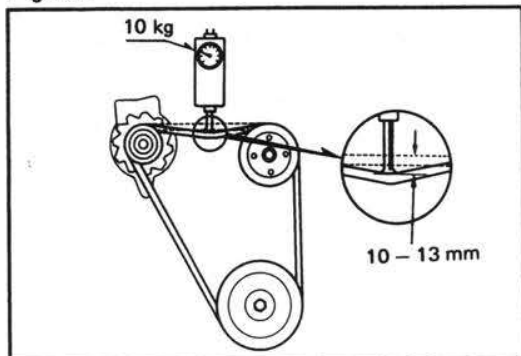


CHARGING SYSTEM – On-Vehicle Inspection

9-3

Fig. 9-3**ON-VEHICLE INSPECTION****CHECK FOLLOWING ITEMS**

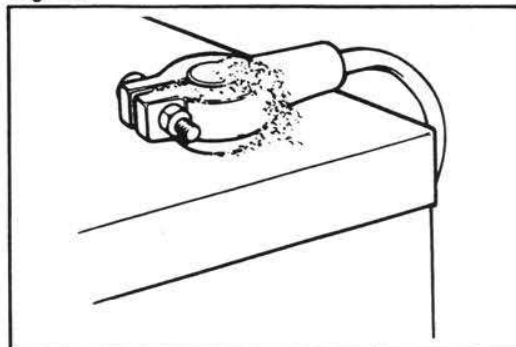
1. Fuses

Fig. 9-4

2. Drive belt tension

Fig. 9-5

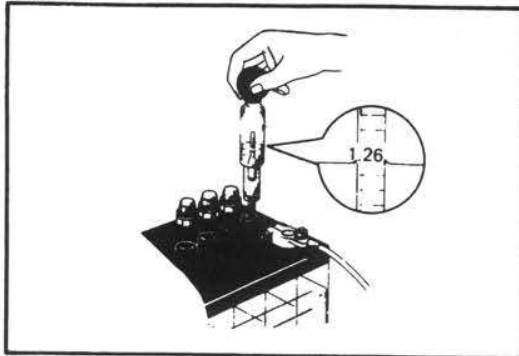
3. Wiring condition

Fig. 9-6

4. Battery terminal
Looseness
Corrosion
Burn

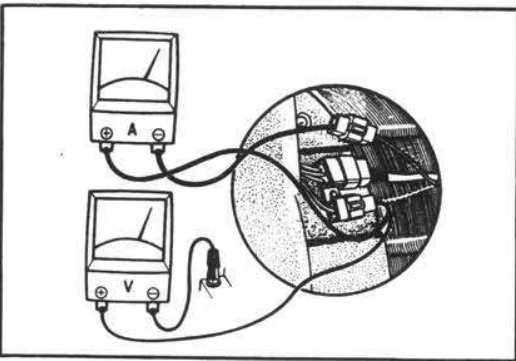
9-4 CHARGING SYSTEM – On-Vehicle Inspection

Fig. 9-7



5. Specific gravity
1.25 – 1.27 at 20°C (68°F)

Fig. 9-8

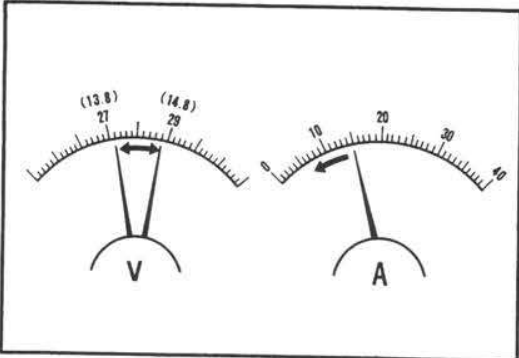


PERFORMANCE TEST

When Voltmeter & Ammeter are Used.

1. Connect voltmeter and ammeter as illustrated, and switch off all accessory parts.

Fig. 9-9



2. No-load performance test

Engine speed Idling to 2000 rpm

Regulated voltage

12V type 13.8 – 14.8V

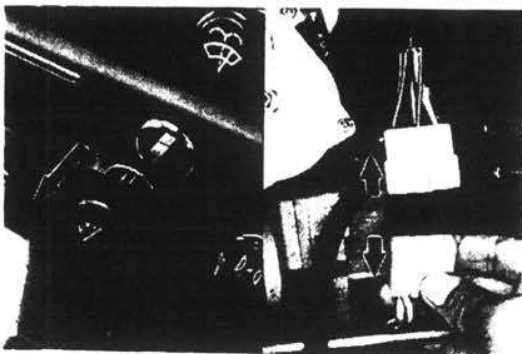
24V type 27 – 29V

Current

24V, 15A type Less than 10A

Others Less than 15A

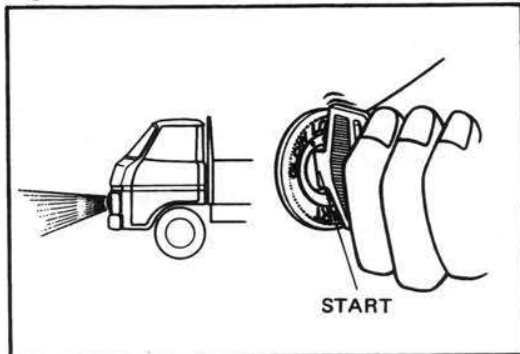
Fig. 9-10



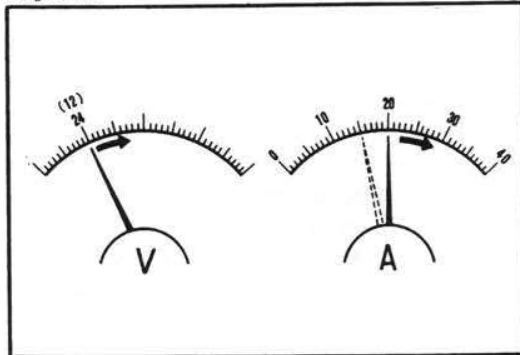
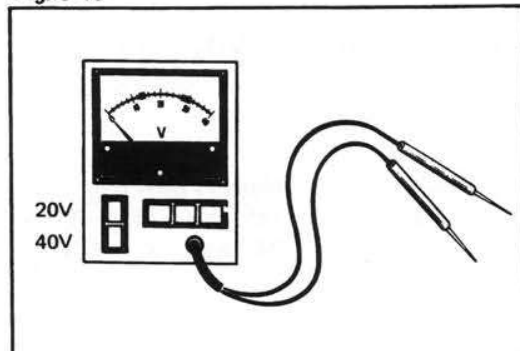
3. Load performance test
 - (1) Pull the stop button all the way out, or disconnect the connector of EDIC motor wires, and crank the engine by turning starter motor for 5 to 10 seconds.

CHARGING SYSTEM – On-Vehicle Inspection

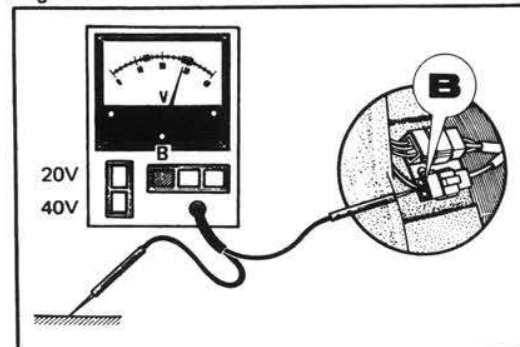
9-5

Fig. 9-11

- (2) Turn on head lights and accessories.
- (3) Start the engine, and run it at approximately 2000 rpm.

Fig. 9-12**Regulated voltage 12V or 24V****Current****24V, 15A & 20A type****More than 15A****Others****More than 20A****Fig. 9-13****PERFORMANCE TEST****When Alternator Checker is Used.**

1. Attach tester wirings to tester.
2. Push "20V" button when testing 12V type alternator, and push "40V" button when testing 24 V type alternator.

Fig. 9-14

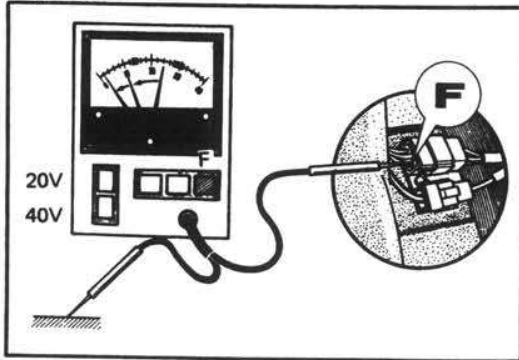
3. Start the engine.
4. Push "B" button and check "B" terminal voltage with the engine speed from idling to 2000 rpm.

Standard voltage**12V type 13.8 – 14.8V****24V type 27 – 29V**

If not within standard, probable cause is alternator regulator.

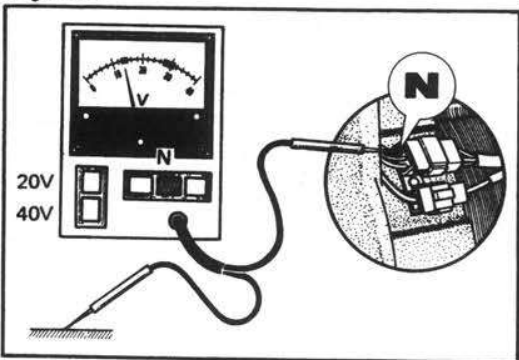
9-6 CHARGING SYSTEM – On-Vehicle Inspection

Fig. 9-15



5. Push "F" button and check "F" terminal voltage.
Gradually raise engine speed. The checker reading should gradually decrease from 12V or 24V to 2V.
If decrease is not registered, probable cause is alternator regulator.

Fig. 9-16



6. Push "N" button and check "N" terminal voltage by maintaining engine speed at approximately 1500 rpm.
The needle should be at about half the "B" terminal voltage.

Standard voltage

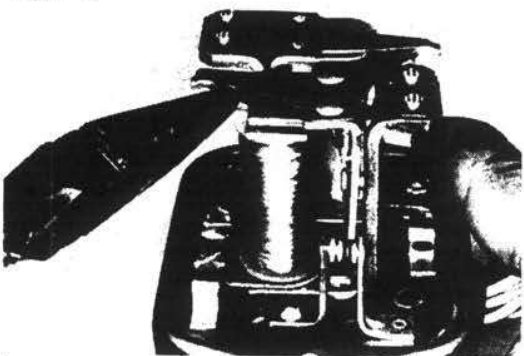
12V type 6.9 – 7.4V

24 type 13.5 – 14.5V

If the voltage is higher, the cause will be (+) rectifier.

If the voltage is lower, the cause will be (–) rectifier.

Fig. 9-17

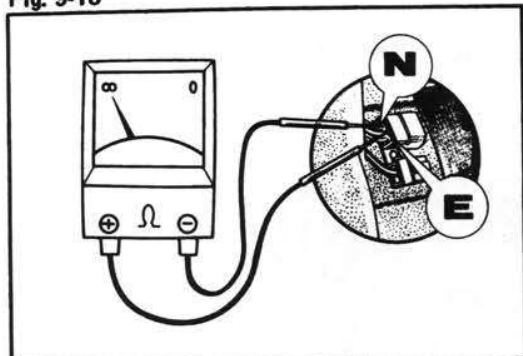


ADJUST OUTPUT VOLTAGE

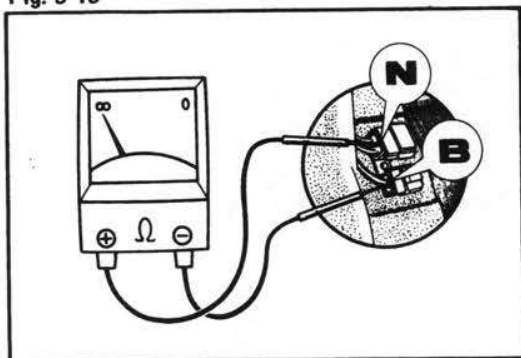
If not within the output voltage, adjust by bending the adjusting arm.

Engine speed	Idling to 2000 rpm
Voltage	12V type 13.8 – 14.8V
	24V type 27 – 29V

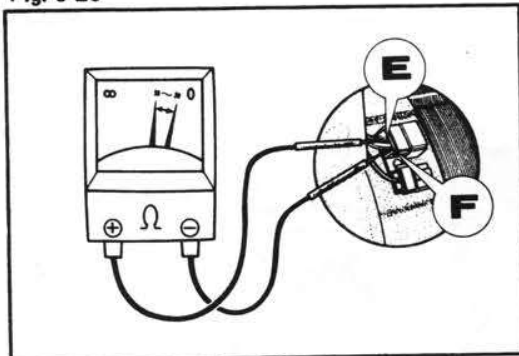


CHARGING SYSTEM – On-Vehicle Inspection**9-7****Fig. 9-18****INSPECT ALTERNATOR**

1. Negative side rectifier short test
Connect an ohmmeter (–) lead to “N” terminal and (+) lead to “E” terminal.
Meter should indicate infinity.

Fig. 9-19

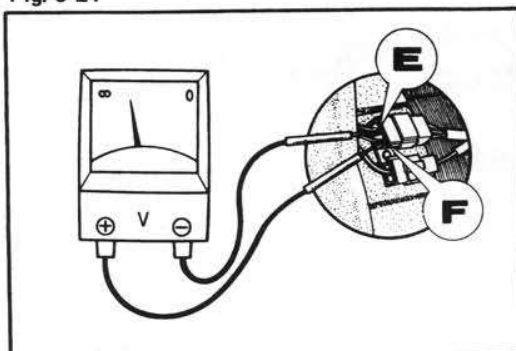
2. Positive side rectifier short test
Connect an ohmmeter (–) lead to “B” terminal and (+) lead to “N” terminal.
Meter should indicate infinity.

Fig. 9-20

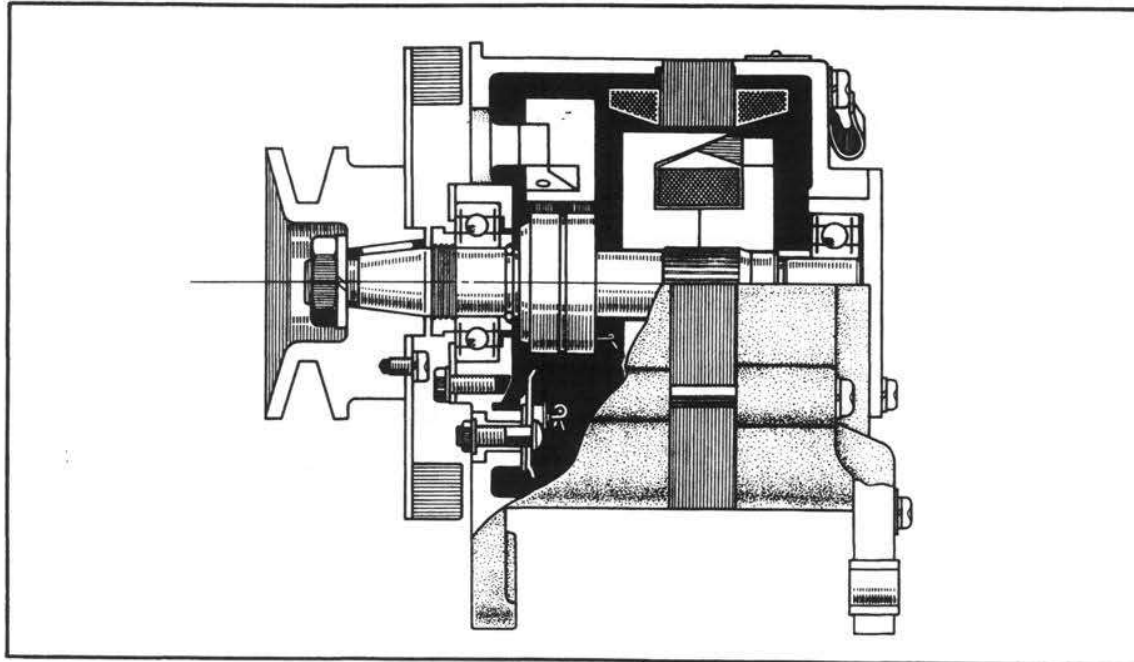
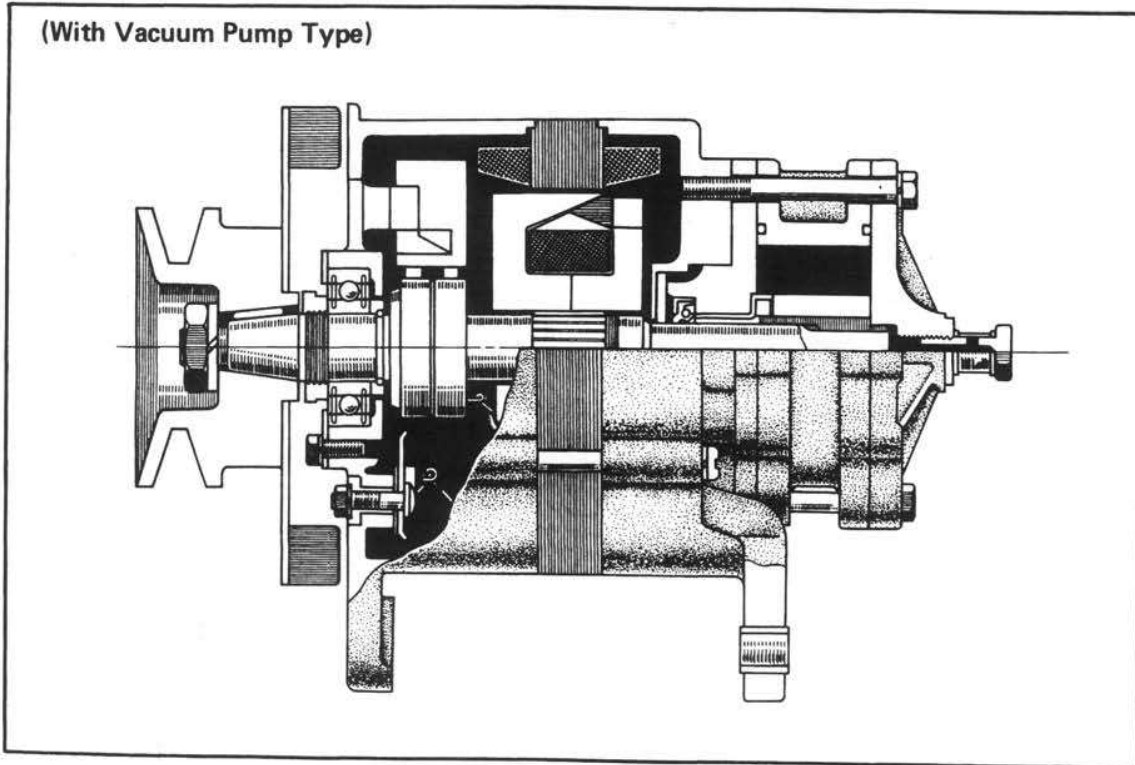
3. Check rotor coil resistance.

Resistance

12V, 35A type	4.2Ω
24V, 15A type	19.0Ω
24V, 20A type	19.0Ω
24V, 65A type	19.0Ω

Fig. 9-21

4. Check if there is battery voltage at “F” terminal when the ignition switch is turned to “ON” position.
If not, check “ENGINE” fuse.

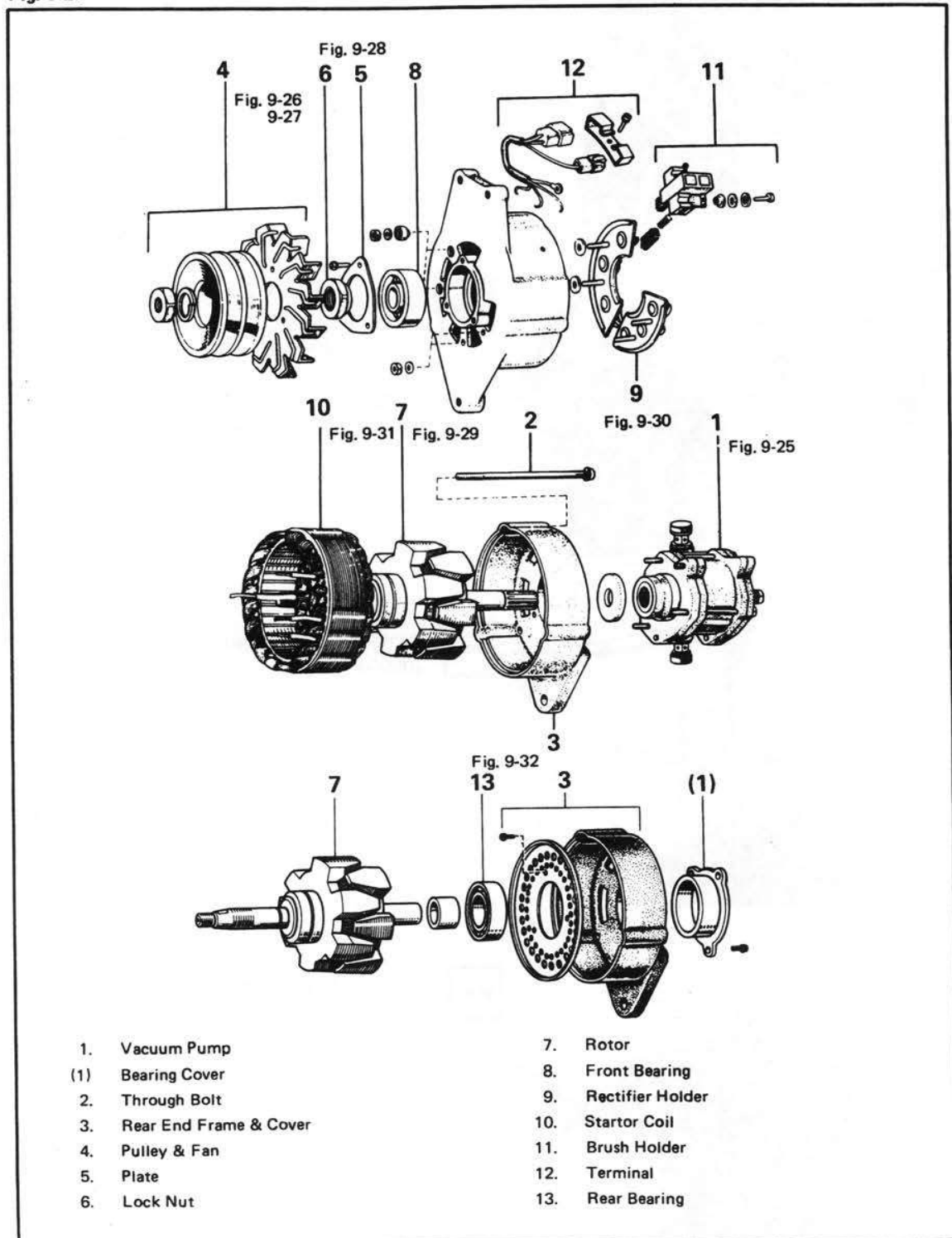
9-8 CHARGING SYSTEM – Alternator (Conventional Type)**ALTERNATOR (CONVENTIONAL TYPE)****CROSS SECTIONAL VIEW****Fig. 9-22****Fig. 9-23****(With Vacuum Pump Type)**

CHARGING SYSTEM — Alternator (Conventional Type)

9-9

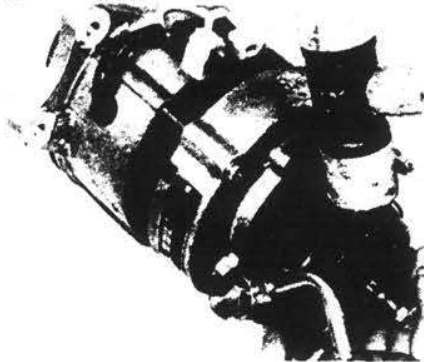
DISASSEMBLY

Disassemble in numerical order.

Fig. 9-24

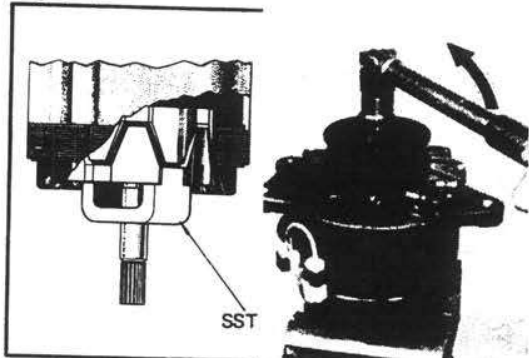
9-10 CHARGING SYSTEM – Alternator (Conventional Type)

Fig. 9-25



Lightly tap the vacuum pump with a plastic hammer, and remove the pump.

Fig. 9-26

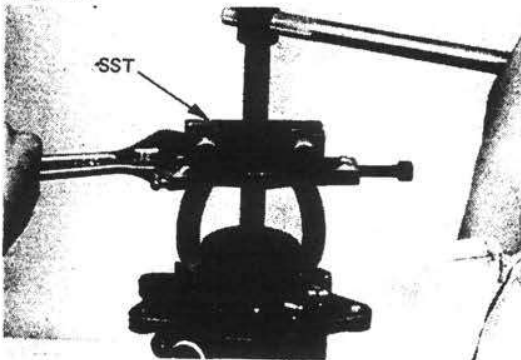


Lock SST[09841-56010] in a vise, and secure rotor core onto SST. Loosen pulley nut.

— Note —

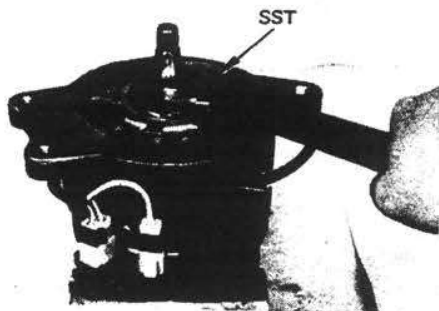
Do not damage stator coil.

Fig. 9-27



Remove pulley together with fan with SST [09950-20011].

Fig. 9-28



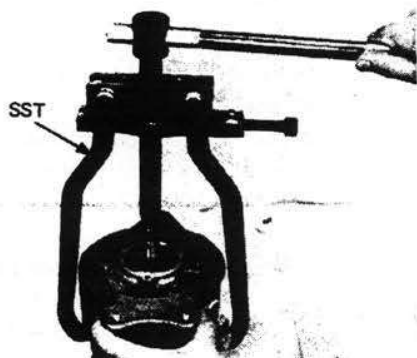
Remove bearing lock nut with SST[09333-55011].

— Note —

The lock nut has left-hand thread.

CHARGING SYSTEM – Alternator (Conventional Type)

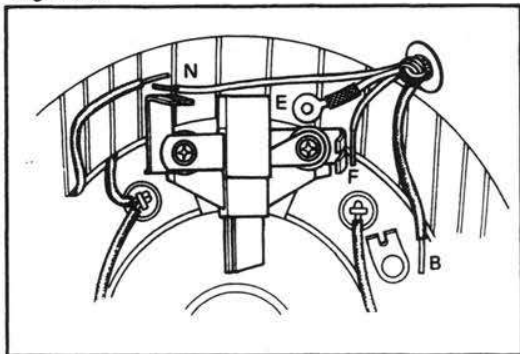
9-11

Fig. 9-29

Remove rotor with SST [09950-20011].

— Note —

Do not damage stator coil.

Fig. 9-30

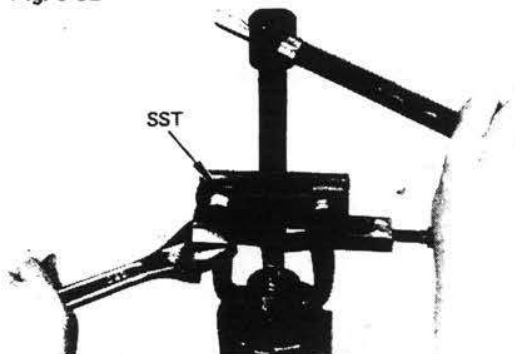
Disconnect "E", "N", "F" and "B" leads by melting solder, and remove stator coil with rectifier holders.

Fig. 9-31

Disconnect stator coil from rectifier holder by melting solder.

— Note —

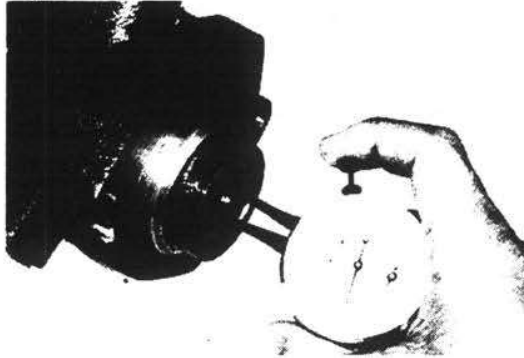
To unsolder the leads, hold the rectifier lead with a long nose pliers to protect rectifier from heat.

Fig. 9-32

Remove rotor shaft rear bearing with SST [09286-46011].

9-12 CHARGING SYSTEM – Alternator (Conventional Type)

Fig. 9-33



INSPECTION

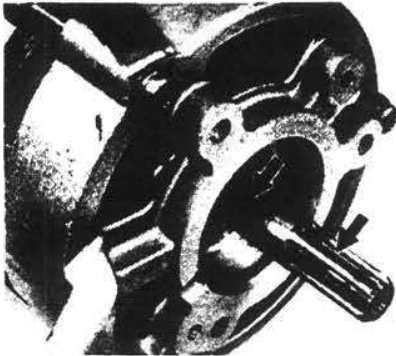


Vacuum Pump

1. Check oil seal and bearing for wear and damage.
2. Measure vacuum pump bearing bore and if it exceeds the limit, replace vacuum pump assembly.

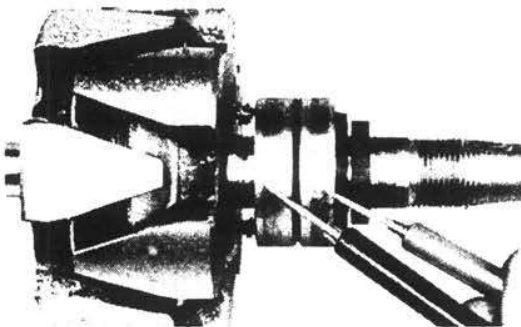
Bore Limit	16.14 mm (0.6354 in.)
STD	16.04 – 16.06 mm (0.6315 – 0.6323 in.)

Fig. 9-34



3. Check the bushing journal and spline tooth for wear.

Fig. 9-35

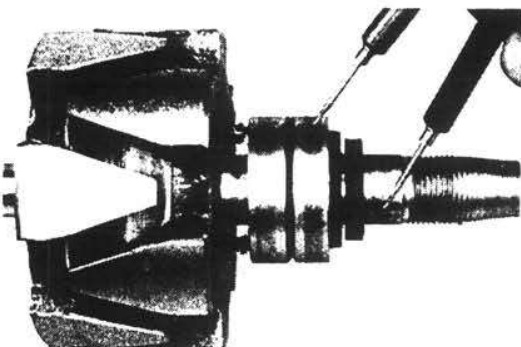


Rotor

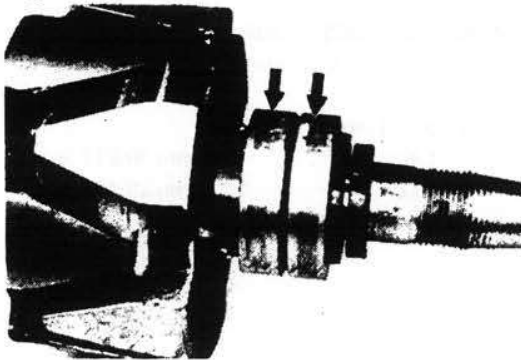
1. Open circuit test
If there is no continuity between the rings, the circuit is open and the rotor must be replaced.

Resistance	
12V, 35A type	4.2Ω
24V, 15A type	19.0Ω
24V, 20A type	19.0Ω

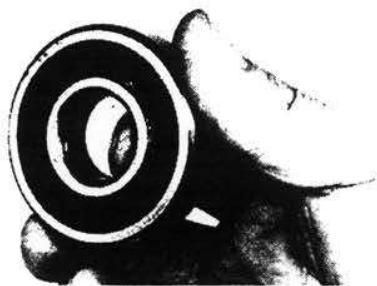
Fig. 9-36



2. Ground test
If there is continuity between slip ring and rotor, the rotor is grounded and must be replaced.

CHARGING SYSTEM – Alternator (Conventional Type)**9-13****Fig. 9-37**

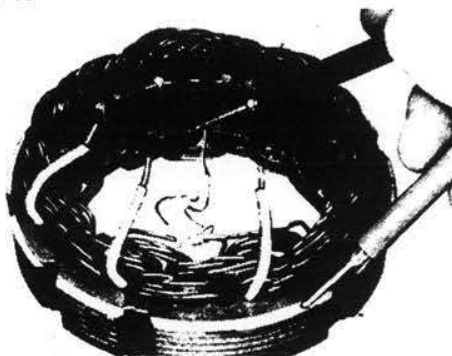
3. Check to see that the slip ring is not dirty or burnt.

Fig. 9-38**Bearing**

Check bearing for wear or roughness.

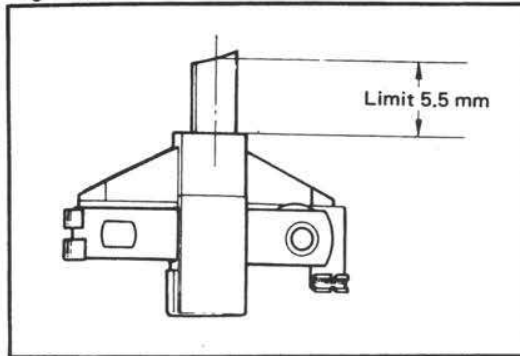
Fig. 9-39**Stator**

1. Open circuit test
Check all four leads for continuity.
If there is no continuity, circuit is open and the stator assembly must be replaced.

Fig. 9-40

2. Ground test
If there is continuity between stator core and stator coil lead, coil is grounded and the stator assembly must be replaced.

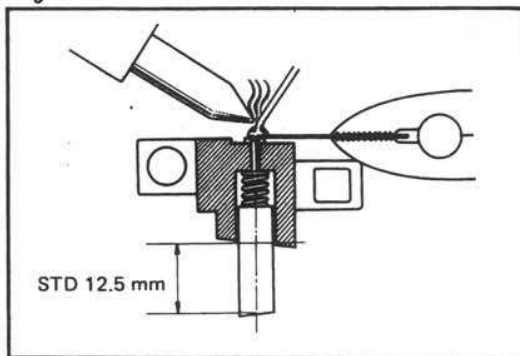
9-14

CHARGING SYSTEM – Alternator (Conventional Type)**Fig. 9-41****Brush & Brush Holder**

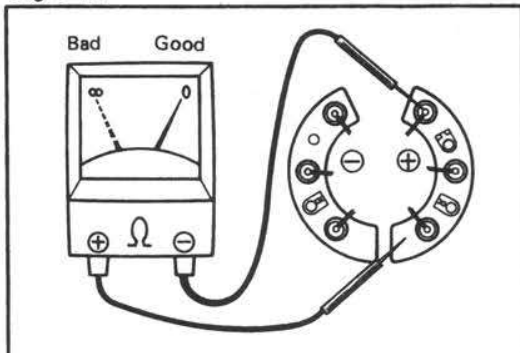
Check exposed brush length.

Exposed length

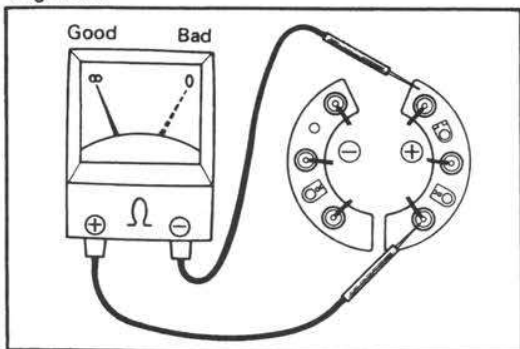
Limit	5.5 mm (0.217 in.)
STD	12.5 mm (0.492 in.)

Fig. 9-42

When replacing the brushes, solder brush lead wire with brush exposed about 12.5 mm (0.492 in.), and cut off excess wire.

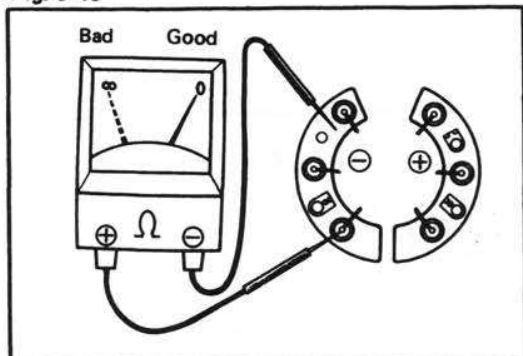
Fig. 9-43**Rectifier**

1. Rectifier holder, positive side
Connect an ohmmeter (+) lead to the rectifier holder, and the (-) lead of the meter to the rectifier terminal.
If there is no continuity, the rectifier assembly must be replaced.

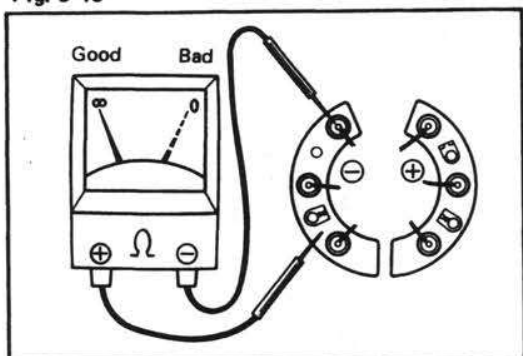
Fig. 9-44

Reverse polarity of test leads and check again.

If there is continuity, the rectifier assembly must be replaced.

CHARGING SYSTEM – Alternator (Conventional Type)**9-15****Fig. 9-45**

2. Rectifier holder, negative side
Connect an ohmmeter (+) lead to the rectifier terminal, and the (-) lead of the meter to the rectifier holder.
If there is no continuity, the rectifier assembly must be replaced.

Fig. 9-46

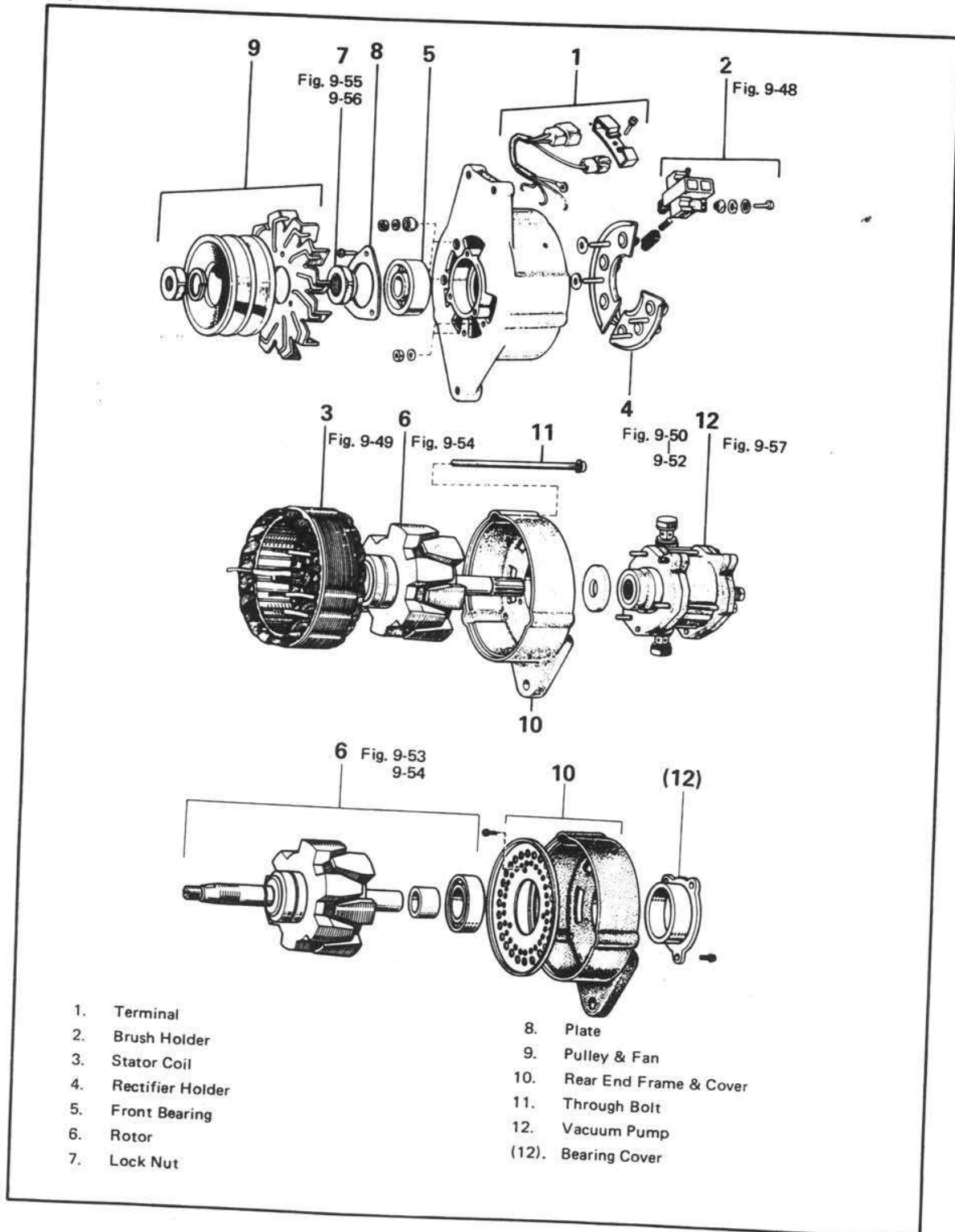
Reverse polarity of test leads and check again.

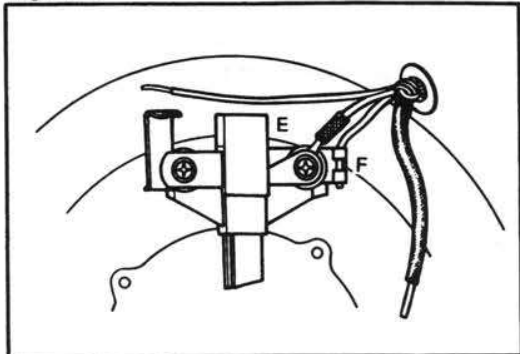
If there is continuity, the rectifier assembly must be replaced.

9-16

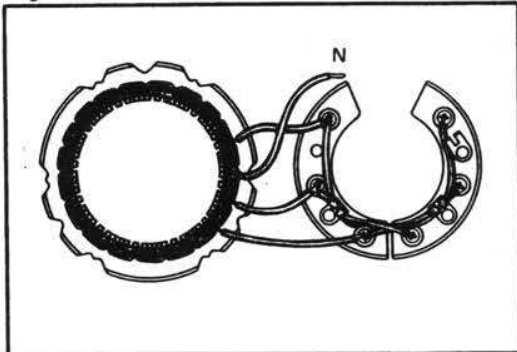
CHARGING SYSTEM – Alternator (Conventional Type)**ASSEMBLY**

Assemble in numerical order.

Fig. 9-47

CHARGING SYSTEM – Alternator (Conventional Type)**9-17****Fig. 9-48**

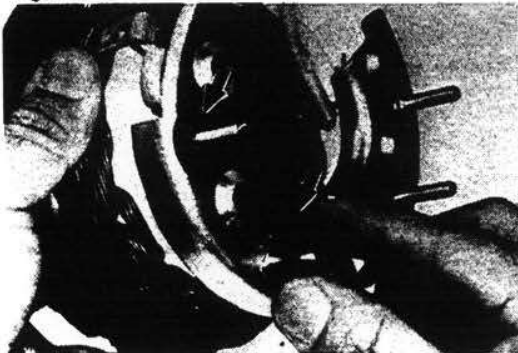
Tie lead wires and solder "F" terminal onto the brush holder.
Connect "E" terminal.

Fig. 9-49

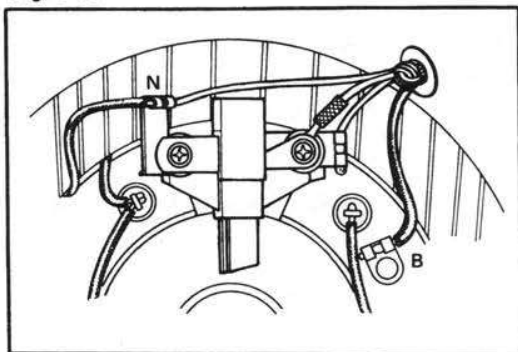
Solder each stator lead to the positive rectifier.

— Note —

When soldering the leads, hold the rectifier terminal with a long nose pliers to protect the rectifier from heat.

Fig. 9-50

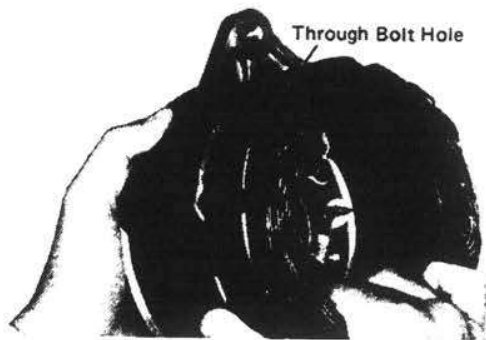
Assemble the rectifier holders and stator coil with insulators onto the drive end frame.

Fig. 9-51

Solder stator coil "N" lead together with the socket "N" lead onto the brush holder, and "B" lead onto the positive rectifier holder.

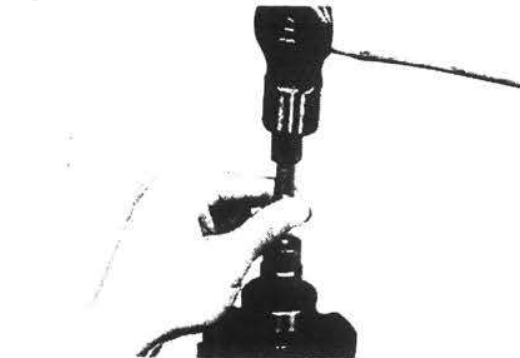
9-18 CHARGING SYSTEM – Alternator (Conventional Type)

Fig. 9-52



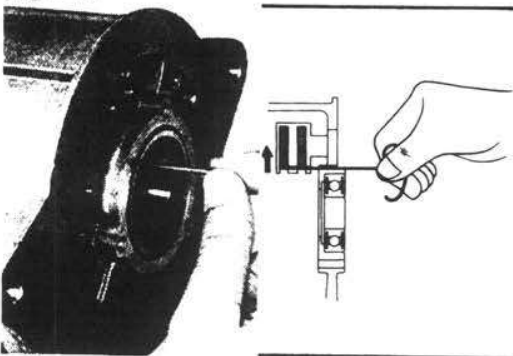
Align stator coil notch with the through bolt hole when assembling the stator coil.

Fig. 9-53



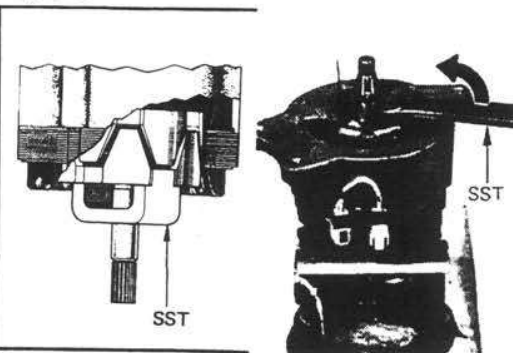
Drive in rotor shaft rear bearing onto rotor shaft.

Fig. 9-54



Push in brushes and temporarily hold in place with wire.

Fig. 9-55

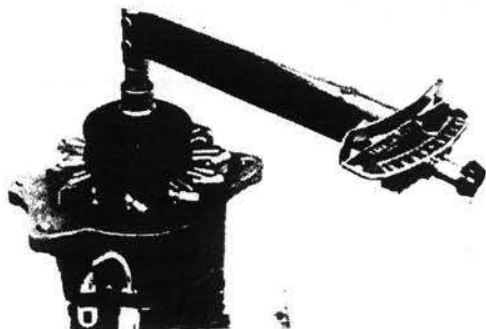


Lock SST[09841-56010] in a vise, and secure rotor core onto SST.
Tighten bearing lock nut with SST[09333-55011].

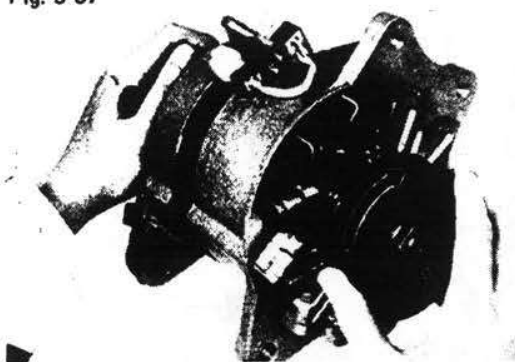
Torque 5.6 – 8 kg-m (41 – 58 ft-lb)

– Note –

1. The lock nut has left-hand thread.
2. Do not damage stator coil.

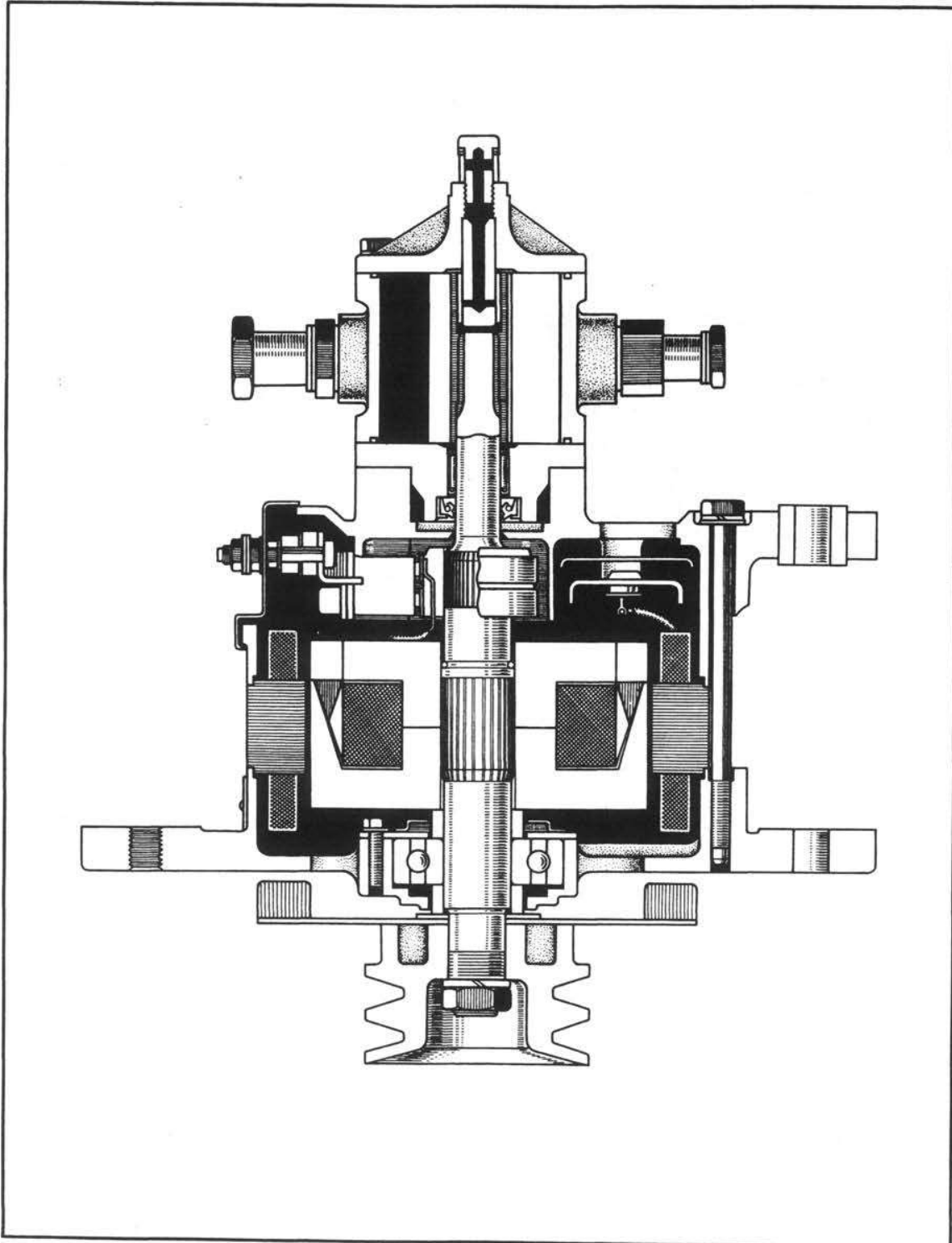
CHARGING SYSTEM – Alternator (Conventional Type)**9-19****Fig. 9-56**

Tighten pulley nut.

Torque 5.0 – 6.5 kg-m (37 – 47 ft-lb)**Fig. 9-57**

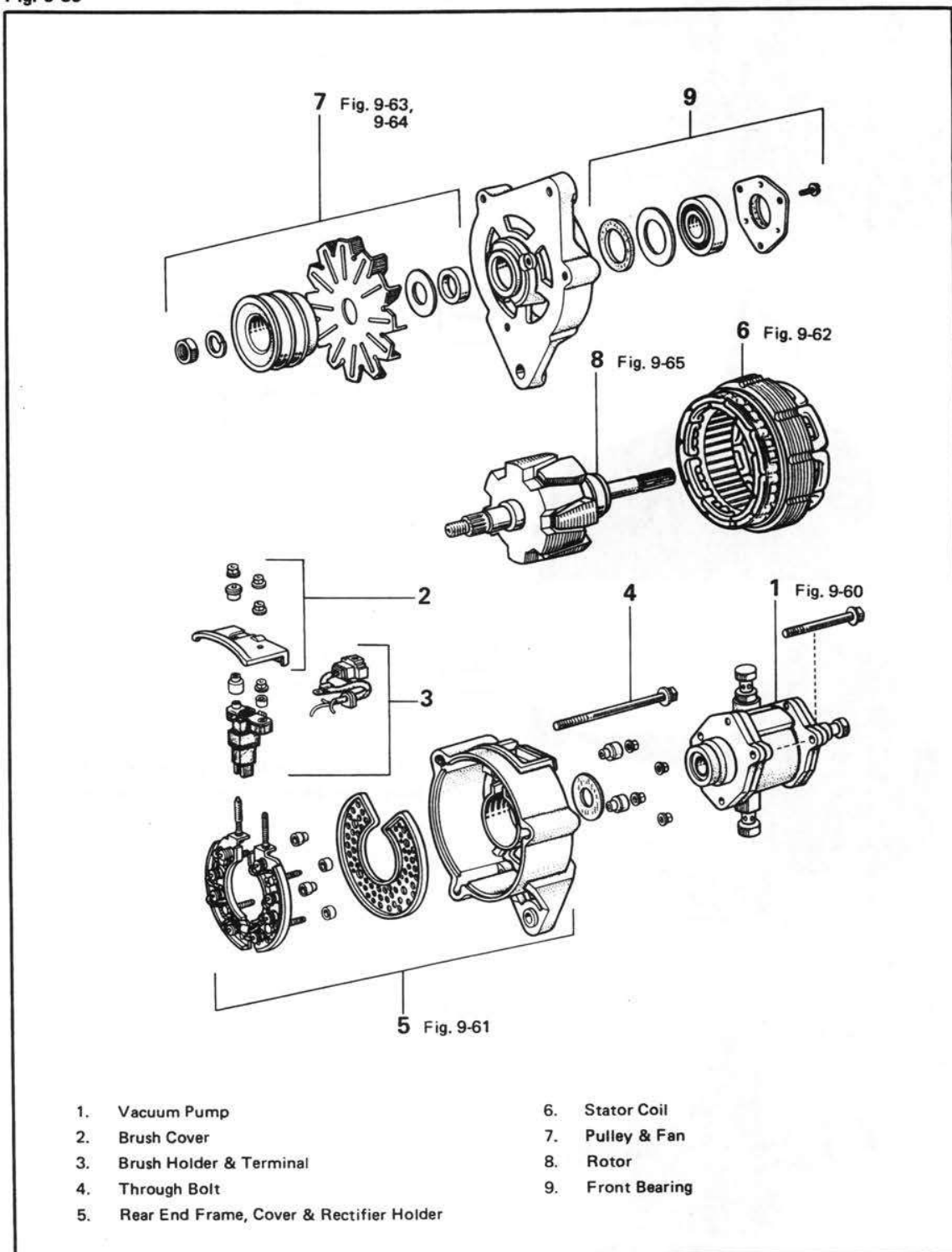
Check rotor for smooth rotation after assembly is completed.

9-20

CHARGING SYSTEM – Alternator (Heavy Duty Type)**ALTERNATOR (HEAVY DUTY TYPE)**
CROSS SECTIONAL VIEW**Fig. 9-58**

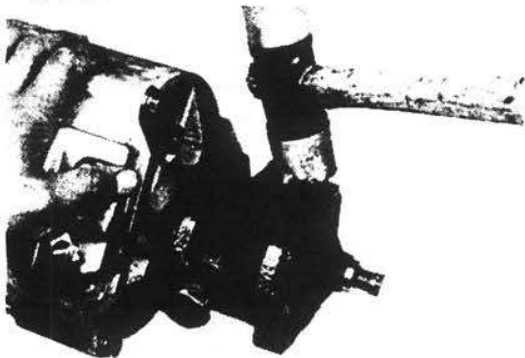
CHARGING SYSTEM – Alternator (Heavy Duty Type)**9-21****DISASSEMBLY**

Disassemble in numerical order.

Fig. 9-59

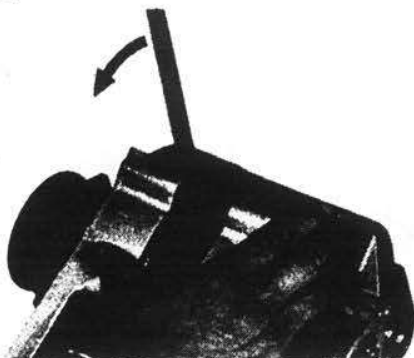
9-22 CHARGING SYSTEM – Alternator (Heavy Duty Type)

Fig. 9-60



Lightly tap vacuum pump with a plastic hammer to remove the pump.

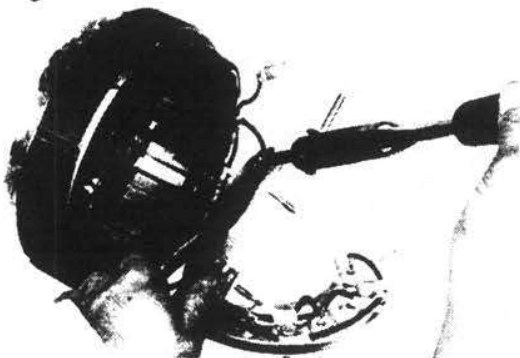
Fig. 9-61



Pry off drive end frame from stator.

— Caution —
Do not damage coil wires.

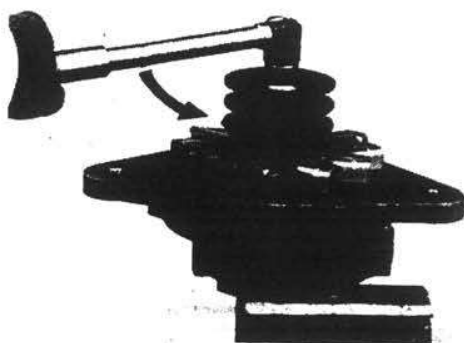
Fig. 9-62



Disconnect stator coil from rectifier holder by melting solder.

— Note —
To unsolder the leads, hold rectifier lead with a long nose pliers to protect rectifier from heat.

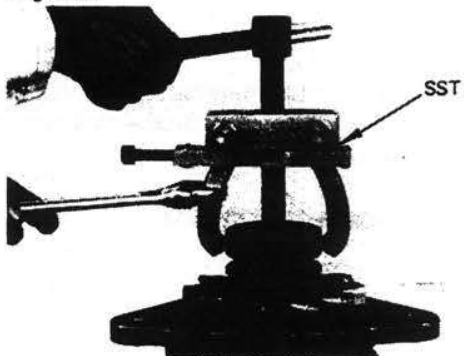
Fig. 9-63



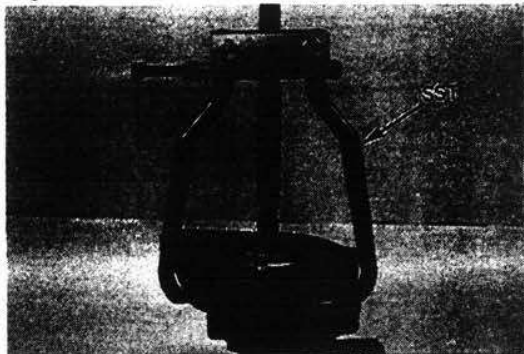
Using a soft jaw vise, loosen pulley nut.

CHARGING SYSTEM – Alternator (Heavy Duty Type)

9-23

Fig. 9-64

Remove pulley with SST [09950-20011].

Fig. 9-65

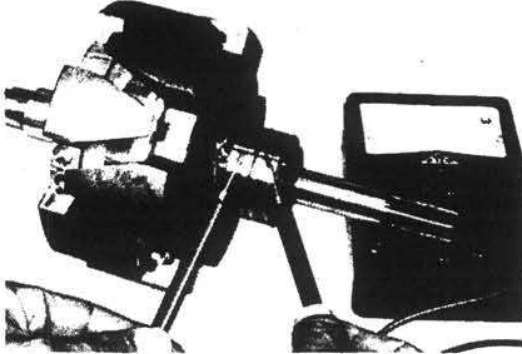
Remove drive end frame with SST [09950-20011].

Fig. 9-66**INSPECTION****Vacuum Pump**

1. Check oil seal and bearing for wear and damage.

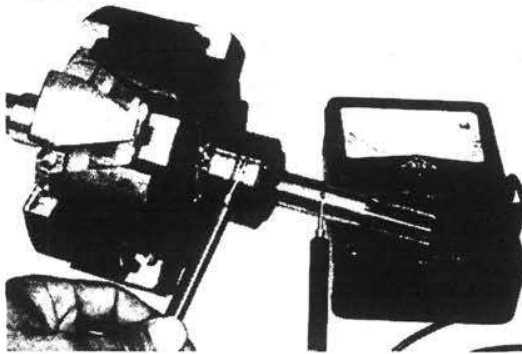
Fig. 9-67

2. Check bearing journal and spline tooth for wear.

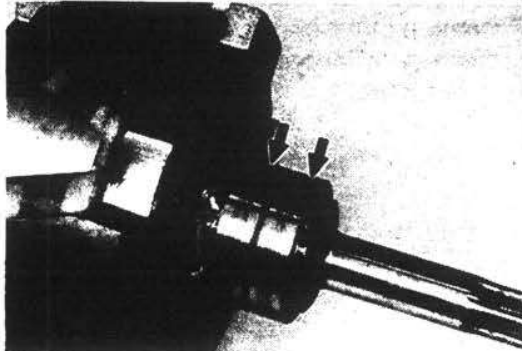
9-24 CHARGING SYSTEM – Alternator (Heavy Duty Type)
Fig. 9-68**Rotor**

1. Open circuit test
If there is no continuity between the rings, the circuit is open and the rotor must be replaced.

Resistance **19.0Ω**

Fig. 9-69

2. Ground test
If there is continuity between slip ring and rotor, the rotor is grounded and must be replaced.

Fig. 9-70

3. Check to see that the slip ring is not dirty or burnt.

Fig. 9-71**Bearing**

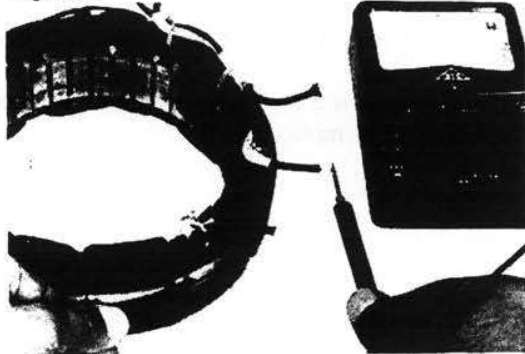
Check bearing for wear or roughness.

CHARGING SYSTEM— Alternator (Heavy Duty Type)

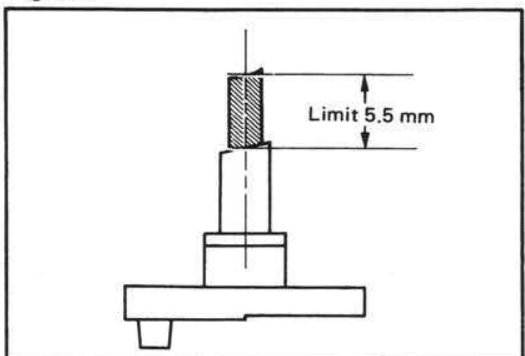
9-25

Fig. 9-72**Stator**

1. Open circuit test
Test all five leads for continuity.
If there is no continuity, circuit is open and the stator assembly must be replaced.

Fig. 9-73

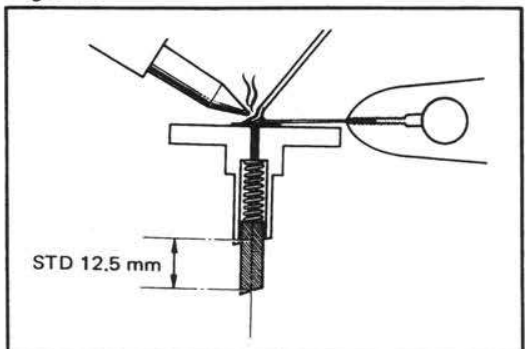
2. Ground test
If there is continuity between stator core and stator coil lead, coil is grounded and the stator assembly must be replaced.

Fig. 9-74**Brush & Brush Holder**

Check exposed brush length.

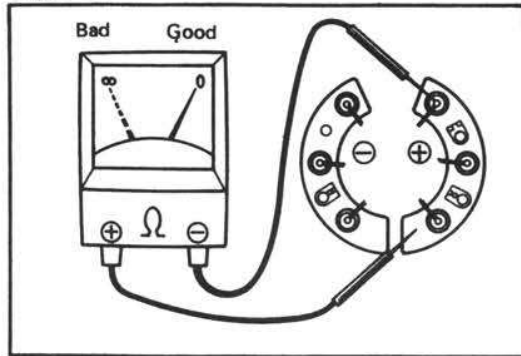
Exposed length

Limit	5.5 mm (0.217 in.)
STD	12.5 mm (0.492 in.)

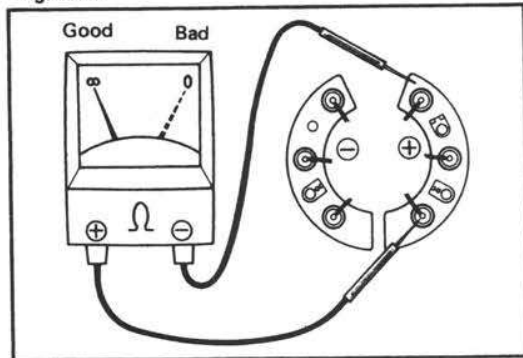
Fig. 9-75

When replacing brushes, solder brush lead wire with brush exposed about 12.5 mm (0.492 in.). Cut off excess wire.

9-26

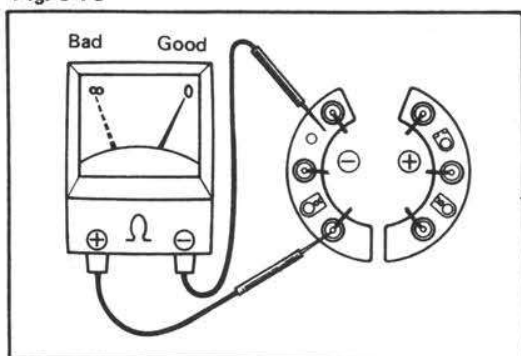
CHARGING SYSTEM – Alternator (Heavy Duty Type)**Fig. 9-76****Rectifier**

1. Rectifier holder, positive side
Connect an ohmmeter (+) lead to the rectifier holder, and the (-) lead of the meter to the rectifier terminal.
If there is no continuity, the rectifier assembly must be replaced.

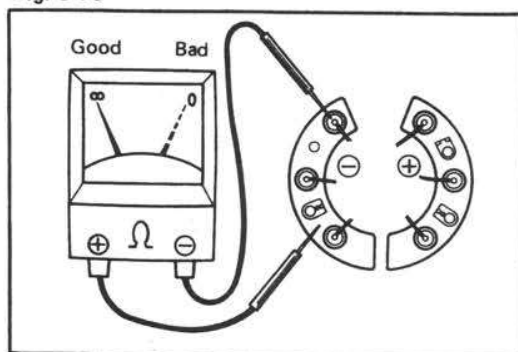
Fig. 9-77

Reverse polarity of test leads and check again.

If there is continuity, the rectifier assembly must be replaced.

Fig. 9-78

2. Rectifier holder, negative side
Connect an ohmmeter (+) lead to the rectifier terminal, and the (-) lead of the meter to the rectifier holder.
If there is no continuity, the rectifier assembly must be replaced.

Fig. 9-79

Reverse polarity of test leads and check again.

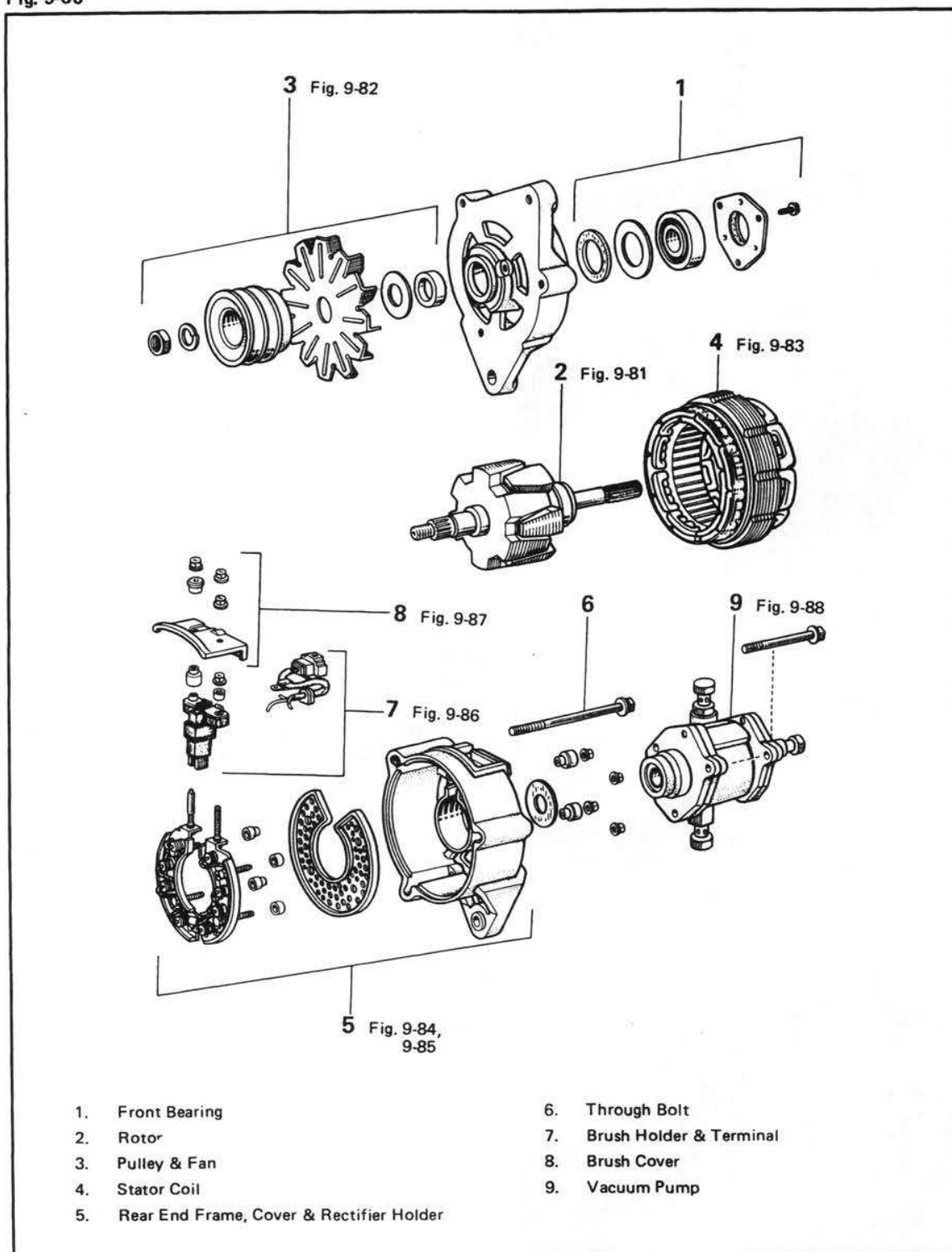
If there is continuity, the rectifier assembly must be replaced.

CHARGING SYSTEM – Alternator (Heavy Duty Type)

9-27

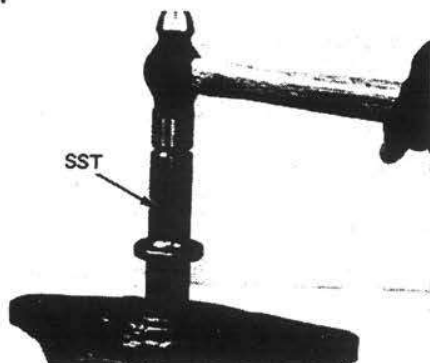
ASSEMBLY

Assemble in numerical order.

Fig. 9-80

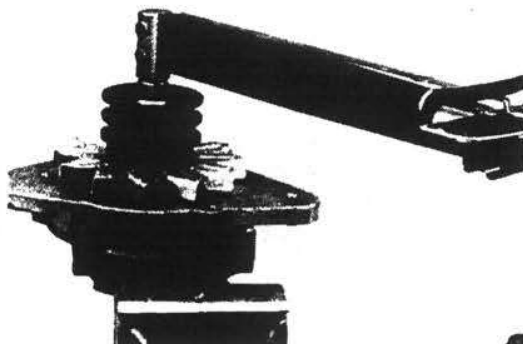
9-28 CHARGING SYSTEM – Alternator (Heavy Duty Type)

Fig. 9-81



Drive the end frame assembly onto the rotor shaft with SST [09325-12010].

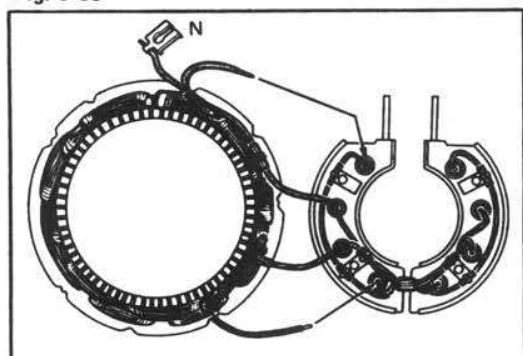
Fig. 9-82



Tighten pulley nut.

Torque 5.0 – 6.5 kg-m (37 – 47 ft-lb)

Fig. 9-83

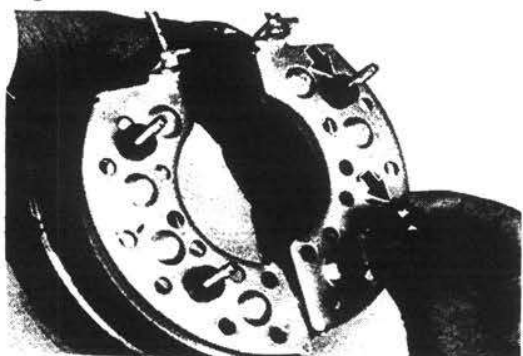


Solder each stator lead to the positive rectifier.

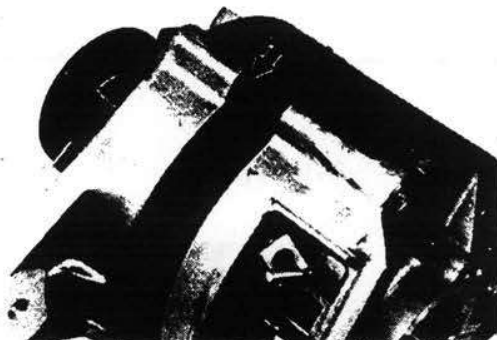
— Note —

When soldering the leads, hold the rectifier terminal with a long nose pliers to protect rectifier from heat.

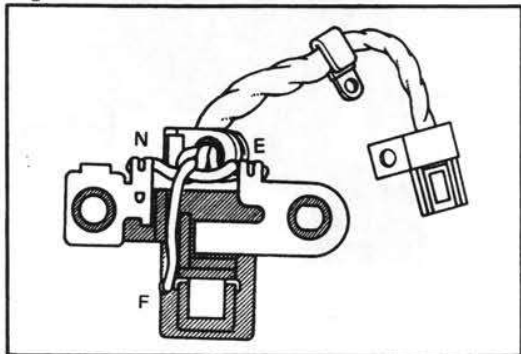
Fig. 9-84



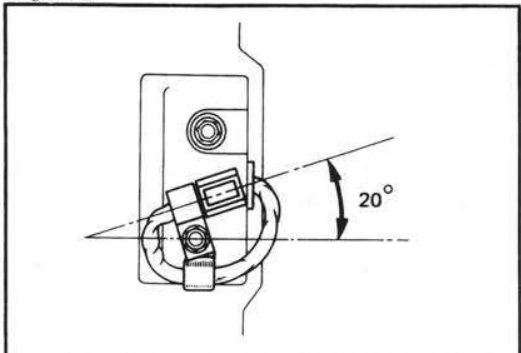
Position the insulators between "B" terminal and drive end frame.

CHARGING SYSTEM – Alternator (Heavy Duty Type)**9-29****Fig. 9-85**

Align the stator coil notch with the through bolt hole of the drive end frame.

Fig. 9-86

Solder "E", "F" and "N" leads to the brush holder.

Fig. 9-87

Assemble the connector in the position as shown.

Fig. 9-88

Check the rotor for smooth rotation after assembly is completed.

9-30 **CHARGING SYSTEM** – Alternator Regulator**ALTERNATOR REGULATOR**

Fig. 9-89

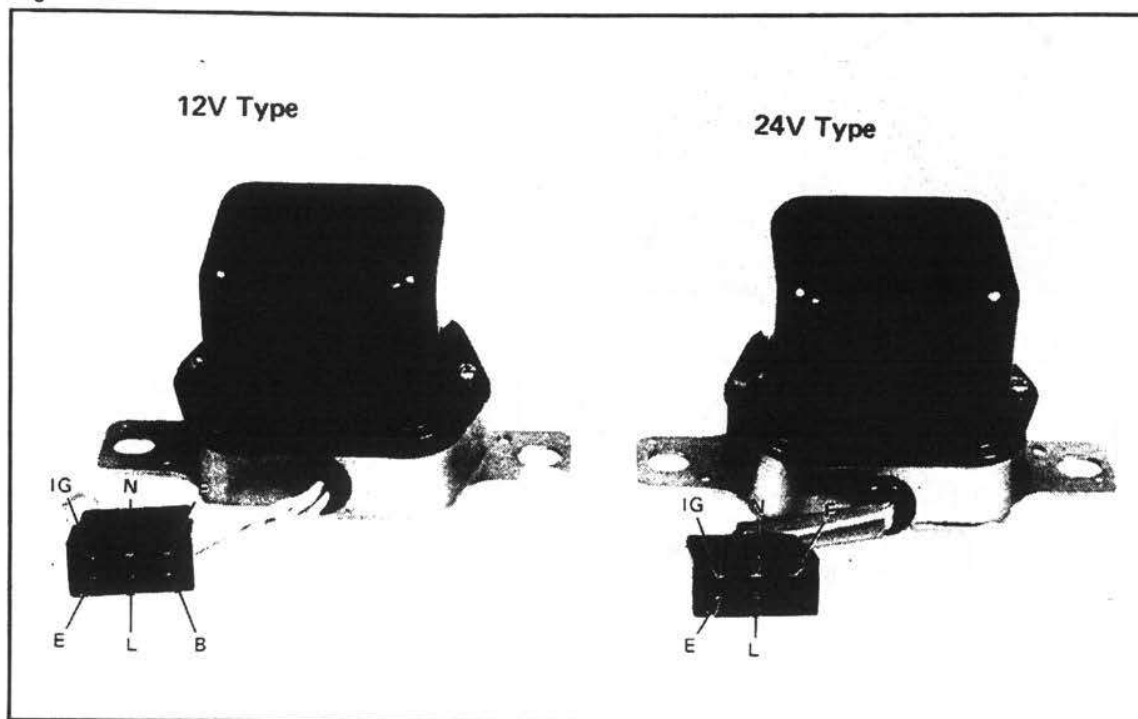


Fig. 9-90

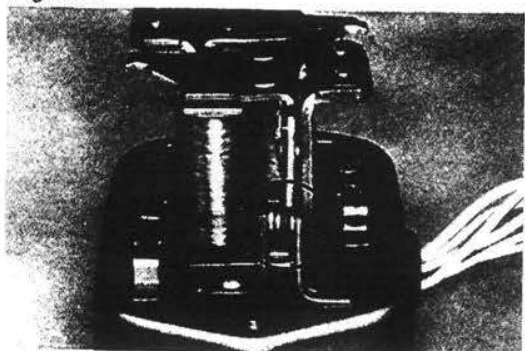
**INSPECTION & ADJUSTMENT**

1. Check connector fitting condition before inspecting regulator.

— Caution —

Always make sure that the regulator connector is pulled out when inspecting and adjusting.

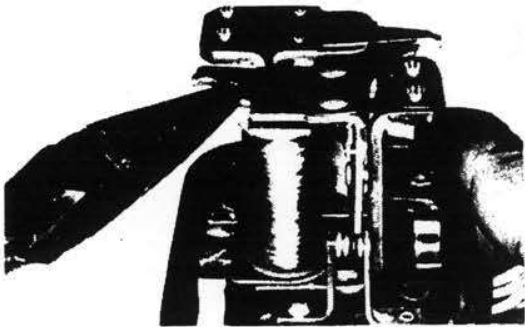
Fig. 9-91



2. Inspect each point surface for burns or excessive damage. Replace if defective.

CHARGING SYSTEM – Alternator Regulator 9-31

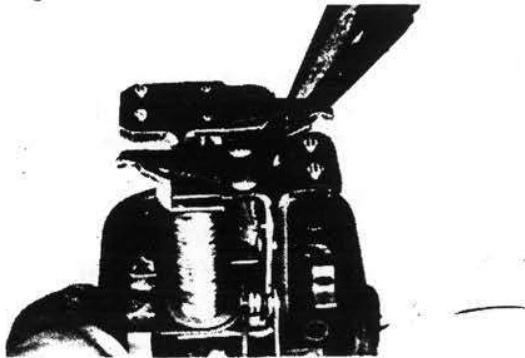
Fig. 9-92



3. To adjust voltage regulator, bend the regulator adjusting arm.

Regulating voltage	
12V type	13.8 – 14.8V
24V type	27 – 29V

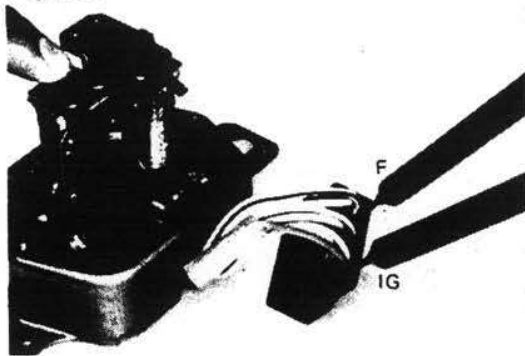
Fig. 9-93



4. To adjust voltage relay, bend the relay adjusting arm.

Relay actuating voltage	
12V type	4 – 5.8V
24V type	8 – 11.6V

Fig. 9-94



5. Measure resistance between terminals.
(1) IG – F

Voltage Regulator	12V Type	24V Type
At rest	0Ω	0Ω
Pulled in	About 11Ω	About 200Ω

Fig. 9-95

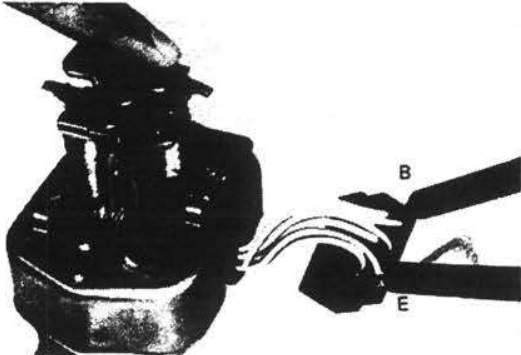


- (2) L – E

Voltage Relay	12V Type	24V Type
At rest	0Ω	0Ω
Pulled in	About 100Ω	About 200Ω

9-32 CHARGING SYSTEM – Alternator Regulator

Fig. 9-96

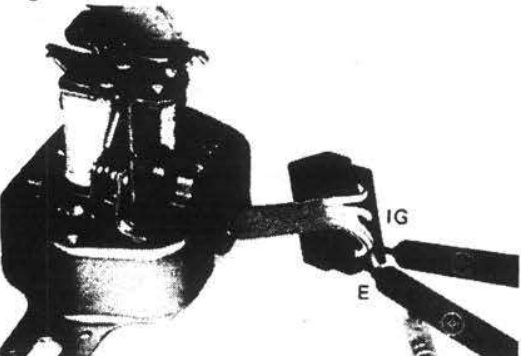


(3) B – E (For 12V type)

Voltage relay

At rest	Infinity
Pulled in	About 100Ω

Fig. 9-97



IG – E (For 24V type)

Connect an ohmmeter (+) lead to the "E" terminal, and the (–) lead of the meter to the "IG" terminal.

Voltage relay

At rest	Infinity
Pulled in	About 200Ω

Fig. 9-98

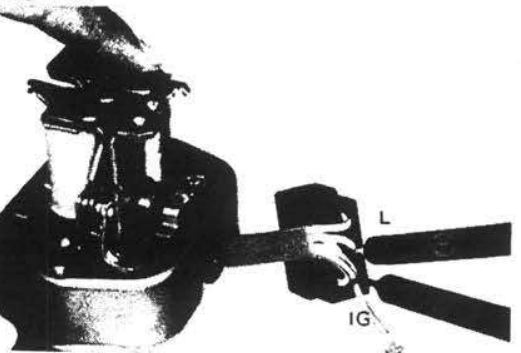


(4) B – L (For 12V type)

Voltage relay

At rest	Infinity
Pulled in	0Ω

Fig. 9-99

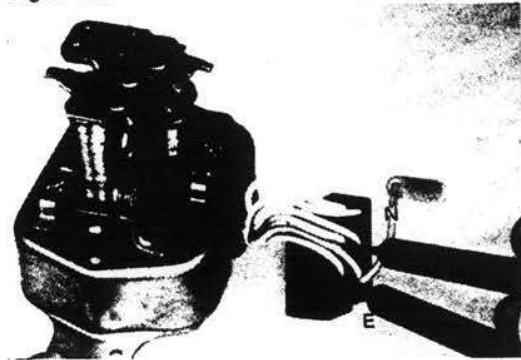


IG – L (For 24V type)

Connect an ohmmeter (+) lead to the "L" terminal, and the (–) lead of the meter to the "IG" terminal.

Voltage relay

At rest	Infinity
Pulled in	0Ω

CHARGING SYSTEM – Alternator Regulator**9-33****Fig. 9-100**

(5) N – E

12V type About 24 Ω 24V type About 100 Ω

