CHARGING SYSTEM

CHARGING SYSTEM CIRCUIT

Tirrill Regulator Type

Fig. 9-1

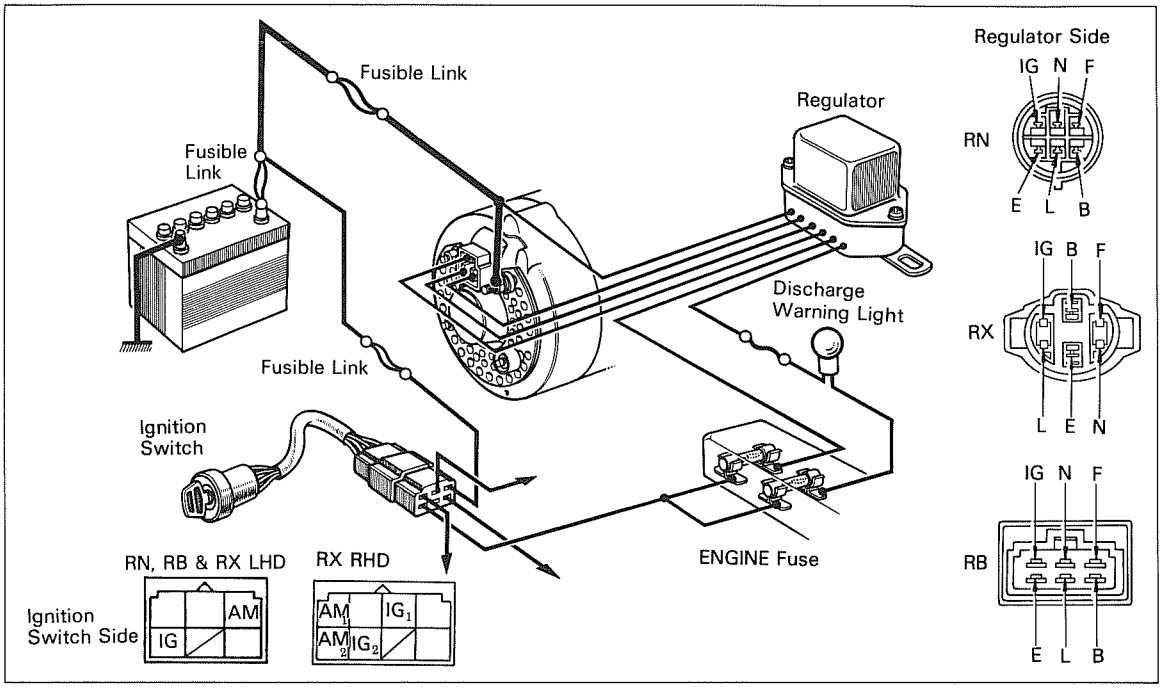
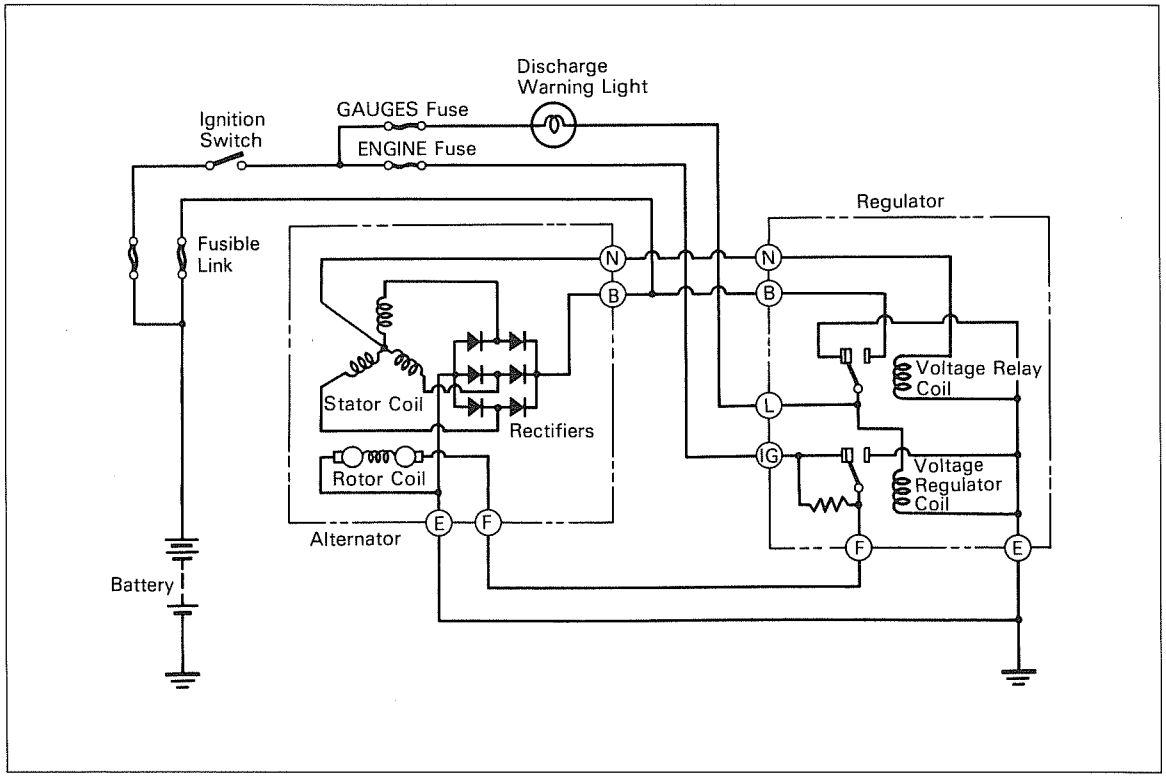


Fig. 9-2



Separate IC Regulator Type

Fig. 9-3

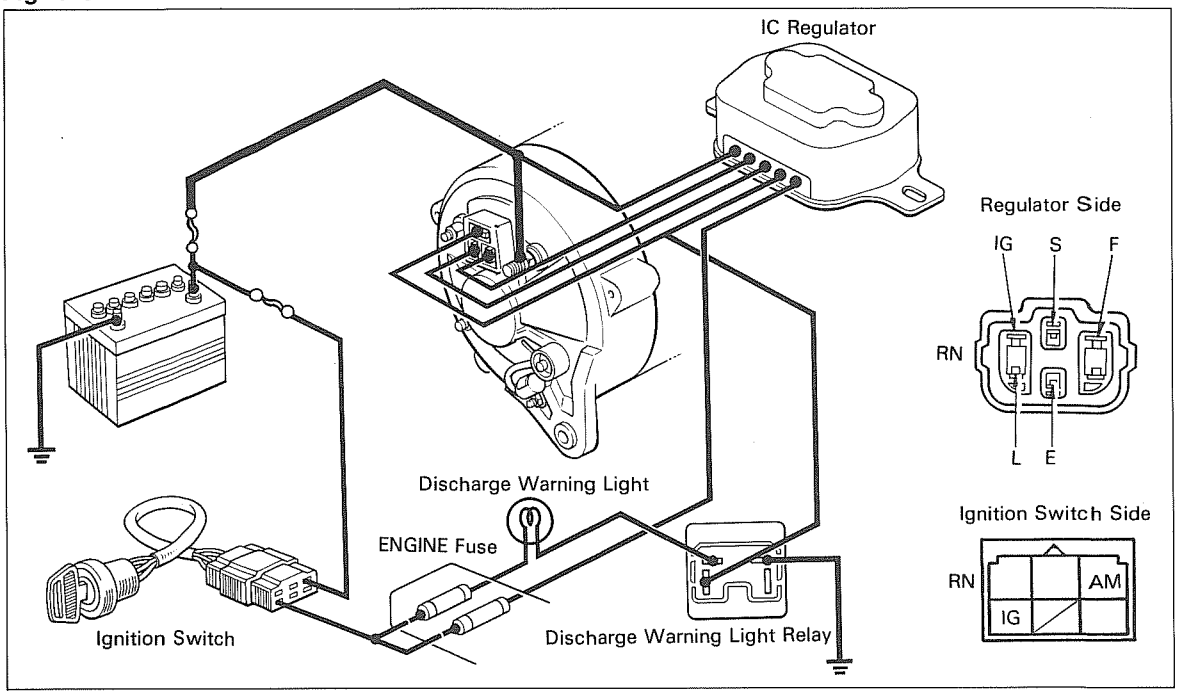
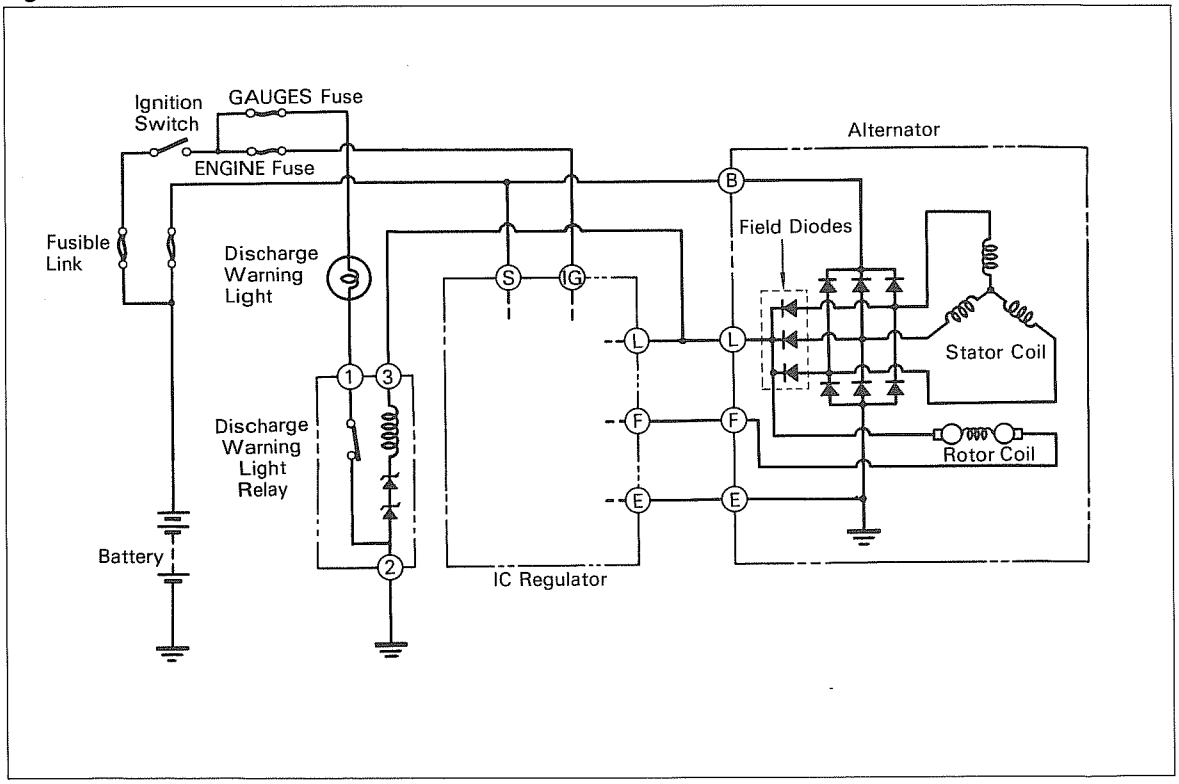


Fig. 9-4



Built-in IC Regulator Type

Fig. 9-5

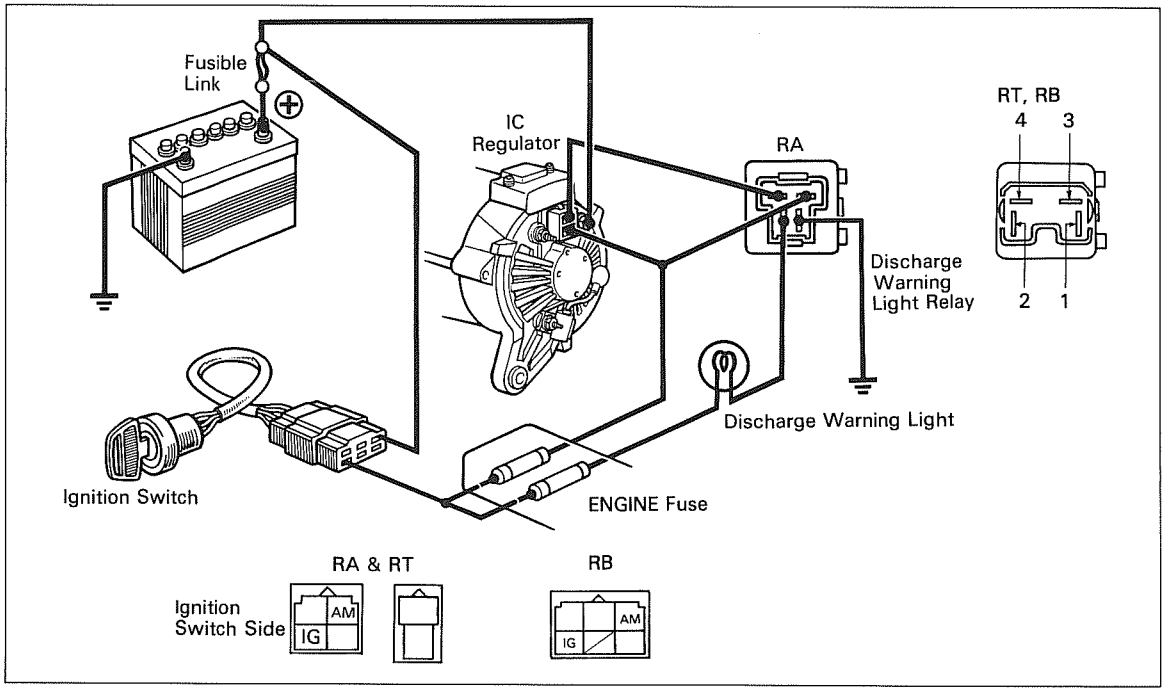


Fig. 9-6

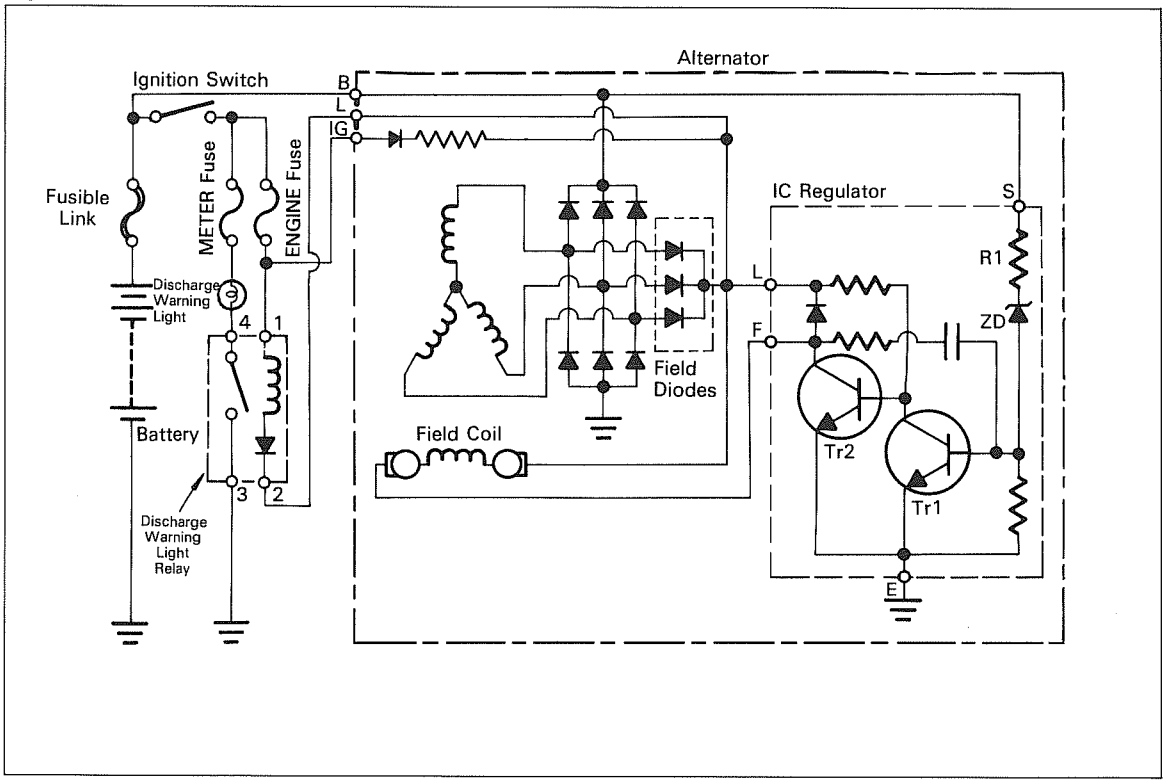
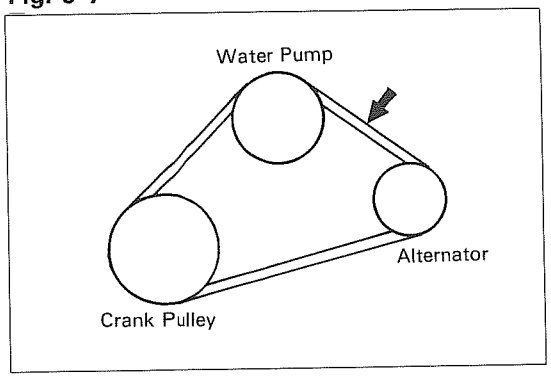


Fig. 9-7



ON-VEHICLE INSPECTION

[Tirrill Regulator Type]

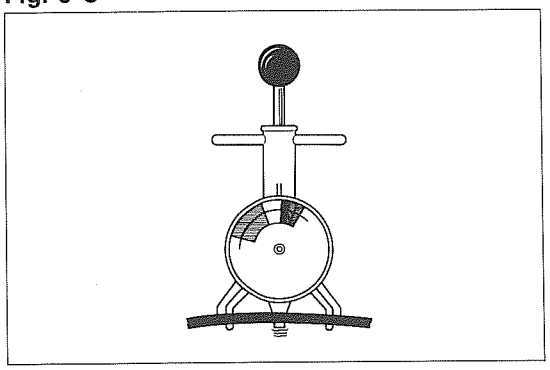
CHECK FOLLOWING ITEMS

1. Drive belt tension.
   (General Countries)

Drive belt tension at 10 kg (22 lb):

New belt	**5 – 7 mm (0.20 – 0.28 in.)**
Used belt	**7 – 10 mm (0.28 – 0.39 in.)**

Fig. 9-8

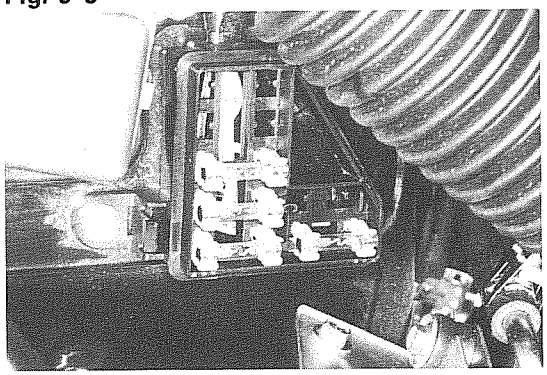


(USA & Canada)
Use a borroughs belt tension gauge, No. BT-33-73F.

Drive belt tension:

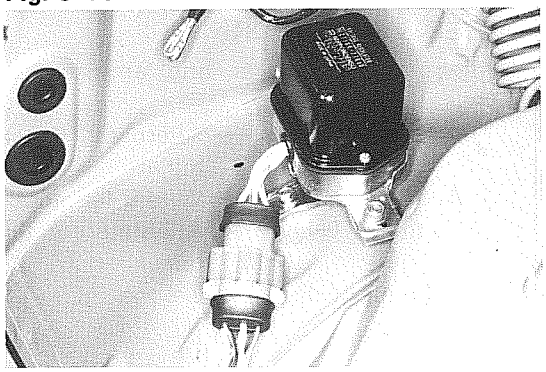
New belt	**100 – 150 lbs**
Used belt	**60 – 100 lbs**

Fig. 9-9



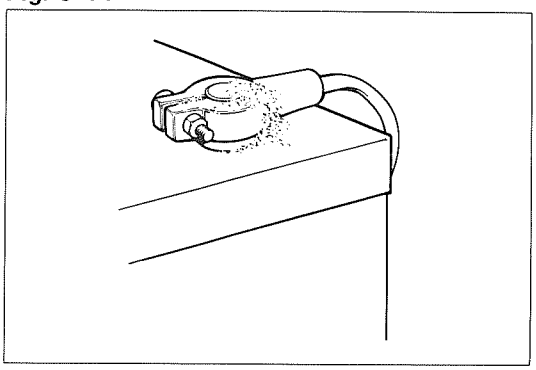
2. Fuses

Fig. 9-10



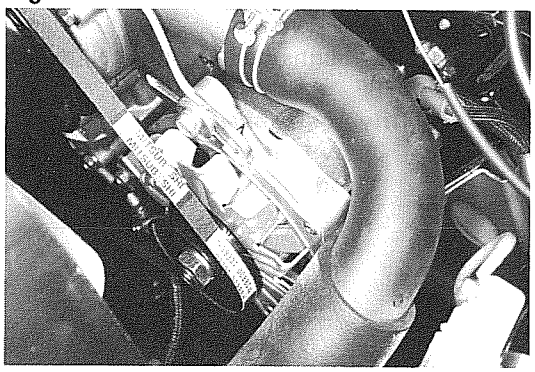
3. Installed condition of wiring for alternator and regulator.

Fig. 9-11



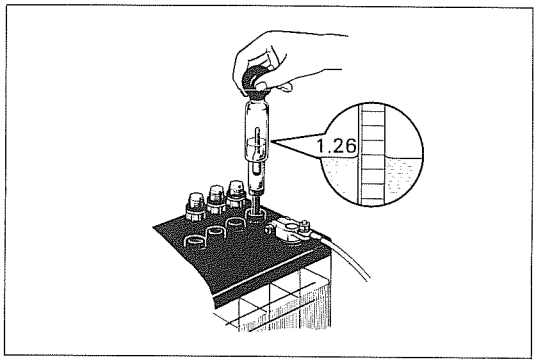
4. Battery terminal and fusible link.
   Loose
   Corroded
   Burnt

Fig. 9-12



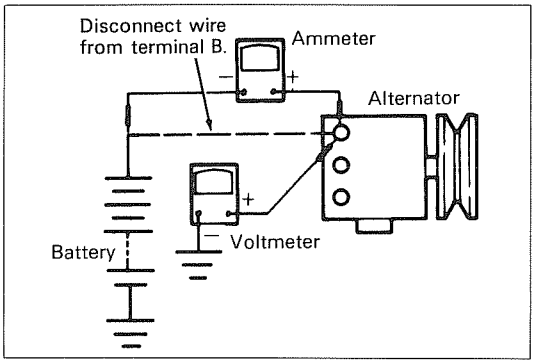
5. Alternator on-vehicle condition.
   Abnormal noise from the alternator when engine is running.

Fig. 9-13



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

Fig. 9-14



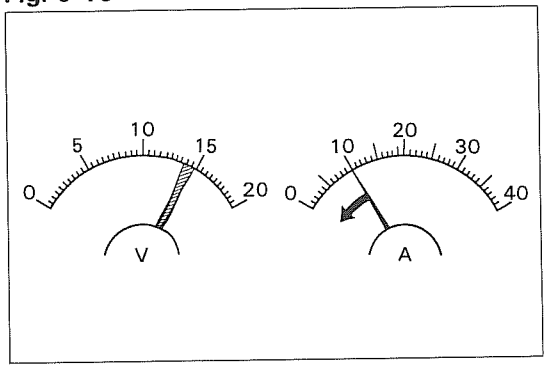
PERFORMANCE TEST WITH VOLTMETER & AMMETER

Connect the voltmeter and ammeter as follows.

Ammeter (+) ——→ Alternator B terminal
Ammeter (–) ——→ Wire B terminal
Voltmeter (+) ——→ Alternator B terminal
Voltmeter (–) ——→ Ground

– Note –
Be careful not to cause a short.

Fig. 9-15

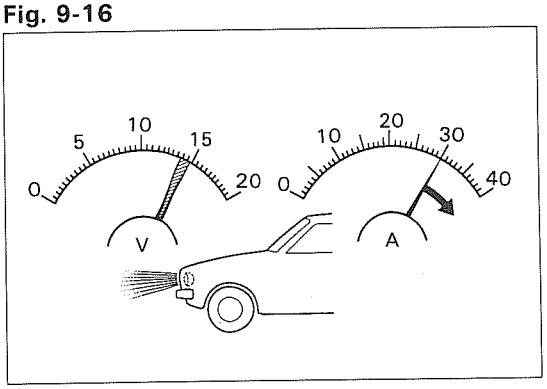


No-load Performance Test

Check the reading on the ammeter and voltmeter.

Current: Less than 10A
Voltage: 13.8 – 14.8 V
Engine speed: Idling to 2,000 rpm

Fig. 9-16

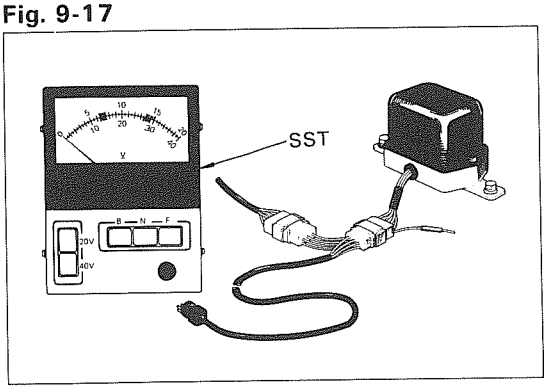


Load Performance Test

1. Run engine at 2,000 rpm.
2. Turn on the headlights and all accessories. Then check the reading on the ammeter and voltmeter.

Current: More than 30A
Voltage: 13.8 – 14.8 V

Fig. 9-17

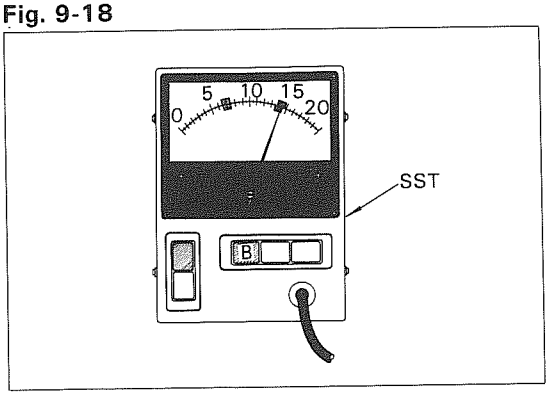


PERFORMANCE TEST WITH ALTERNATOR CHECKER

Disconnect the alternator regulator connector and connect SST.
SST [09081-00011]

Push 20 V switch.

Fig. 9-18



1. Check terminal B voltage.

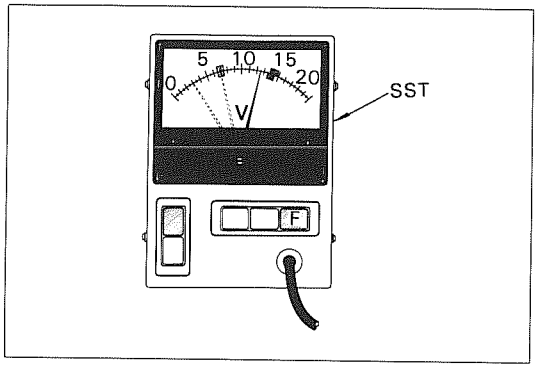
Push switch B.

Raise engine speed from idling to 2,300 rpm.

Voltage:
STD 13.8 – 14.8 V

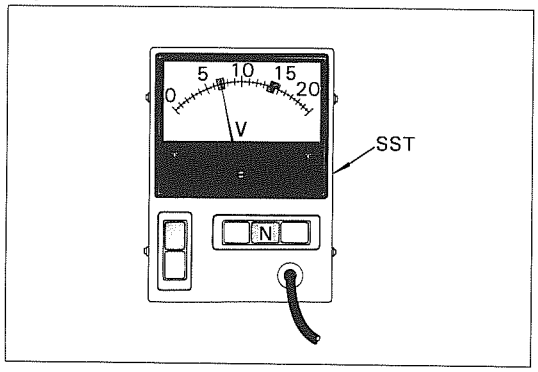
If not within standard, probable cause is the alternator regulator.

Fig. 9-19



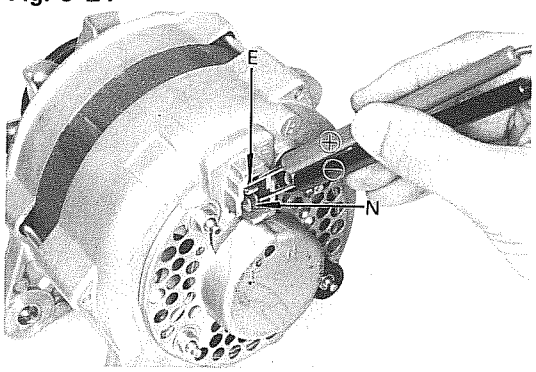
2. Check terminal F voltage.
   Push switch F.
   Raise engine speed from idling to 2,000 rpm.
   The checker reading should gradually decrease from 12 to 3 volts.
   If decrease is not registered, probable cause is alternator regulator.

Fig. 9-20



3. Check terminal N voltage.
   Push switch N.
   Maintain engine speed at approximately 1,500 rpm. The pointer should be a half of terminal B voltage.
   Voltage:
   STD 6.9 – 7.4 V
   If the voltage is higher, the cause is the ⊕ rectifier.
   If the voltage is lower, the cause is the ⊖ rectifier.

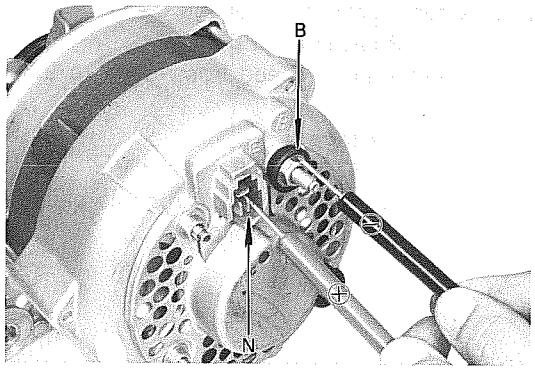
Fig. 9-21



ALTERNATOR INSPECTION

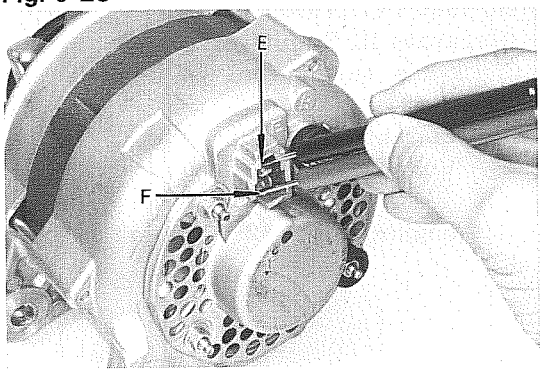
1. Negative side rectifier short test.
   Connect an ohmmeter ⊖ lead to terminal N and ⊕ lead to terminal E.
   Meter should indicate infinity.

Fig. 9-22



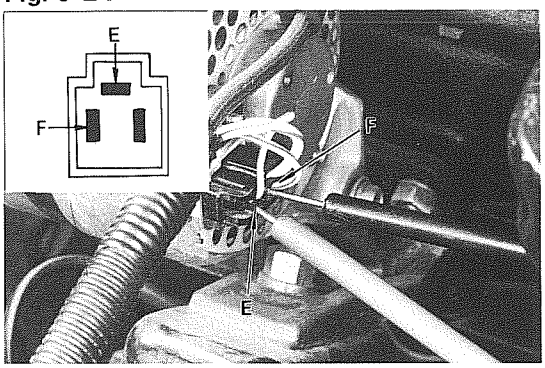
2. Positive side rectifier short test.
   Connect an ohmmeter ⊖ lead to terminal B and ⊕ lead to terminal N.
   Meter should indicate infinity.

Fig. 9-23



3. Check the rotor coil resistance.
   Resistance: 3.9 – 4.1 Ω

Fig. 9-24



4. Turn the starter switch to ON position, and check to see if there is battery voltage at terminal F.
   If not, check the ENGINE fuse.

Fig. 9-25

SEE
CHARGING SYSTEM
ON-VEHICLE INSPECTION
Fig. 9-7 to 9-13

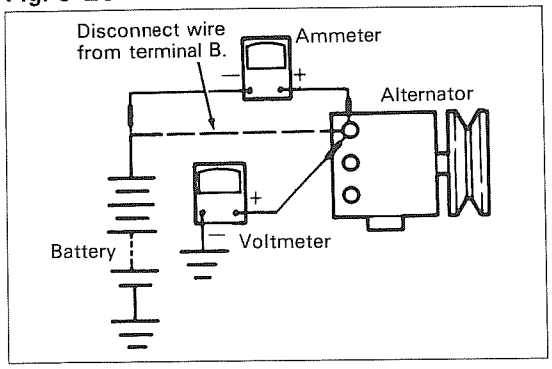
ON-VEHICLE INSPECTION

[IC Regulator Type]

CHECK FOLLOWING ITEMS

1. Drive belt tension.
2. Fuses
3. Installed condition of wiring for alternator and regulator.
4. Battery terminal and fusible link.
5. Alternator on-vehicle condition.
6. Specific gravity.

Fig. 9-26



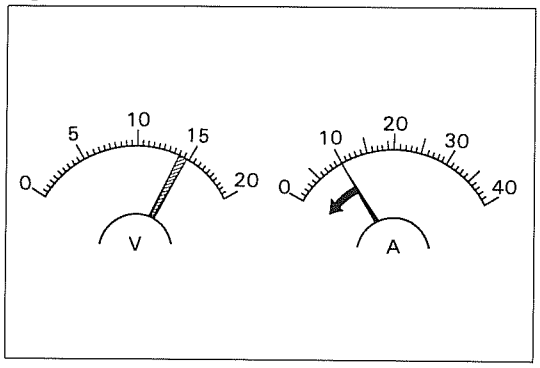
PERFORMANCE TEST

Connect the voltmeter and ammeter as follows.

Ammeter (+) ——→ Alternator B terminal
Ammeter (–) ——→ Wire B terminal
Voltmeter (+) ——→ Alternator B terminal
Voltmeter (–) ——→ Ground

– Note –
Be careful not to cause a short.

Fig. 9-27

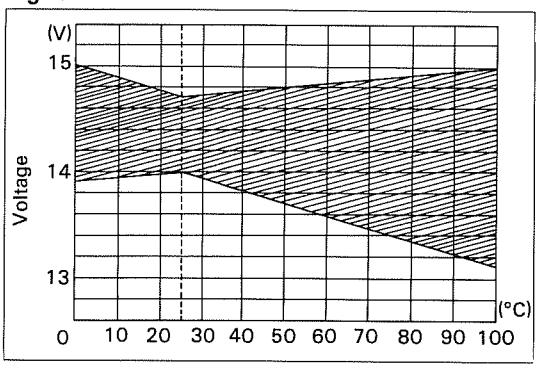


No-load Performance Test (Separate IC Regulator Type)

Check the reading on the ammeter and voltmeter.

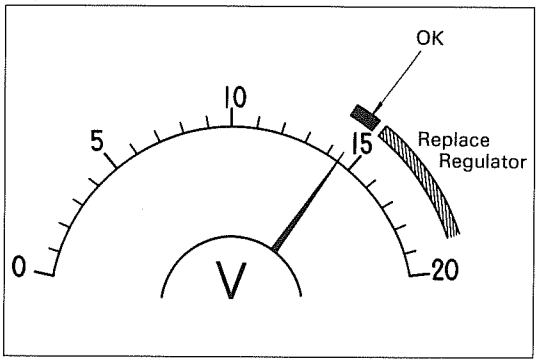
Current: Less than 10A
Voltage: 14.0 – 14.7 V
(25°C or 77°F)
Engine speed: 2,000 rpm

Fig. 9-28



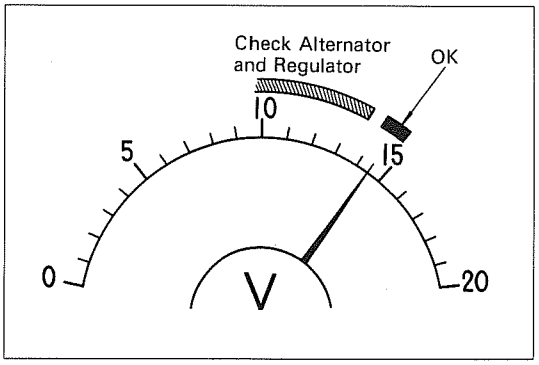
– Note –
If the temperature is not 25°C (77°F), find the voltage limits in the chart for the correct temperature.

Fig. 9-29



If the voltage reading is greater than 15.0 V, replace the IC regulator.

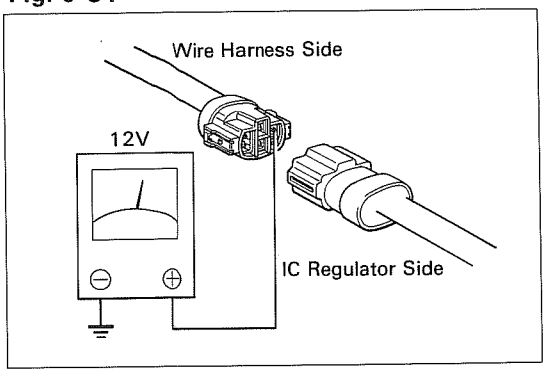
Fig. 9-30



If the voltage reading is less than 13.5 V, check the alternator and IC regulator as follows.

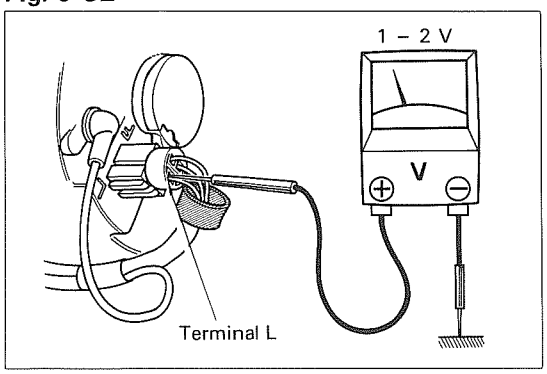
1. Turn off the engine and disconnect the connector from the IC regulator.

Fig. 9-31



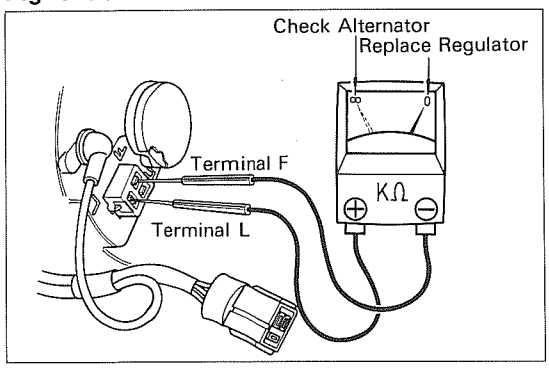
2. Turn the starter switch to ON po sition.
3. Check the voltage reading at the alternator terminal IG.
   If no voltage, check the engine fuse and/or starter switch.

Fig. 9-32



4. Connect the connector to the IC regulator and then check the voltage reading at the alternator terminal L.
   If the reading is 1 — 2 V, check the alternator.

Fig. 9-33



5. If the voltage reading is same as battery voltage, turn the starter switch to OFF and disconnect the connector from the alternator. Then check that there is continuity between the alternator terminals L and F.
   No continuity ——→ Check the alternator
   Continuity ——→ Replace the IC regulator

Fig. 9-34

SEE

CHARGING SYSTEM

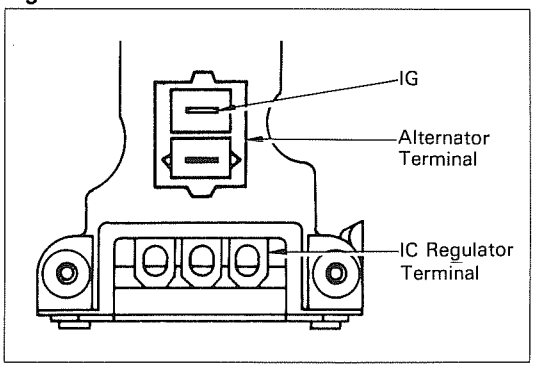
ON-VEHICLE INSPECTION

Fig. 9-27 & 9-28

No-load Performance Test (Built-in IC Regulator Type)

Check the reading on the ammeter and voltmeter.

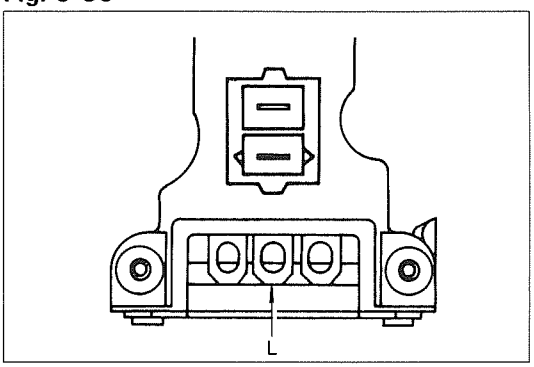
Fig. 9-35



If the voltage reading is less than 13.5 V, check the alternator and IC regulator as follows.

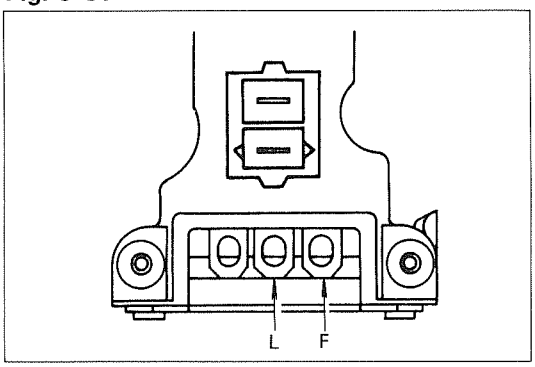
1. Turn the starter switch to ON position and check the voltage reading at the alternator IG terminal.
   If no voltage, check the engine fuse and/or starter switch.

Fig. 9-36



2. Remove the end cover from the IC regulator and check the voltage reading at the regulator terminal L.
   If the voltage reading is zero to 2 volts, check the alternator.

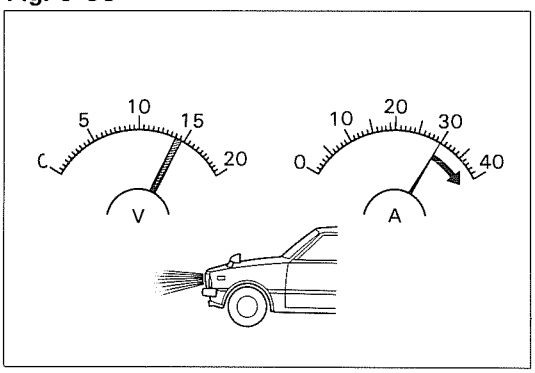
Fig. 9-37



If the voltage reading is same as battery voltage, turn the starter switch to OFF and check that there is continuity between the regulator terminals L and F.

No continuity ——— Check the alternator
Continuity ——— Replace the IC regulator

Fig. 9-38



Load Performance Test

1. Run engine at 2,000 rpm.
2. Turn on the headlights and all accessories. Then check the reading on the ammeter and voltmeter.

Current: **More than 30 A**
Voltage: **14.0 – 14.7 V**

ALTERNATOR

CUTAWAY VIEW

Fig. 9-39

Tirrill Regulator Type

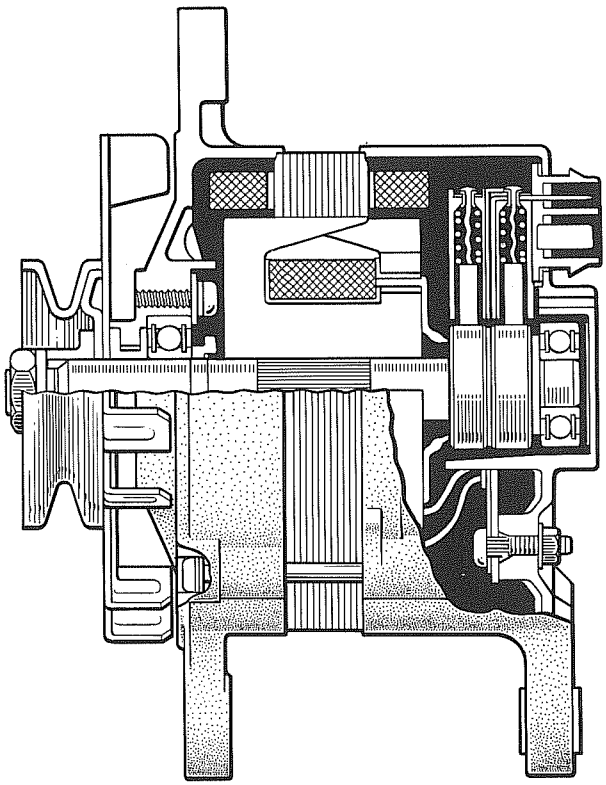
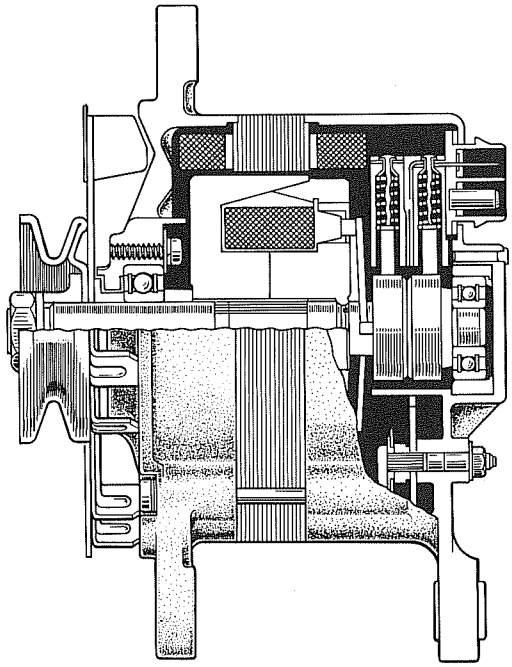
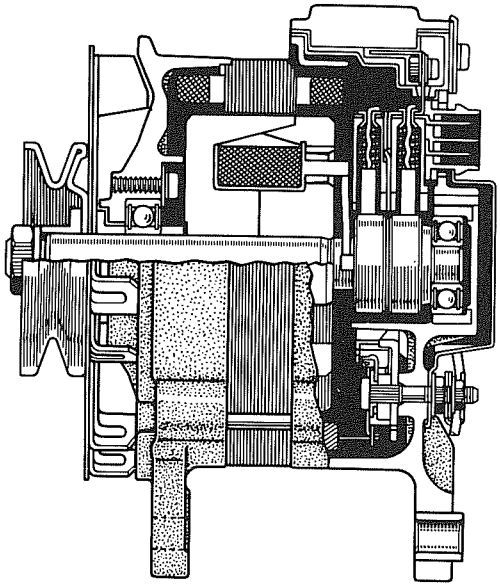


Fig. 9-40

Separate IC Regulator Type



Built-in IC Regulator Type

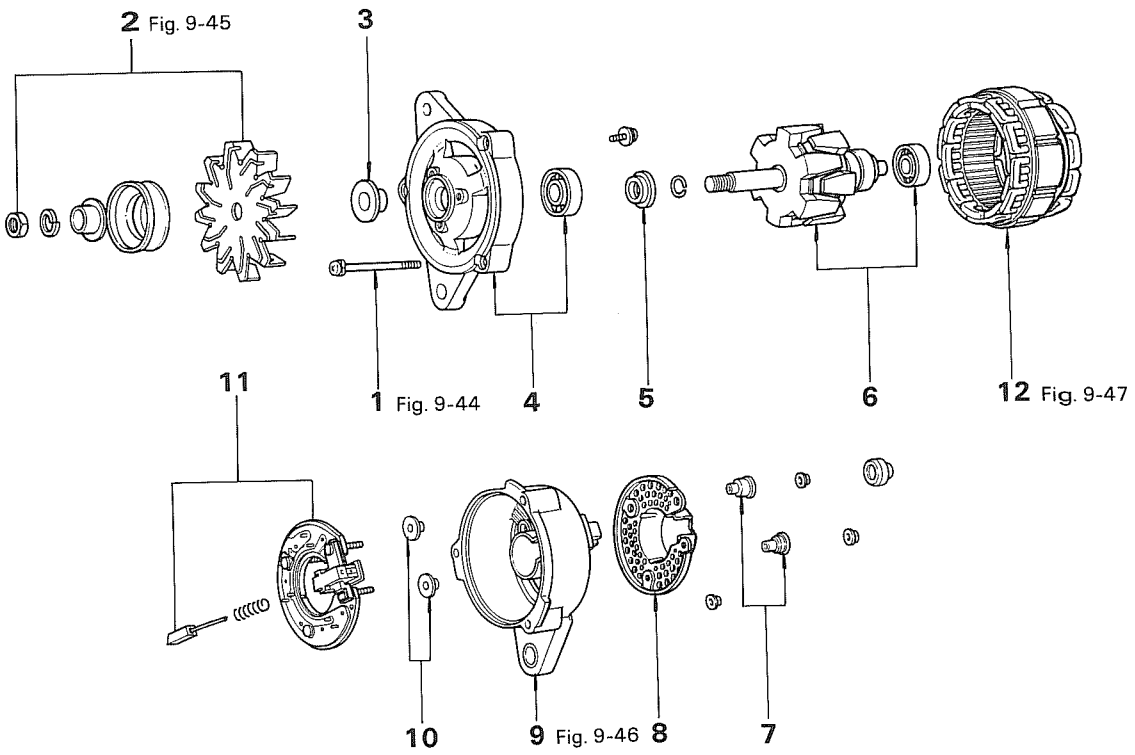


DISASSEMBLY

Disassemble the parts in the numerical order shown in the figure.

Fig. 9-41

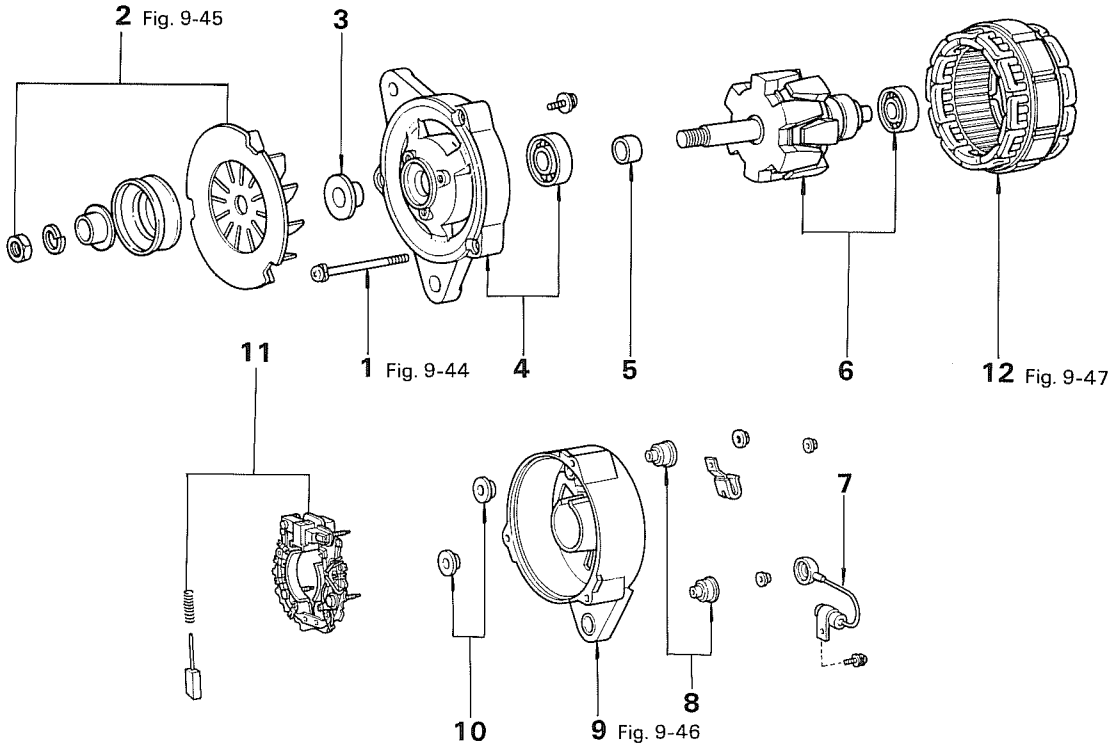
Tirrill Regulator Type



1. Through Bolt
2. Space Collar, Pulley & Fan
3. Space Collar
4. Drive End Frame & Front Bearing
5. Space Collar
6. Rotor & Rear Bearing
7. Insulator
8. Rear End Cover (except RN)
9. Rear End Frame
10. Insulator
11. Brush Holder & Rectifier Holder
12. Stator Coil

Fig. 9-42

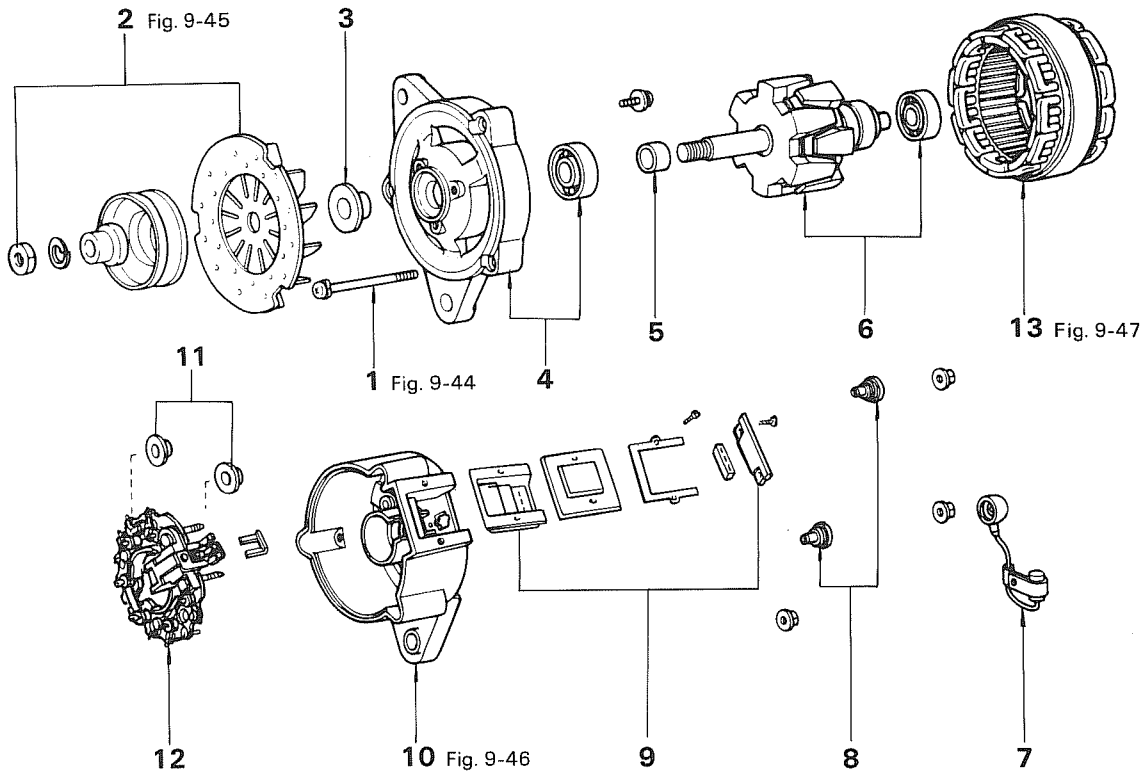
Separate IC Regulator Type



1. Through Bolt
2. Space Collar, Pulley & Fan
3. Space Collar
4. Drive End Frame & Front Bearing
5. Space Collar
6. Rotor & Rear Bearing
7. Noise Supression Condenser
8. Insulator
9. Rear End Frame
10. Insulator
11. Brush Holder & Rectifier Holder
12. Stator Coil

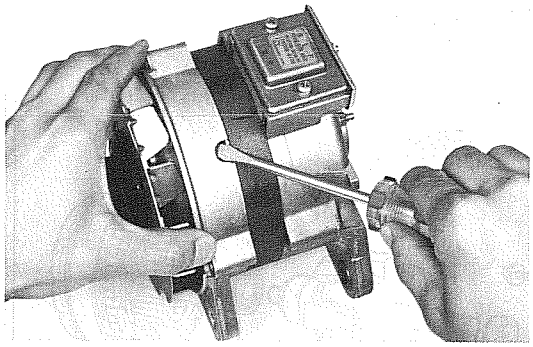
Fig. 9-43

Built-in IC Regulator Type



1. Through Bolt
2. Space Collar, Pulley & Fan
3. Space Collar
4. Drive End Frame & Front Bearing
5. Space Collar
6. Rotor & Rear Bearing
7. Noise Supression Condenser
8. Insulator
9. IC Regulator
10. Rear End Frame
11. Insulator
12. Brush Holder & Rectifier Holder
13. Stator Coil

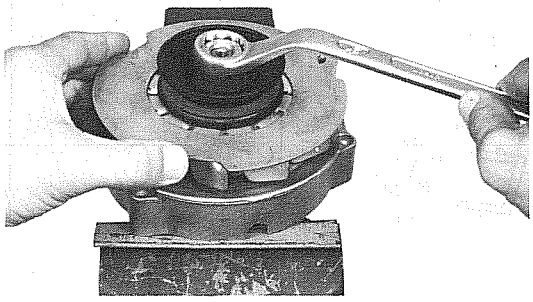
Fig. 9-44



Pry off the drive end frame from the stator.

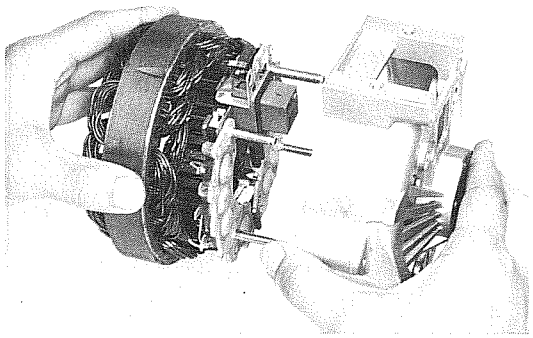
– Note –
Be careful not to damage the coil wires.

Fig. 9-45



Clamp the rotor in a soft jaw vise and loosen the pulley nut.

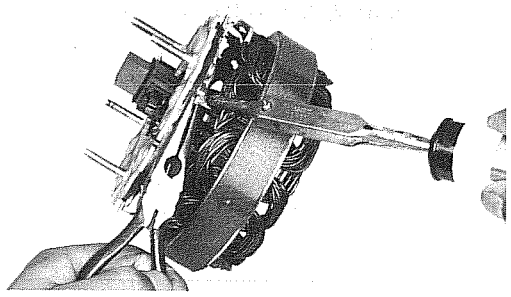
Fig. 9-46



Remove the rear end frame from the stator and rectifier holder.

– Note –
As for the built-in IC regulator type, remove the IC regulator before separating the rear end frame.

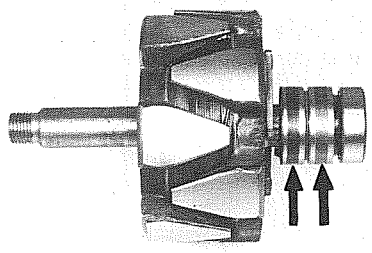
Fig. 9-47



Disconnect the stator coil from the rectifier holder by melting the solder.

– Note –
When unsoldering the leads, hold the rectifier lead with a long nose pliers to protect the rectifier from heat.

Fig. 9-48

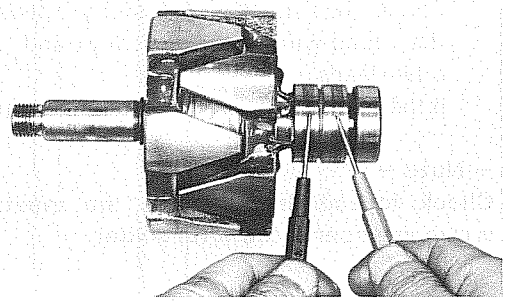


INSPECTION

Rotor

1. Check the slip rings for dirt or burns.

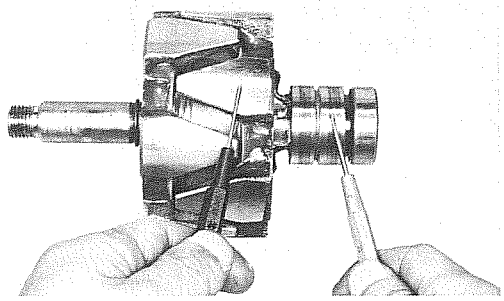
Fig. 9-49



2. Open circuit test
   Check for continuity between both slip rings.
   If there is no continuity, replace the rotor.

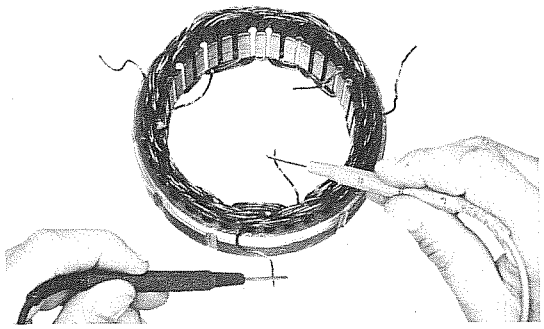
   Resistance:
   Tirrill regulator type
   3.9 – 4.1 Ω
   IC regulator type
   2.8 – 3.0 Ω

Fig. 9-50



3. Ground test
   Check that there is no continuity between the slip ring and rotor.
   If there is continuity, replace the rotor.

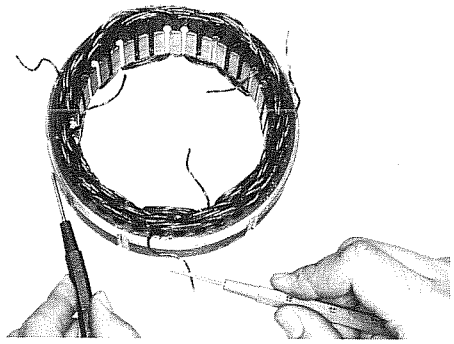
Fig. 9-51



Stator (Tirrill Regulator Type)

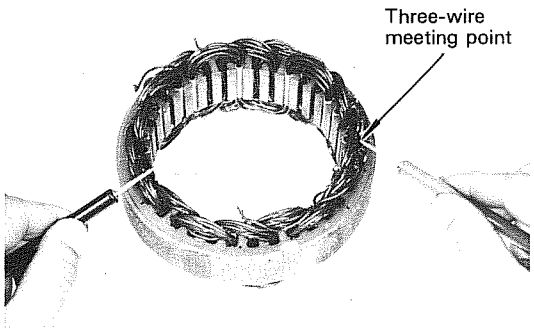
1. Open circuit test
   Check that there is continuity between the two leads near each other.
   If there is no continuity, replace the stator.

Fig. 9-52



2. Ground test
   Check that there is no continuity between the coil leads and stator core.
   If there is continuity, replace the stator.

Fig. 9-53

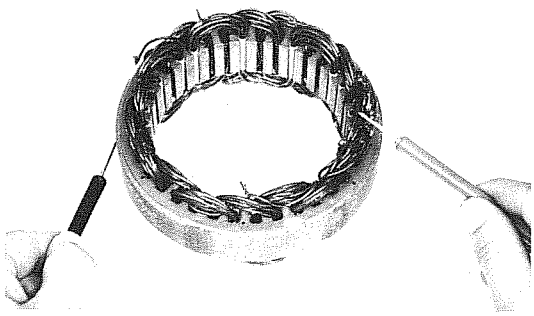


Stator (IC Regulator Type)

1. Open circuit test
   Check that there is continuity between the three-wire meeting point and the other leads.
   If there is no continuity, replace the stator.

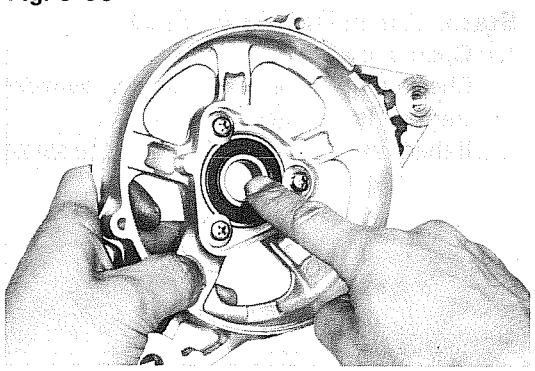
– Note –
Check for continuity when the meeting wires are connected with solder.

Fig. 9-54



2. Ground test
   Check that there is no continuity between the coil leads and stator core.
   If there is continuity, replace the stator.

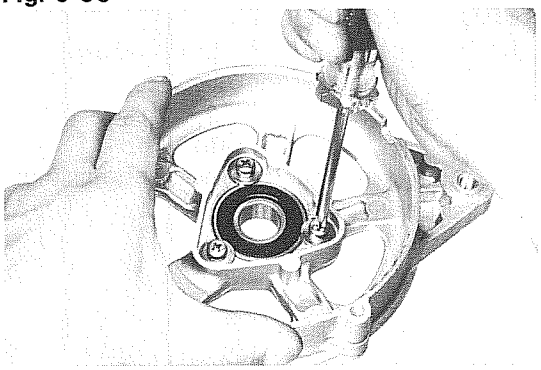
Fig. 9-55



Bearing

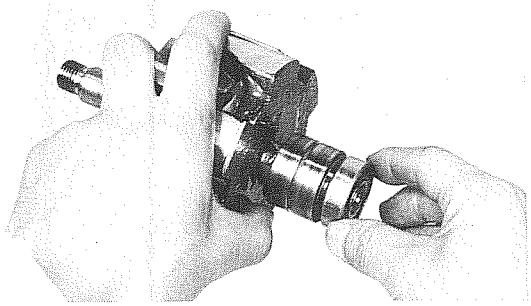
1. Check the front bearing for wear or roughness.

Fig. 9-56



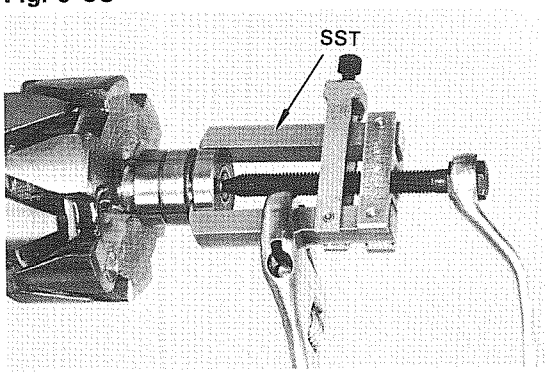
2. Replace the front bearing with new one if necessary.

Fig. 9-57



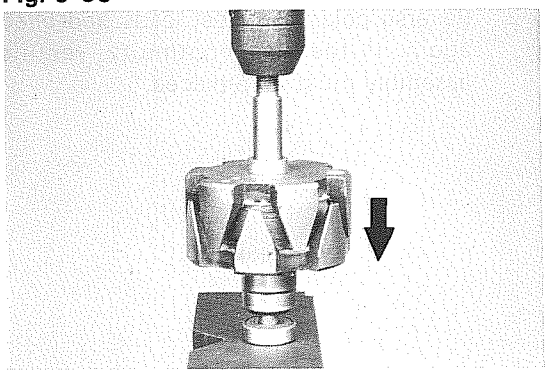
3. Check the rear bearing for wear or roughness.

Fig. 9-58



4. Replace the rear bearing if necessary.
   (1) Remove the rear bearing with SST.
   SST [09286-46011]

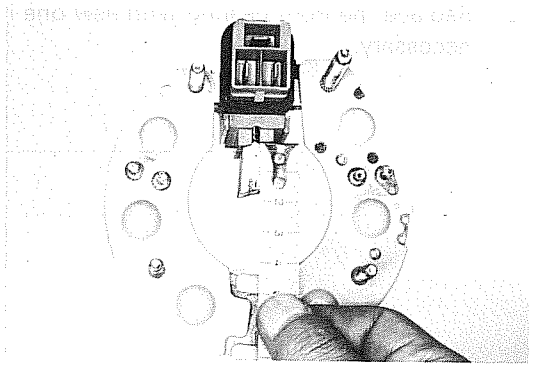
Fig. 9-59



(2) Press a new bearing onto the rotor shaft.

— Note —
Be careful not to press it in slantwise.

Fig. 9-60



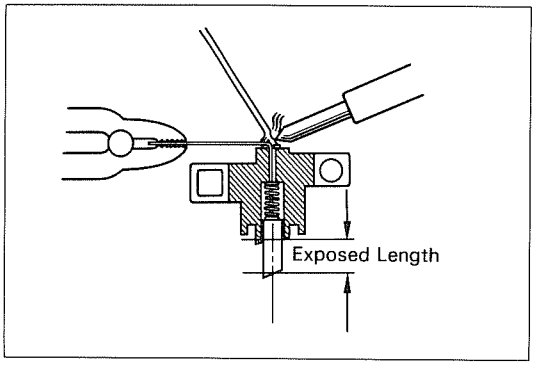
Brush & Brush Holder

1. Measure the exposed brush length.

Exposed length:
Minimum 5.5 mm
(0.217 in.)

If the brush length is less than minimum, replace the brush.

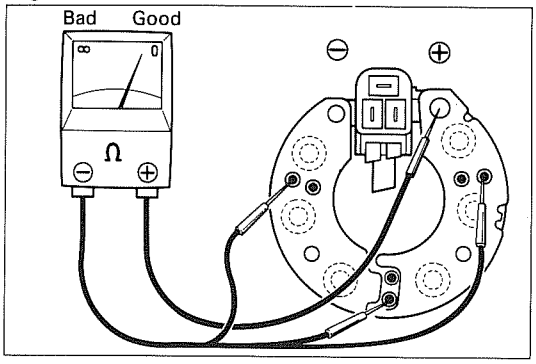
Fig. 9-61



2. When replacing the brush, assemble them as shown in the figure.

Exposed length: 12.5 mm
(0.492 in.)

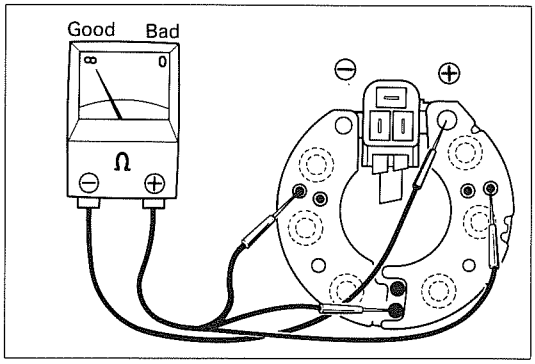
Fig. 9-62



Rectifier (Tirrill Regulator Type — 40, 45A)

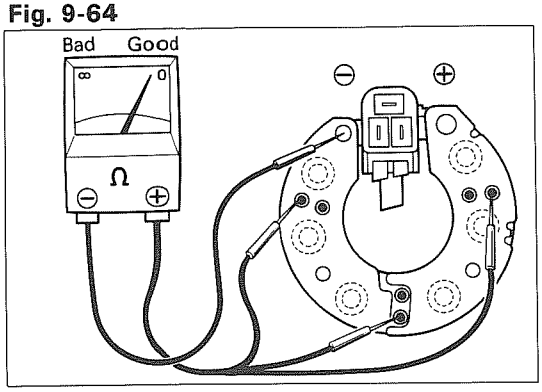
1. Rectifier holder positive side:
Connect an ohmmeter ⊕ lead to the rectifier holder, and the ⊖ lead of the meter to each rectifier terminal. If there is no continuity, rectifier assembly must be replaced.

Fig. 9-63



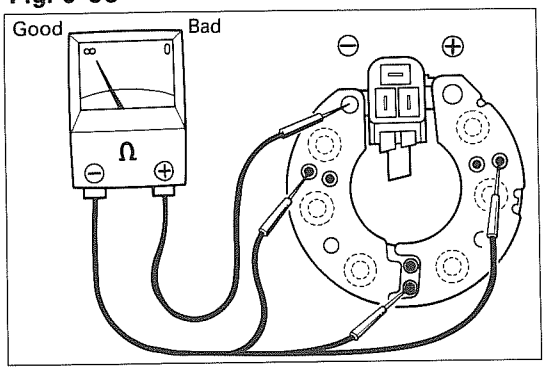
2. Reverse polarity of test leads and check again. If there is continuity, rectifier assembly must be replaced.

Fig. 9-64



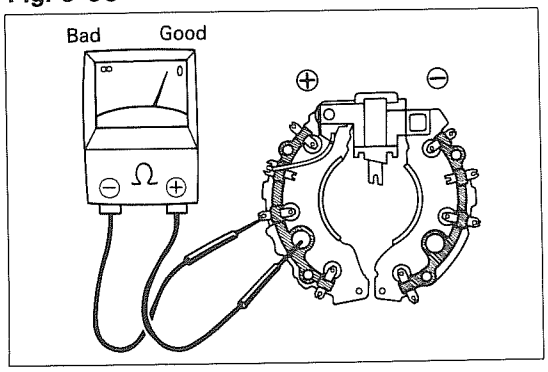
3. Rectifier holder negative side:
Connect an ohmmeter ⊕ lead to each rectifier terminal, and the ⊖ lead of the meter to the rectifier holder. If there is no continuity, rectifier assembly must be replaced.

Fig. 9-65



4. Reverse polarity of test leads and check again. If there is continuity, rectifier assembly must be replaced.

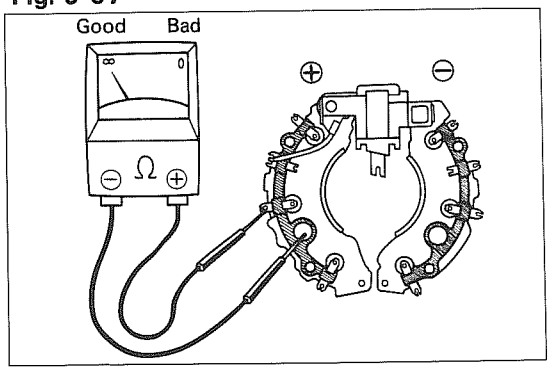
Fig. 9-66



Rectifier (Tirrill Regulator Type — 50, 55A)

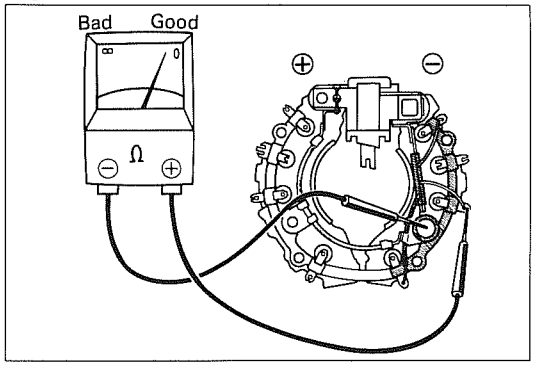
1. Rectifier holder positive side:
Connect an ohmmeter ⊕ lead to the rectifier holder, and the ⊖ lead of the meter to the rectifier terminal. If there is no continuity, the rectifier assembly must be replaced.

Fig. 9-67



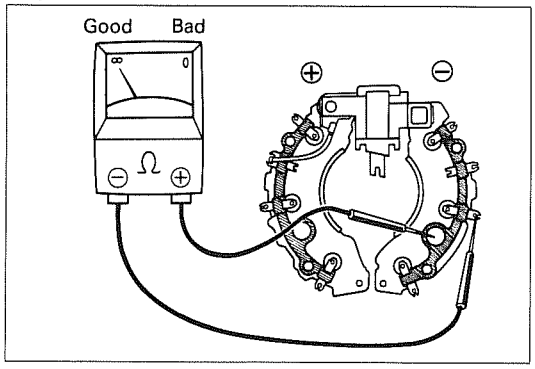
2. Reverse polarity of the test leads and check again. If there is continuity, the rectifier assembly must be replaced.

Fig. 9-68



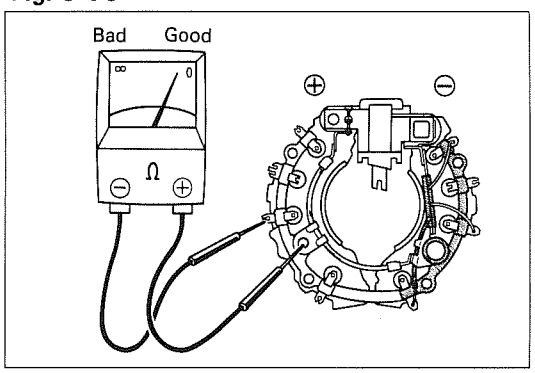
3. Rectifier holder negative side:
Connect an ohmmeter ⊕ lead to the rectifier terminal, and the ⊖ lead of the meter to the rectifier holder. If there is no continuity, the rectifier assembly must be replaced.

Fig. 9-69



4. Reverse polarity of the test leads and check again. If there is continuity, the rectifier assembly must be replaced.

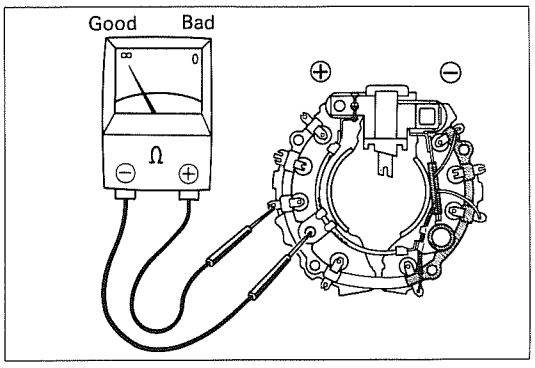
Fig. 9-70



Rectifier (IC Regulator Type)

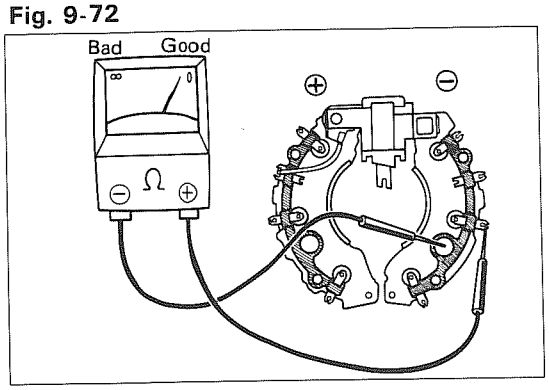
1. Rectifier holder positive side:
Connect an ohmmeter ⊕ lead to the rectifier holder, and the ⊖ lead of the meter to the rectifier terminal. If there is no continuity, rectifier assembly must be replaced.

Fig. 9-71



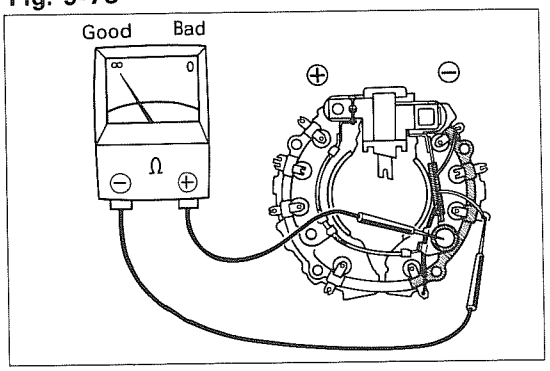
2. Reverse polarity of test leads and check again. If there is continuity, rectifier assembly must be replaced.

Fig. 9-72



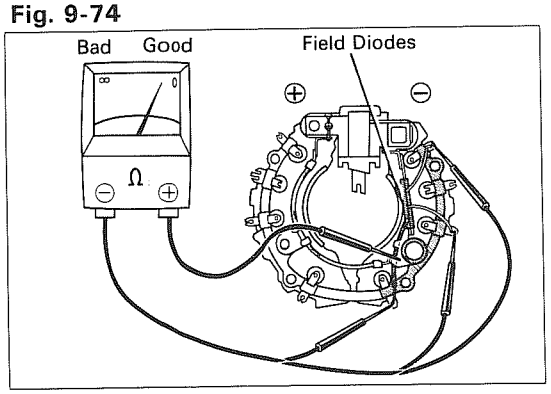
3. Rectifier holder negative side: Connect an ohmmeter ⊕ lead to the rectifier terminal, and the ⊖ lead of the meter to the rectifier holder. If there is no continuity, rectifier assembly must be replaced.

Fig. 9-73



4. Reverse polarity of test leads and check again. If there is continuity, rectifier assembly must be replaced.

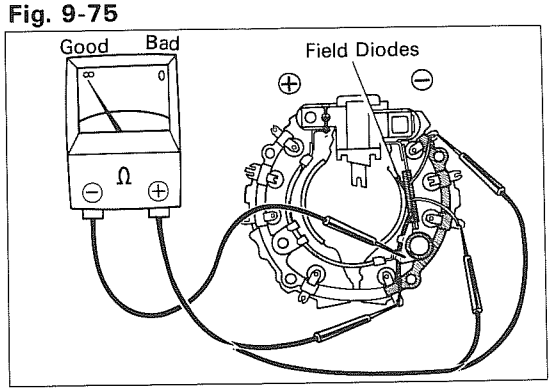
Fig. 9-74



Field Diodes (IC Regulator Type)

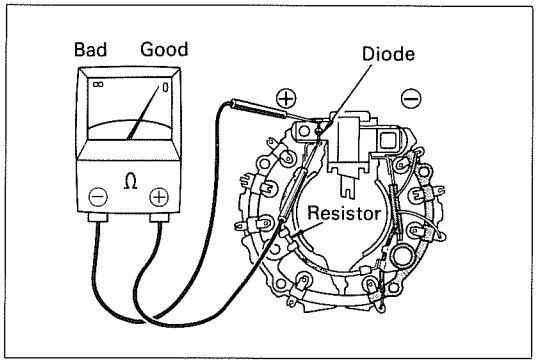
1. Connect an ohmmeter ⊕ lead to the rectifier holder, and the ⊖ lead of the meter to the field diode terminal. If there is no continuity, rectifier assembly must be replaced.

Fig. 9-75



2. Reverse polarity of test leads and check again. If there is continuity, rectifier assembly must be replaced.

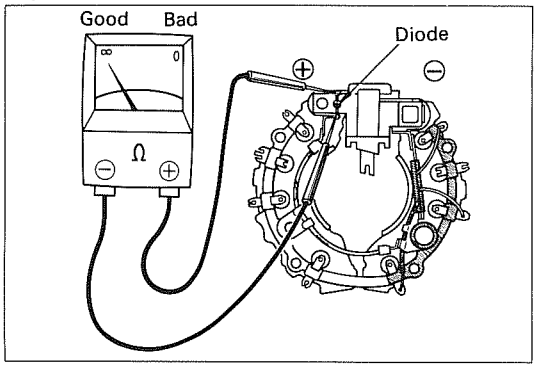
Fig. 9-76



Diode (IC Regulator Type)

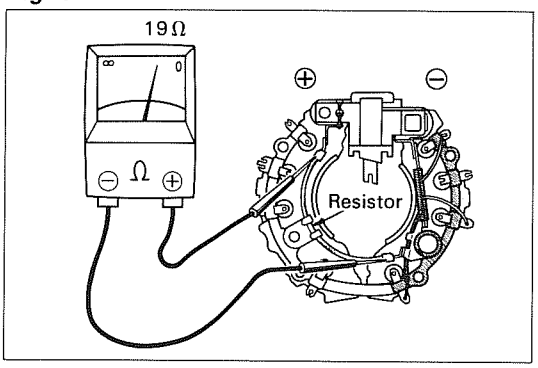
1. Connect an ohmmeter ⊕ lead to the resistor side, and the ⊖ lead of the meter to the diode other side. If there is no continuity, rectifier assembly must be replaced.

Fig. 9-77



2. Reverse polarity of test leads and check again. If there is continuity, rectifier assembly must be replaced.

Fig. 9-78



Resistor (IC Regulator Type)

Measure the resistance of the resistor with an ohmmeter.

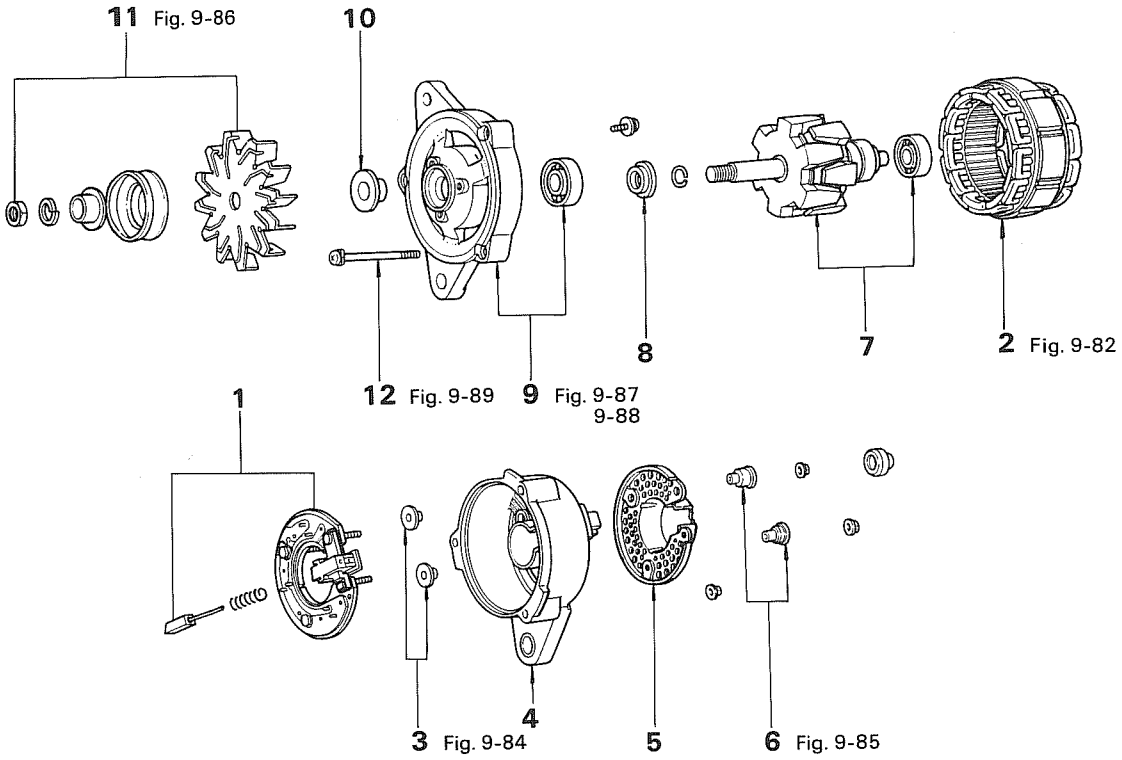
Resistance: 19Ω

ASSEMBLY

Assemble the parts in the numerical order shown in the figure.

Fig. 9-79

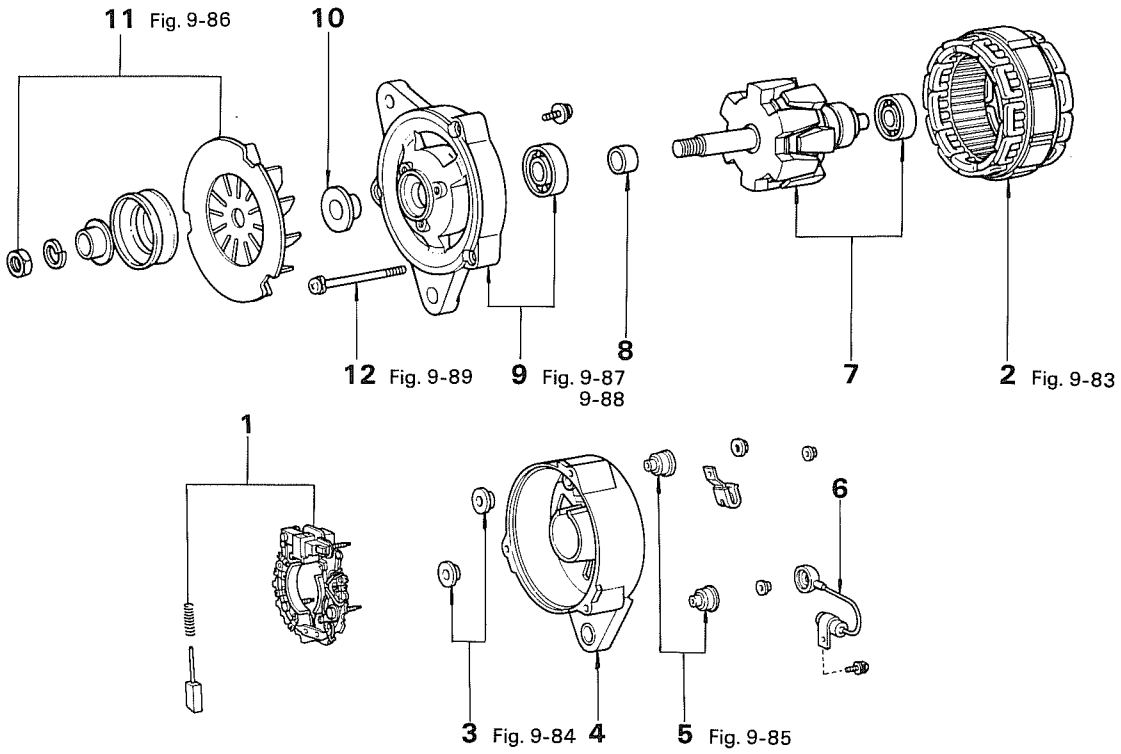
Tirrill Regulator Type



1. Brush Holder & Rectifier Holder
2. Stator Coil
3. Insulator
4. Rear End Frame
5. Rear End Cover (except RN)
6. Insulator
7. Rotor & Rear Bearing
8. Space Collar
9. Drive End Frame & Front Bearing
10. Space Collar
11. Space Collar, Pulley & Fan
12. Through Bolt

Fig. 9-80

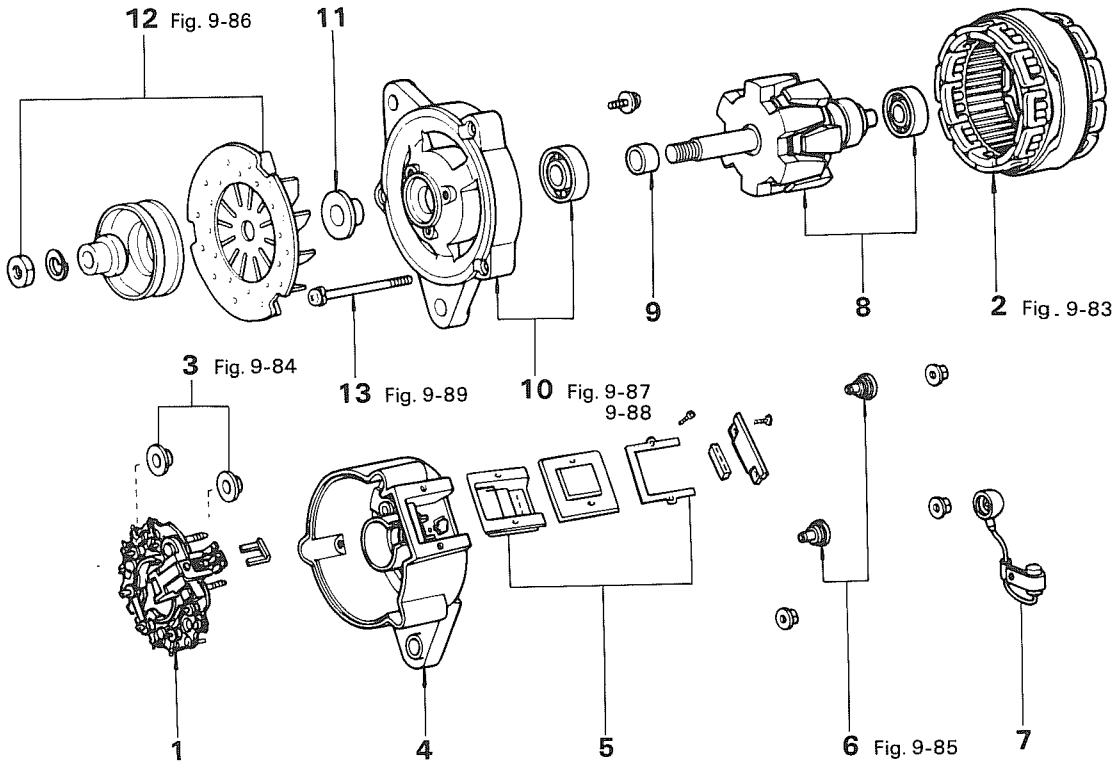
Separate IC Regulator Type



1. Brush Holder & Rectifier Holder
2. Stator Coil
3. Insulator
4. Rear End Frame
5. Insulator
6. Noise Supression Condenser
7. Rotor & Rear Bearing
8. Space Collar
9. Drive End Frame & Front Bearing
10. Space Collar
11. Space Collar, Pulley & Fan
12. Through Bolt

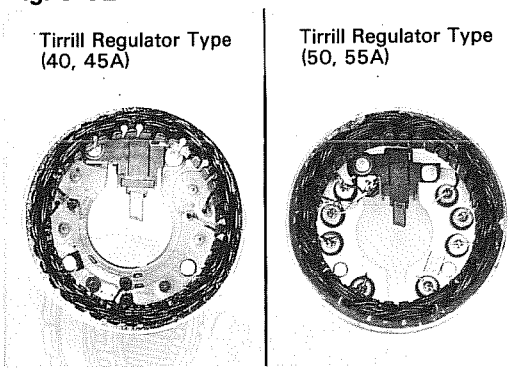
Fig. 9-81

Built-in IC Regulator Type



1. Brush Holder & Rectifier Holder
2. Stator Coil
3. Insulator
4. Rear End Frame
5. IC Regulator
6. Insulator
7. Noise Supression Condenser
8. Rotor & Rear Bearing
9. Space Collar
10. Drive End Frame & Front Bearing
11. Space Collar
12. Space Collar, Pulley & Fan
13. Through Bolt

Fig. 9-82



Solder each lead wire onto the rectifier or terminal as shown in the figure.

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

Fig. 9-83

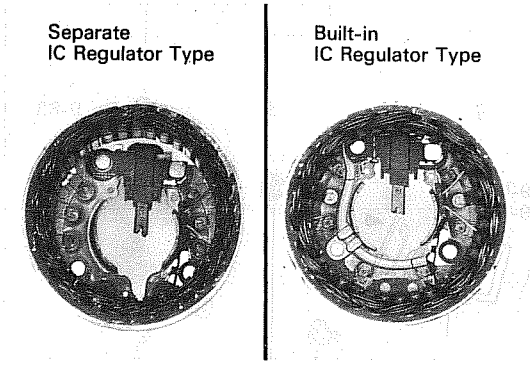
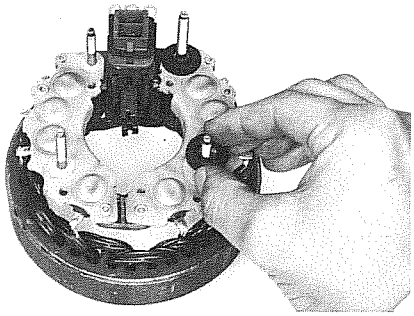
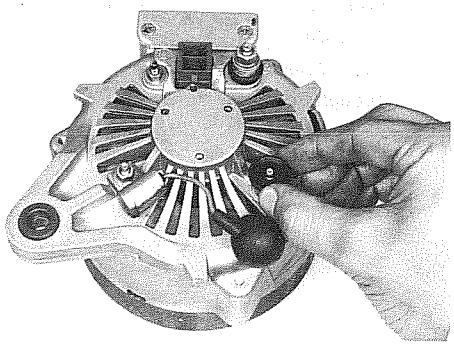


Fig. 9-84



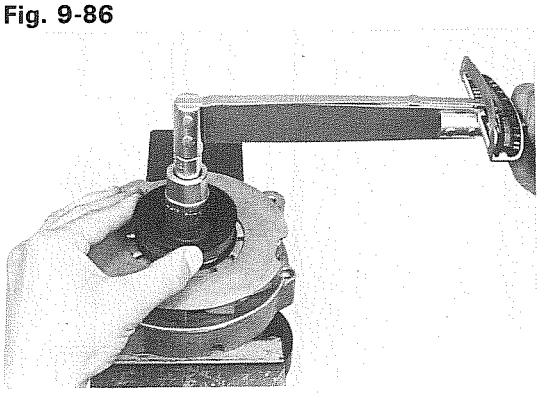
Assemble the rectifier holder with the insulators.

Fig. 9-85



Assemble the rear end cover with the insulators.

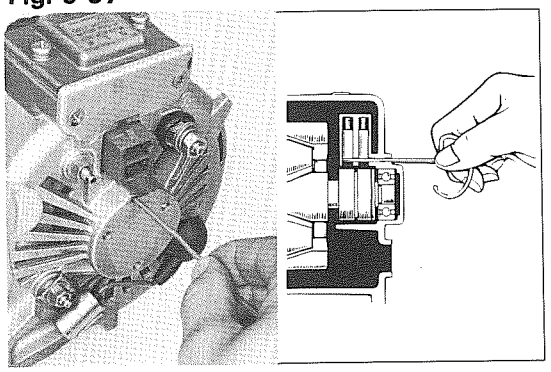
Fig. 9-86



Clamp the rotor with a soft jaw vise and tighten the pulley nut.

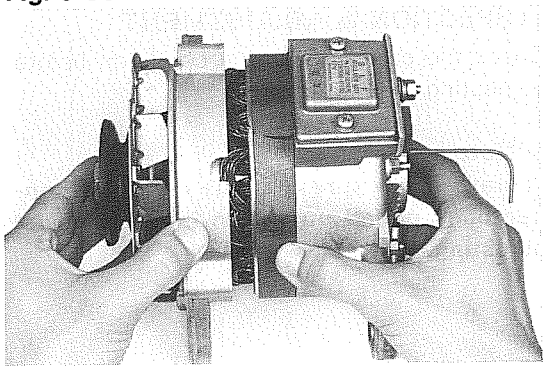
Tightening torque: 5.0 – 6.5 kg-m (37 – 47 ft-lb)

Fig. 9-87



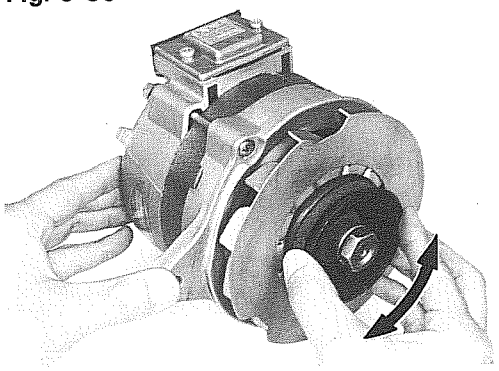
Push in the brushes and temporarily lock them in place with wire inserted through the access hole in the rear end frame.

Fig. 9-88



Assemble the drive end frame and the rectifier end frame by inserting the rear bearing into the rear end frame.
Then, remove the wire from the access hole.

Fig. 9-89



Check the rotor for smooth rotation after assembly is completed.

ALTERNATOR REGULATOR

Fig. 9-90

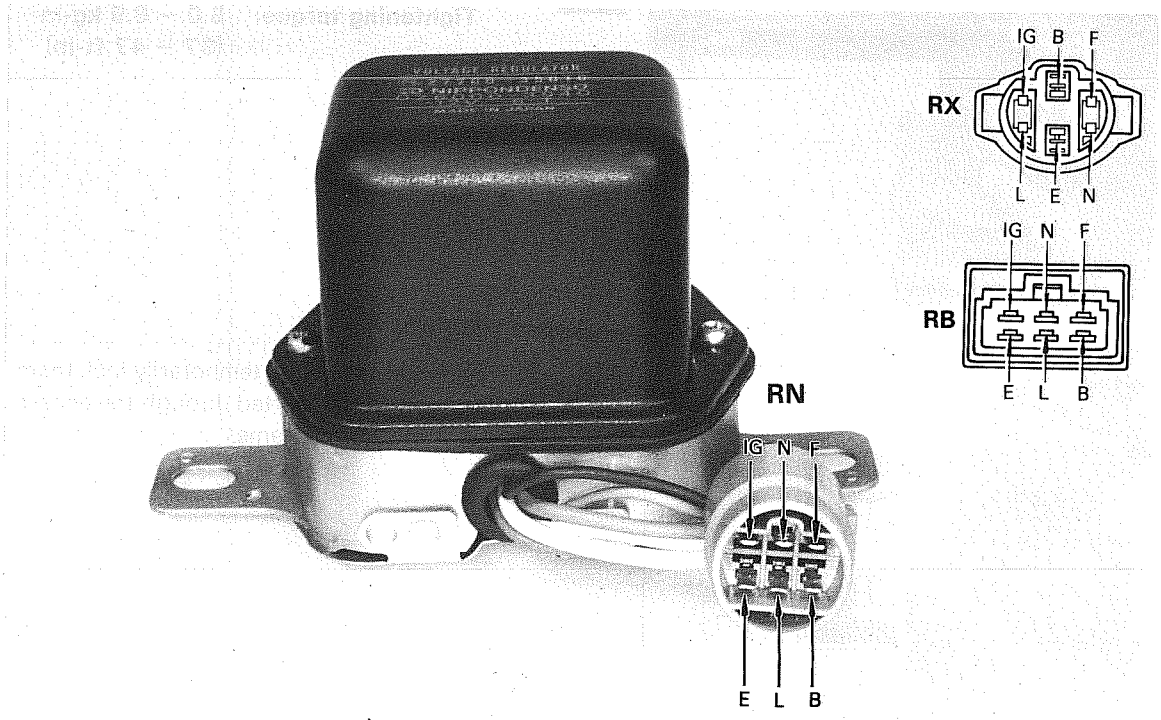


Fig. 9-91

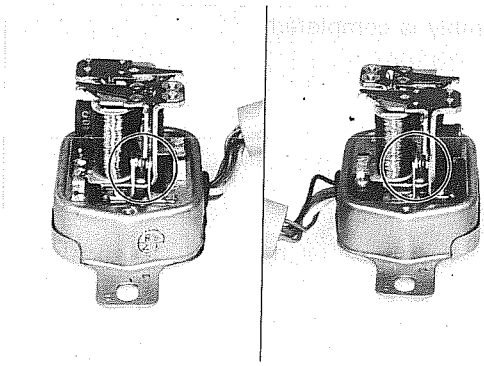
INSPECTION & ADJUSTMENT

Check the connector fitting condition before inspecting the regulator.

– Note –

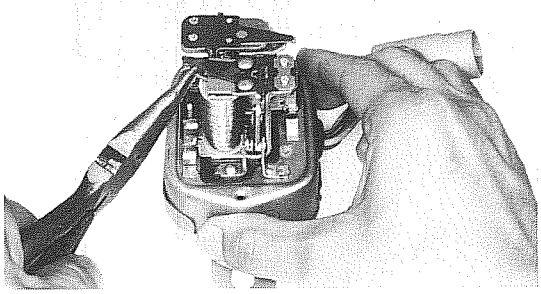
Always make sure that the regulator connector is pulled out when inspecting and adjusting.

Fig. 9-92



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

Fig. 9-93

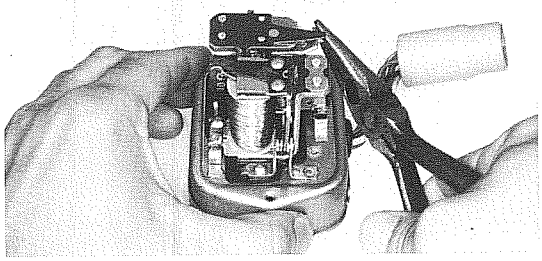


Voltage Adjustment

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

Regulated voltage:
13.8 – 14.8 V

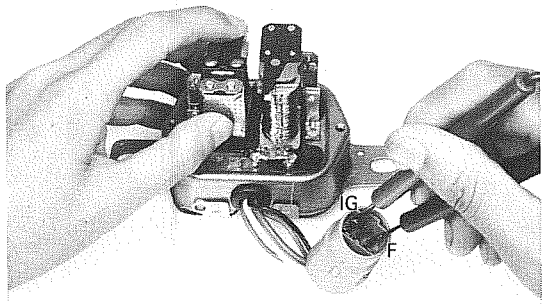
Fig. 9-94



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

Relay actuating voltage:
4.0 – 5.8 V

Fig. 9-95

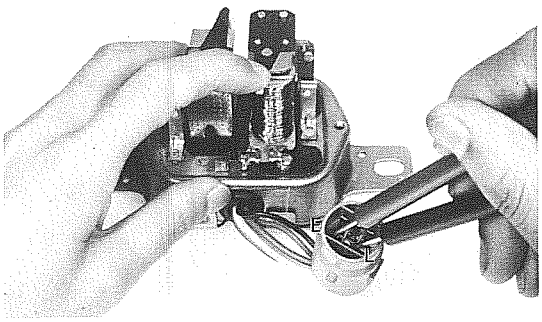


Resistance Measurement

1. IG – F

Voltage relay	Open 0Ω
	Closed Approx. 11Ω

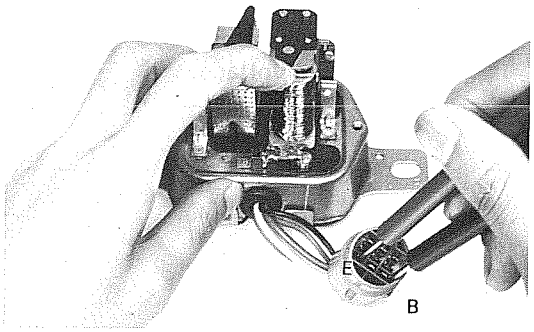
Fig. 9-96



2. L – E

Voltage relay	Open 0Ω
	Closed Approx. 100Ω

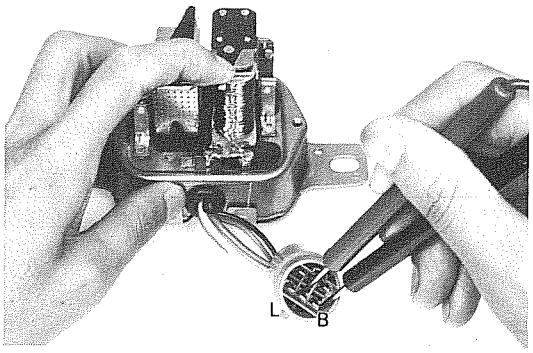
Fig. 9-97



3. B — E

Voltage relay	Open	Infinity
	Closed	Approx. 100 Ω

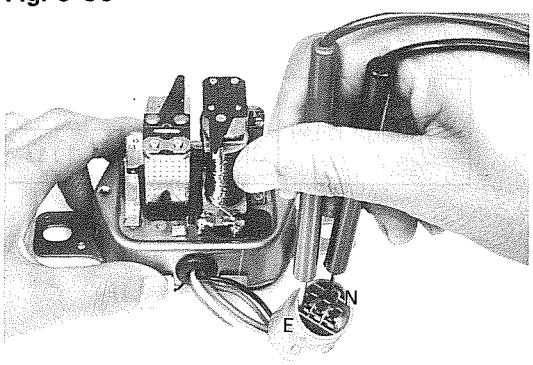
Fig. 9-98



4. B — L

Voltage relay	Open	Infinity
	Closed	0 Ω

Fig. 9-99



5. N — E
Approx. 23 Ω

DISCHARGE WARNING LIGHT RELAY

CIRCUIT

Fig. 9-100

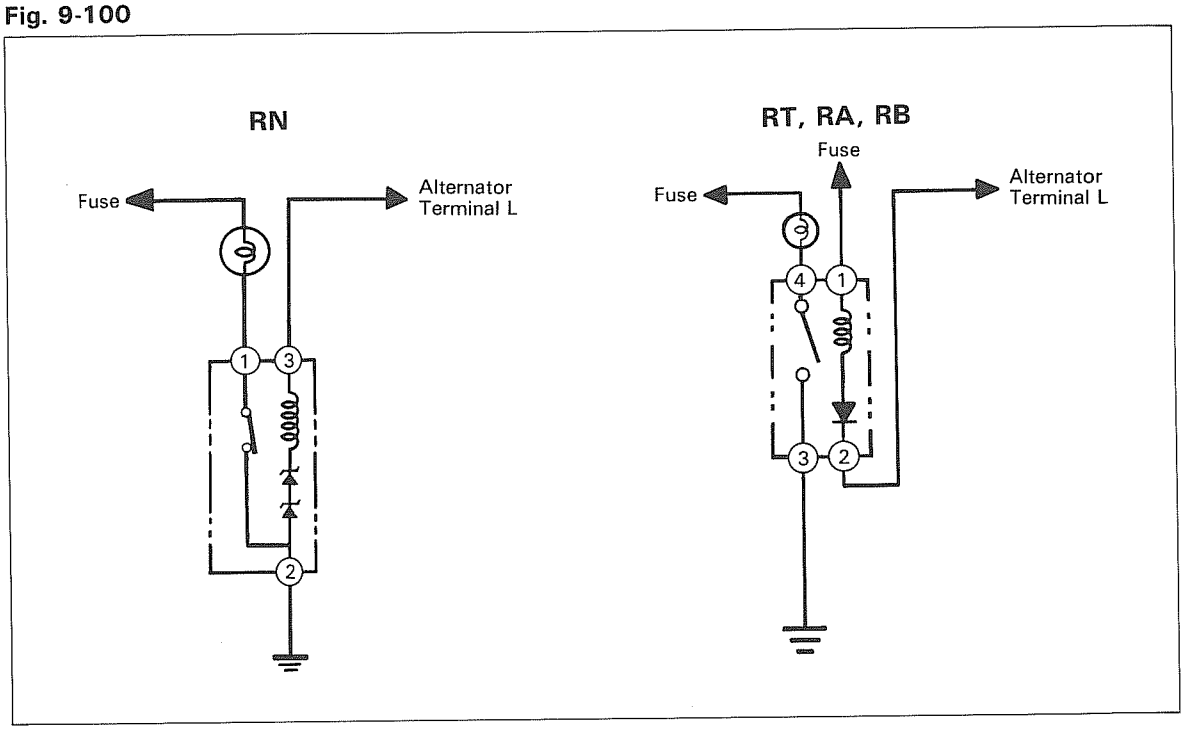
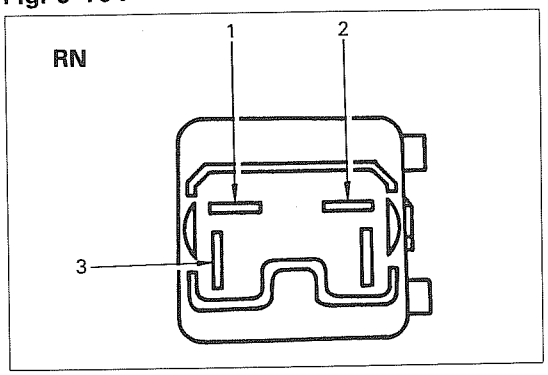


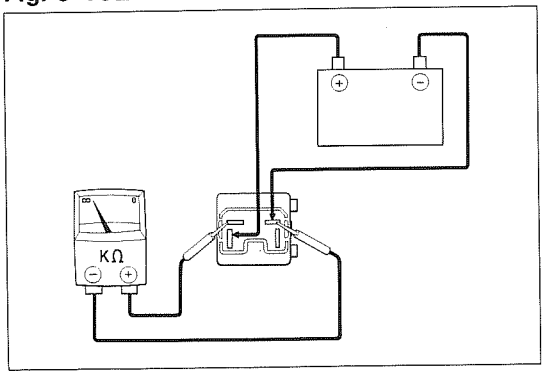
Fig. 9-101



CHECK RELAY FOR CONTINUITY

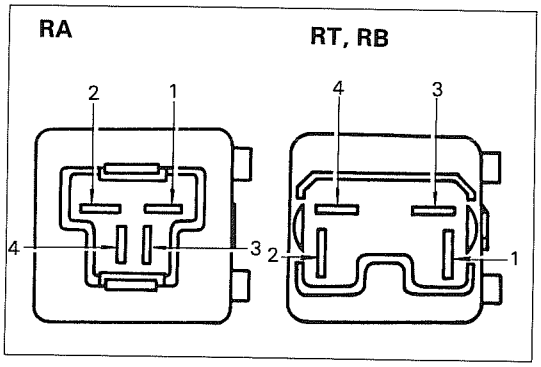
1. (RN)
   Check that there is continuity between terminals 1 and 2.
   If there is no continuity, replace the relay.

Fig. 9-102



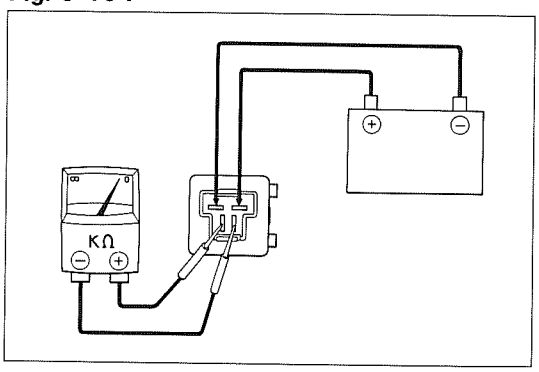
2. Connect ⊕ lead from the battery to terminal 3 of the relay and ⊖ lead to terminal 2.
   Check that there is no continuity between terminals 1 and 2.
   If there is continuity, replace the relay.

Fig. 9-103



1. (RT, RA, RB)
   Check that there is no continuity between terminals 3 and 4.
   If there is continuity, replace the relay.

Fig. 9-104



2. Connect ⊕ lead from the battery to terminal 1 of the relay and ⊖ lead to terminal 2.
   Check that there is continuity between terminals 3 and 4.
   If there is no continuity, replace the relay.