

CHARGING SYSTEM

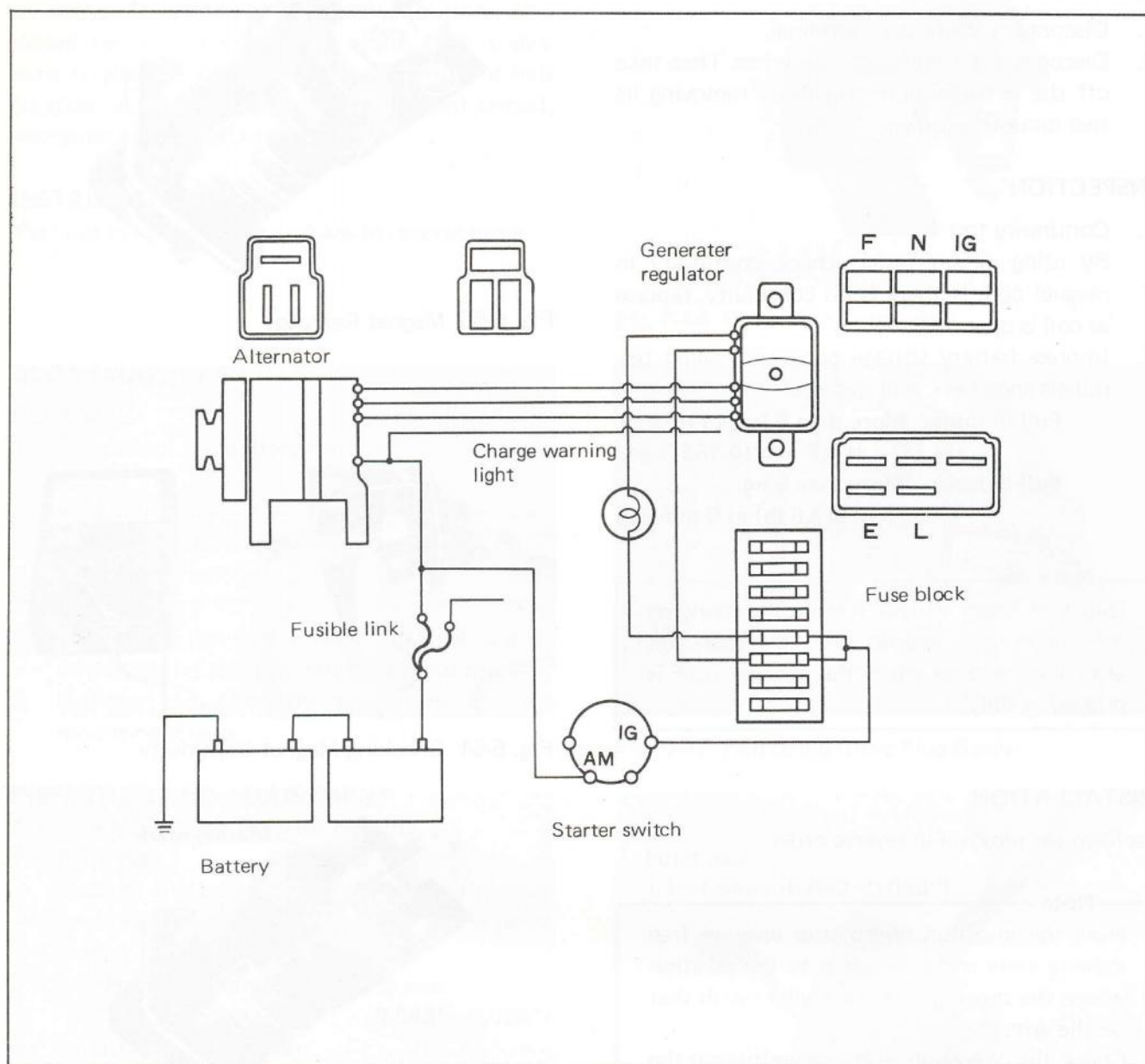


Fig. 6-53 Charging System Wiring Diagram (24 V System)

OPERATION

Charging system circuit is as shown in Fig. 6-54.

EXCITING CURRENT CIRCUIT

Turning the starter switch to ON position forms the circuit from battery → starter switch → fuse (meter 20 A) → charge warning light → regulator L terminal through contacts P₁ P₀ to F terminal → alternator F terminal through its rotor coil → ground. This allows the charge warning light to turn on and also forms the circuit from battery → starter switch → fuse (turn signal 15 A) → regulator IG terminal, through resistance R₁, contacts P₁, P₀, to F terminal → alternator F terminal through its rotor coil → ground, to magnetize the rotor.

AT STARTING OF ENGINE

When the engine starts under the above state, the magnetized rotor begins to turn and induce three-phase alternating current in the stator coils, which is then rectified by the three (+) and three (−) rectifiers and appears between the B and E terminals in the form of direct current.

At the same time the voltage at the stator coil neutral point rises so that at the regulator, voltage is impressed from the N terminal on to coil L₁. This causes contacts P₃ to close and as there will be no voltage difference between the charge warning light terminals under this state, the light turns off. When the alternator generated voltage

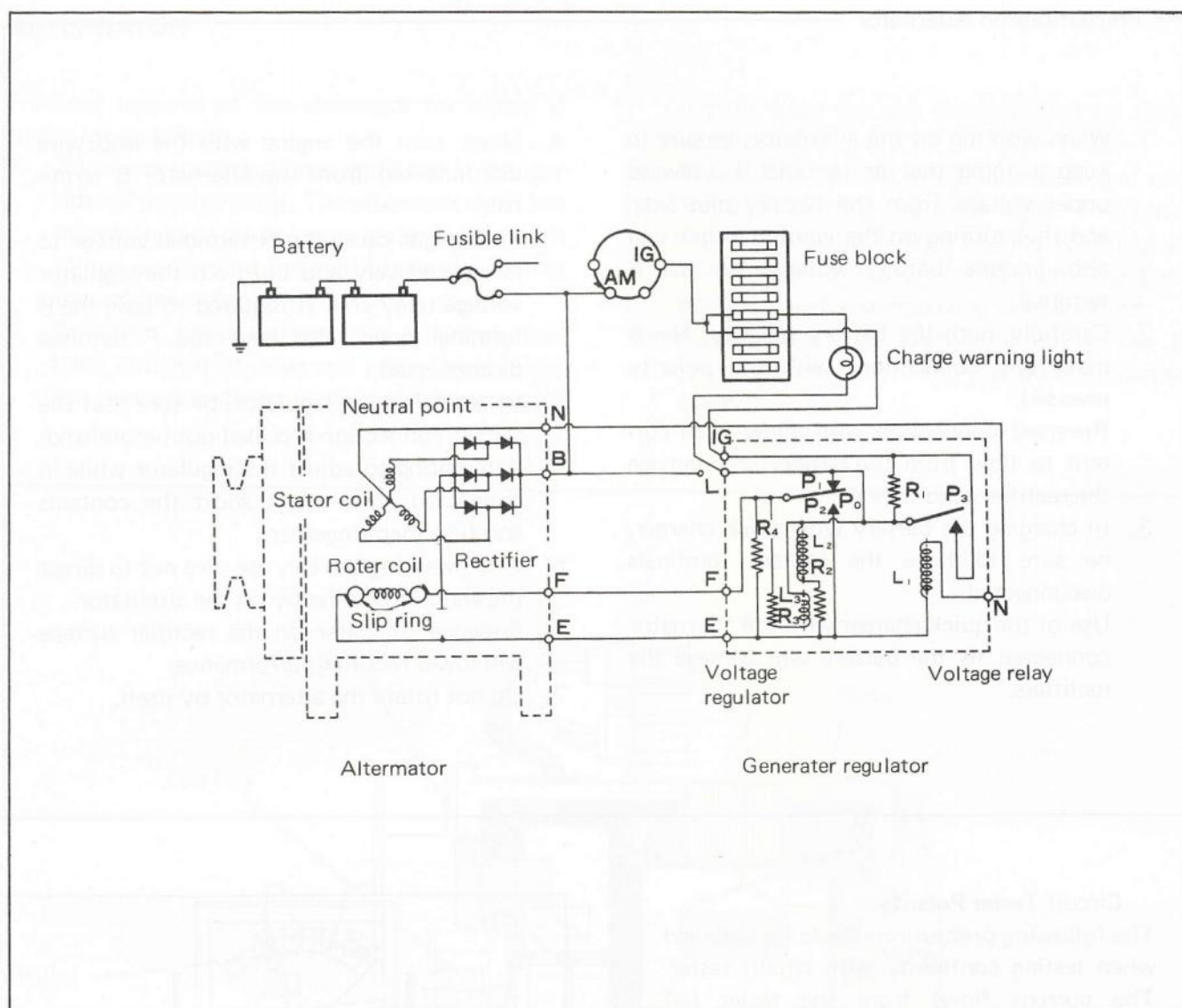


Fig. 6-54 Charging System Wiring Diagram (24 V System)

grows higher than the battery voltage, the current flows to the load or to the battery.

Engine Under Normal Operation

The alternator generated voltage changes in accordance with the alternator rotating speed. Therefore, in order to charge the battery properly, it is necessary not to have the voltage at alternator B terminal rise above a specified value.

When contacts P_3 close, the resistance R_1 is shorted out so that the exciting current then flows as follows :

IG terminal \rightarrow contacts $P_3 \rightarrow$ contacts $P_1P_0 \rightarrow$ F terminal \rightarrow rotor coil \rightarrow ground . . . (1) to allow full excitation. The rotor then speeds up, causing the generated voltage to rise rapidly. As the voltage rises, the pull-in force of coil L_2 increases, tending to open the contact P_0 .

When contact P_0 opens, the exciting current then

flows as follows :

IG terminal \rightarrow contacts $P_3 \rightarrow$ coil $L_3 \rightarrow$ resistance $R_3 \rightarrow$ F terminal \rightarrow rotor coil \rightarrow ground . . . (2)

The current flowing to the rotor coil is reduced since it passes through the resistance R_3 , causing the generated voltage to become lower. Due to the coil L_3 being wound to have its pull-in force act in opposed direction to that of coil L_2 , the formation of the above exciting circuit (2) causes the coil L_3 to pull in and close the contacts P_0P_1 . But when the contacts P_0P_1 close, the above exciting circuit (1) is formed, tending to open the contact P_0 . The generated voltage is normally regulated by repetition of the above actions but in case the load is light and the speed is high so that it is impossible to regulate voltage by means of above exciting circuit (2), the contact P_0 closes against P_2 , to reduce the current flow to rotor coil to zero and thereby regulate the voltage.

Precautions on Alternator

1. When working on the alternator, be sure to keep in mind that its terminal B is always under voltage from the battery plus side, and that turning on the ignition switch will also impress battery voltage on the F terminal.
2. Carefully note the battery polarity. Never make any connections with the polarity reversed.
Reversed connection will allow large current to flow from the battery and damage the rectifiers and wiring.
3. In charging the battery with quick charger, be sure to have the battery terminals disconnected.
Use of the quick charger with the alternator connected to the battery will damage the rectifiers.
4. Never turn the engine with the lead wire disconnected from the alternator B terminal.
This might cause the N terminal voltage to rise excessively and burn out the regulator voltage relay coil. If required to have the B terminal open, also have the F terminal disconnected.
5. In adjusting the regulator, be sure that the socket connection is pulled out beforehand. Attempting to adjust the regulator while in connected state might short the contacts and fuse them together.
6. When washing the car, use care not to direct the water hose directly on the alternator. Presence of water on the rectifier surface will lower rectifier performance.
7. Do not rotate the alternator by itself.

Circuit Tester Polarity

The following precaution should be observed when testing continuity with circuit tester. The current flows from the tester (—) terminal to its (+) terminal. The tester (+) terminal becomes (—) polarity and tester (—) terminal becomes (+) polarity, and differs from those when taking voltage and current measurements. Therefore, if the semiconductor being tested shows the same polarity, this indicates continuity. If reverse, this indicates no continuity. This point should be specially kept in mind when checking rectifiers.

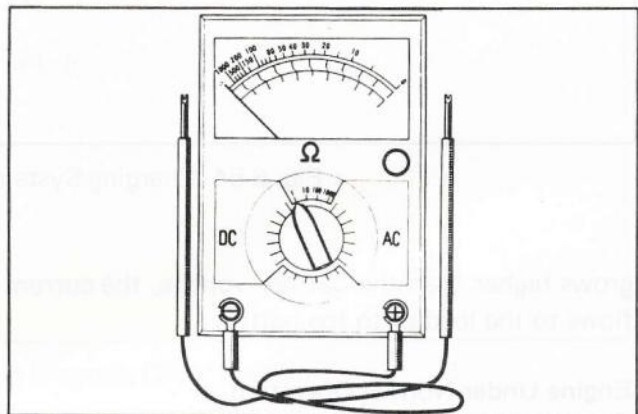


Fig. 6-55 Circuit Tester

ALTERNATOR

Principal features of the alternator for Model B engine are as follows :

1. A vacuum pump has been equipped at the rear side of the alternator. The alternator shaft has therefore been made longer and provided with splines on the end for meshing in and driving the vacuum pump rotor.
2. Rectifiers, brush holders, and slip rings have been arranged at drive end plate (front) side, for improving diode cooling and for preventing oil from vacuum pump getting on these parts.
3. There is no bearing in the alternator rear end frame supporting the rotor shaft. This function is taken up by the bearing (bushing) in the vacuum pump drive end plate, the two-point support system having been adopted.
4. A connector has been adopted at the B terminal for improving serviceability and safety.

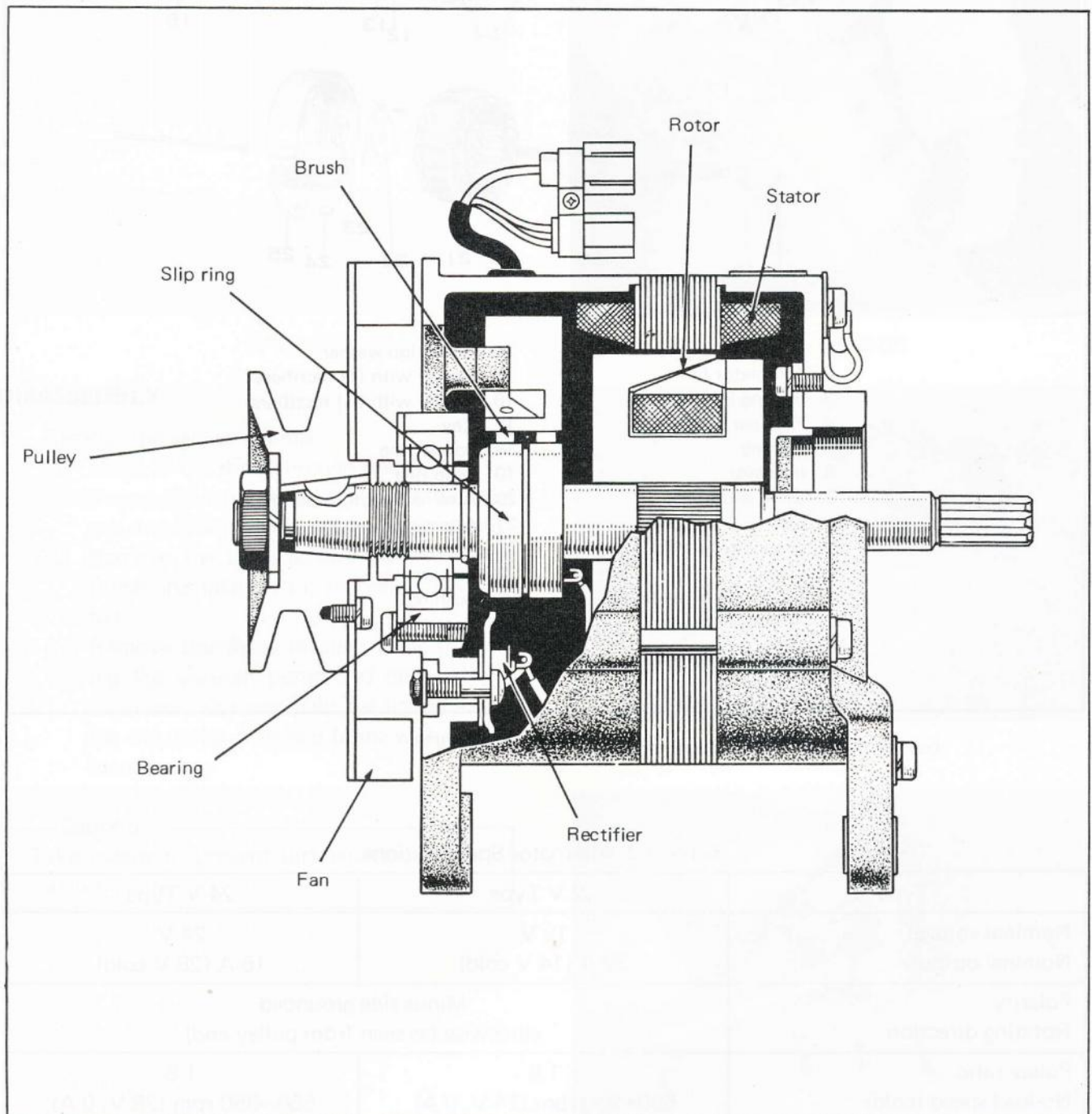


Fig. 6-56 Cutaway View of Alternator

COMPONENTS

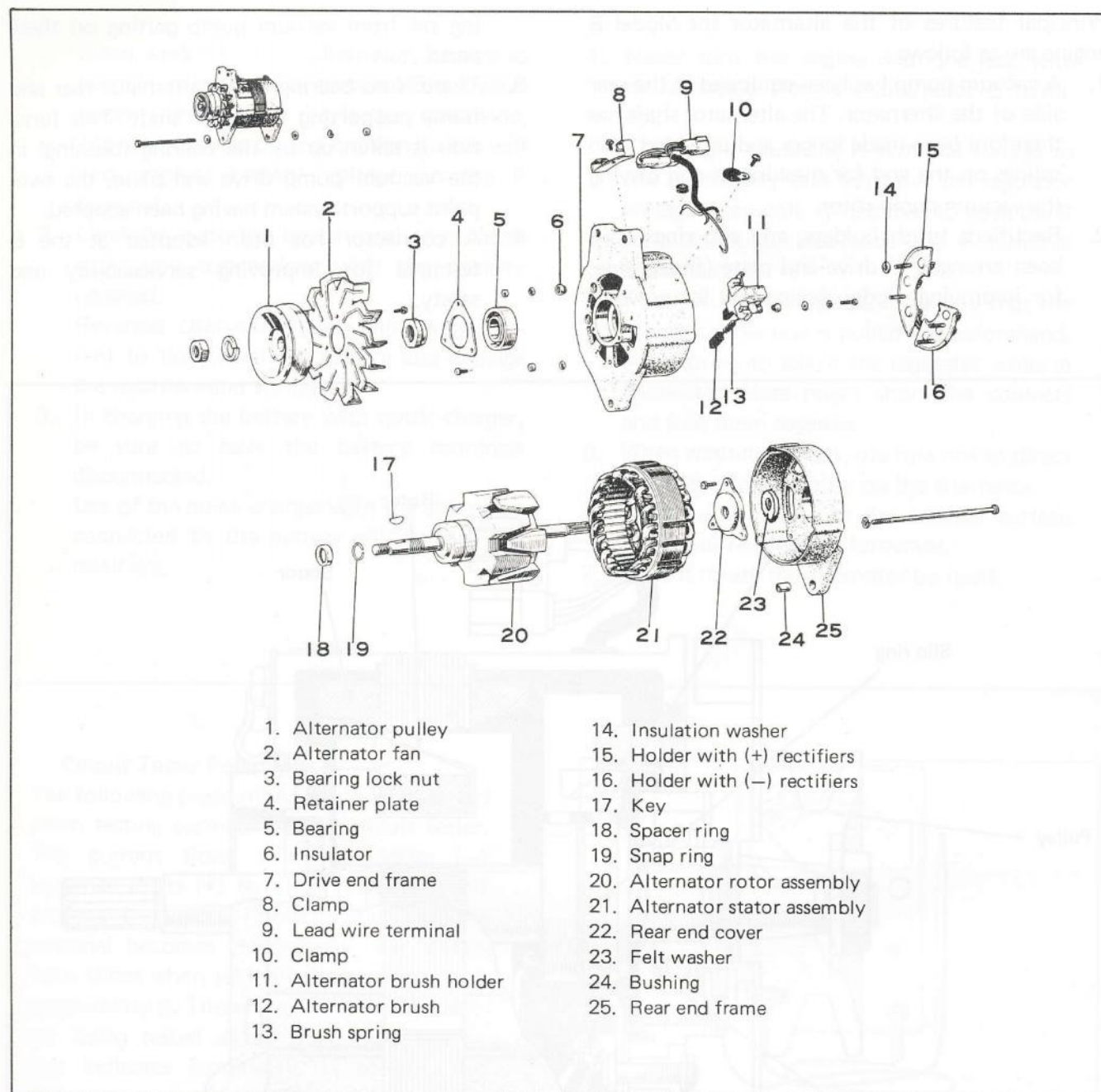


Fig. 6-57 Alternator Parts

Table 6-3 Alternator Specifications

Type	12 V Type	24 V Type
Nominal voltage	12 V	24 V
Nominal output	30 A (14 V cold)	15 A (28 V cold)
Polarity	Minus side grounded clockwise (as seen from pulley end)	
Rotating direction		
Pulley ratio	1.8	1.8
No-load speed (cold)	650~950 rpm (14 V, 0 A)	550~850 rpm (28 V, 0 A)
Output speed (cold)	2500 rpm maximum (14 V, 30 A)	2000 rpm maximum (28 V, 15 A)

REMOVAL

1. Disconnect the battery-to-ground cable from the battery.
2. Pull out the alternator wiring sockets (1).
3. Pull out the temperature gauge wiring socket, and unclamp the wiring (2).
4. Disconnect the oil inlet hose (3) and oil outlet hose (4).
5. Disconnect the vacuum takeoff hoses (5) and (6).
6. Remove the fan belt adjusting stay lock bolt.
7. Remove the bolt mounting the alternator, and take out the alternator assembly with vacuum pump through the engine service hole.

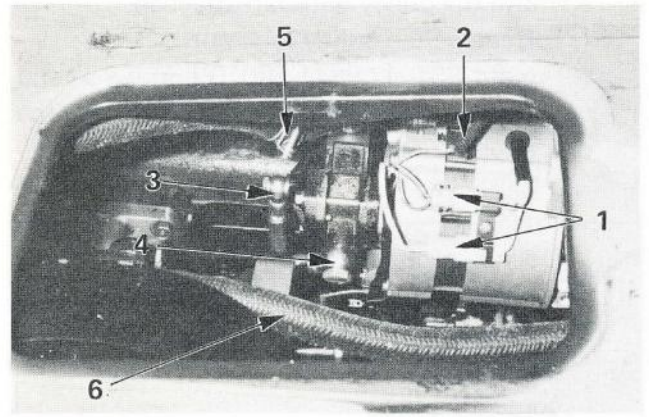


Fig. 6-58 Alternator Removal (1)

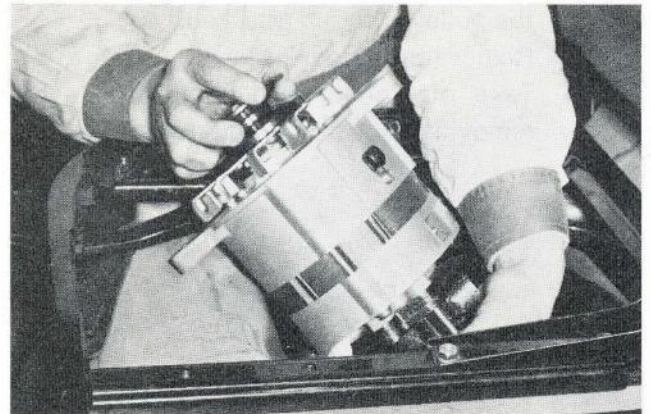


Fig. 6-59 Alternator Removal (2)

DISASSEMBLY

1. Remove the vacuum pump.
 - (1) Remove the three through bolts attaching the rear end frame, and take off the rear end frame with vacuum pump attached.
 - (2) Remove the three screws from rear end frame and take off the rear end cover and felt.
 - (3) Remove the three through bolts mounting the vacuum pump and take off the vacuum pump assembly by lightly tapping the pump drive end frame with plastic hammer.

Caution

Take means to prevent dirt entering in the vacuum pump.

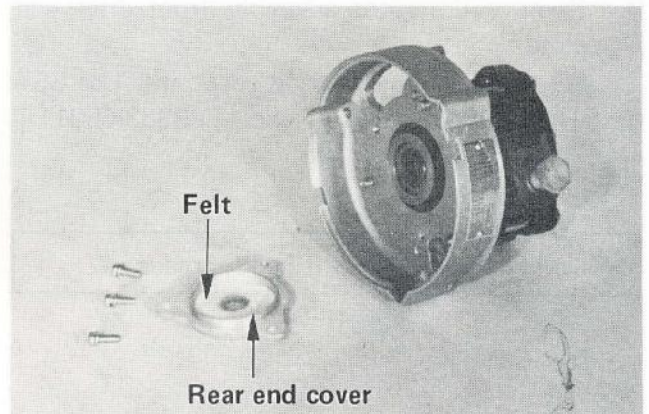


Fig. 6-60 Rear End Frame Removed.

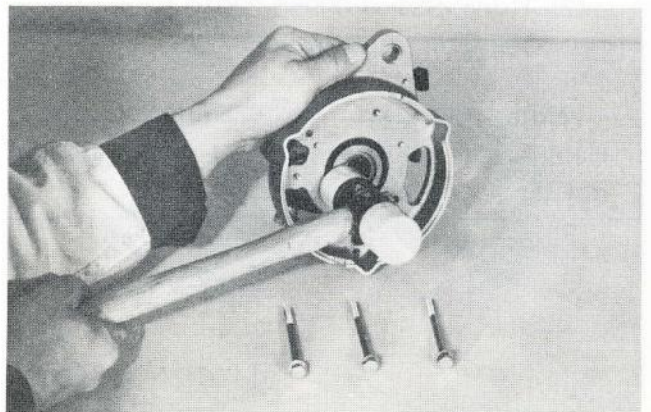


Fig. 6-61 Removing Vacuum Pump

2. Remove the pulley with fan attached.
 - (1) Remove the pulley lock nut.
Hold SST [09841-56010] in a vise and have the rotor core locked in to the alternator stand.

Note

1. Do not attempt to remove the lock nut by holding the rotor shaft in a vise.
2. Clamp the SST [09841-56010] in the vise such that the stator coil will not be contacting the vise.

- (2) By using SST [09950-20010], remove the pulley with fan attached.
- (3) Remove the woodruff key.
- (4) Take off the bearing retainer plate by removing three attaching screws.

3. Remove the rotor assembly from drive end plate.

- (1) Remove the bearing lock nut. Use SST [09841-56010] and [09333-55011] 32 mm wrench.

Caution

Bearing lock nut has left hand threads.

- (2) Using SST [09950-20010], draw out the rotor assembly.

Note

Hook on the universal puller such that it will not contact on stator coil.

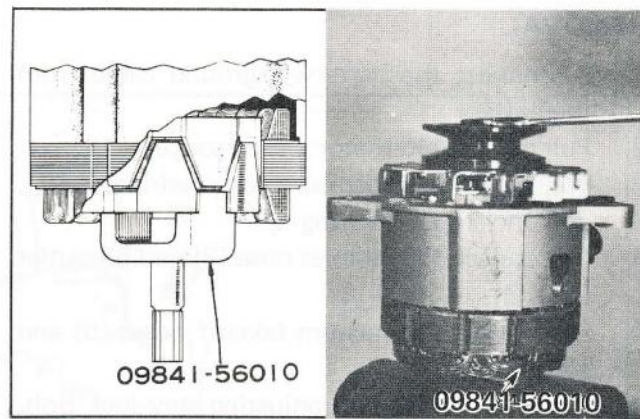


Fig. 6-62 Removing Pulley Lock Nut

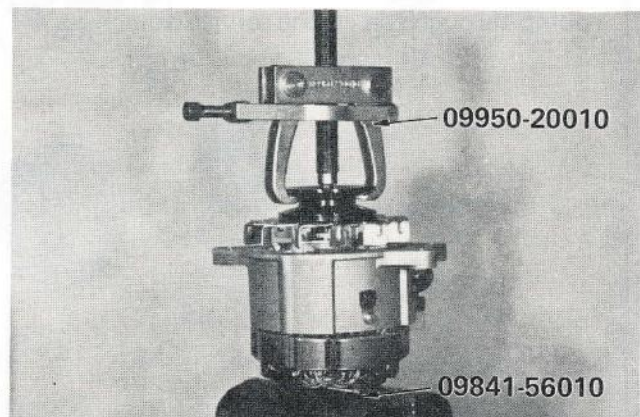


Fig. 6-63 Removing Pulley



Fig. 6-64 Removing Bearing Lock Nut

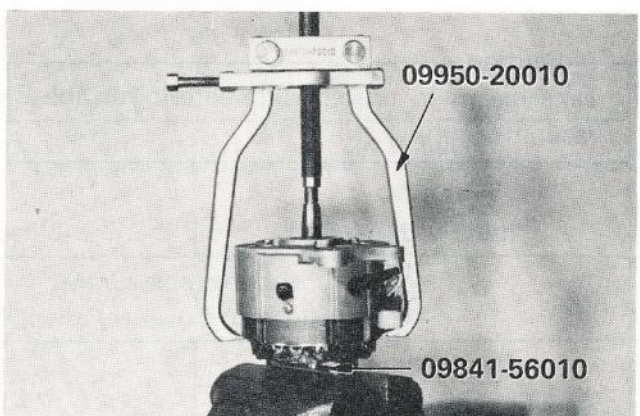


Fig. 6-65 Removing Rotor Assembly

4. Remove the bearing from drive end plate.

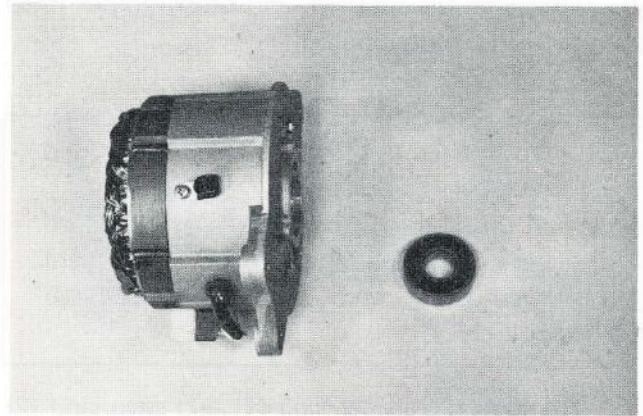


Fig. 6-66 Bearing Removed

5. Pull out the stator coil with brush holders with rectifiers complete from the drive end frame.

- (1) Remove the brush holder mounting screws (1) from the inner side of drive end frame.

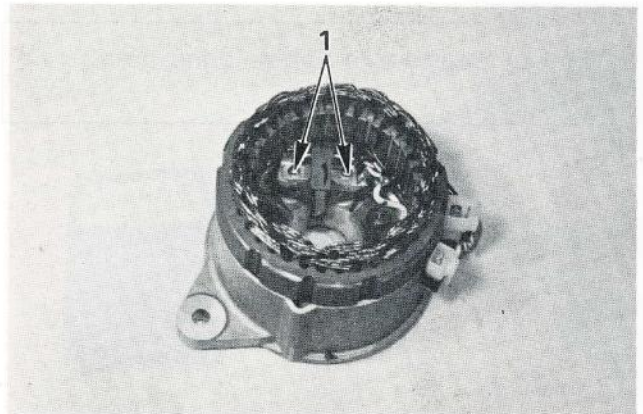


Fig. 6-67 Brush Holder Removal

- (2) Remove the rectifier mounting nuts (1), washers (2), and (+) side insulators (3) from front side of drive end frame.

- (3) Remove the socket mounting clamp (4) from the frame by removing one screw.

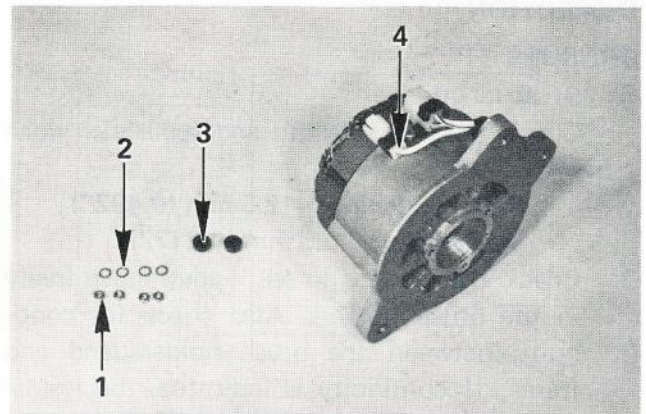


Fig. 6-68 Rectifier Removal

- (4) Take out the stator coil with brush holders with rectifiers complete from the drive end frame.

Note

1. Rectifiers at (+) side are provided with insulation washers (1).
2. Tuck in the wiring harness from socket when drawing out the stator coil

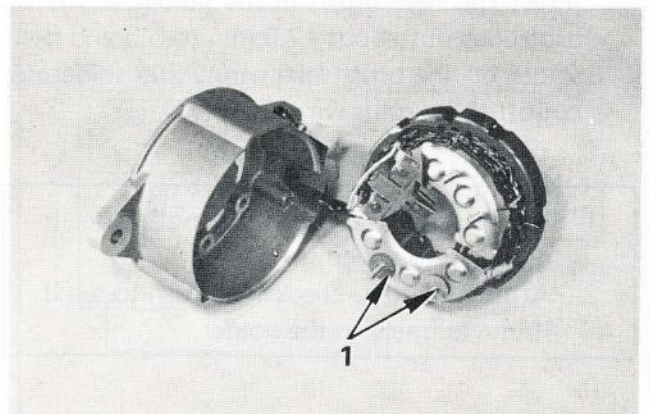


Fig. 6-69 Stator Coil Drawn Out

6. Unsolder the rectifier and brush holder leads by using soldering iron.

Note

1. Do not remove the rectifier unless found necessary to do so.
2. In unsoldering the rectifier, hold its lead wire with long nose pliers to prevent overheating and melt off the solder quickly.

7. Remove the spacer ring (1) and snap ring (2) from rotor assembly.

Note

Do not disassemble unless found necessary to do so.

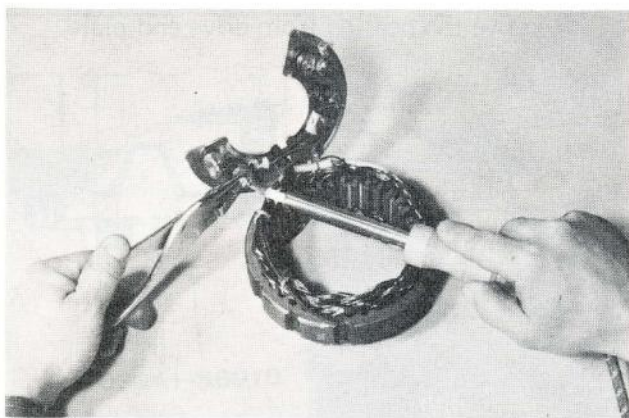


Fig. 6-70 Removing Rectifier

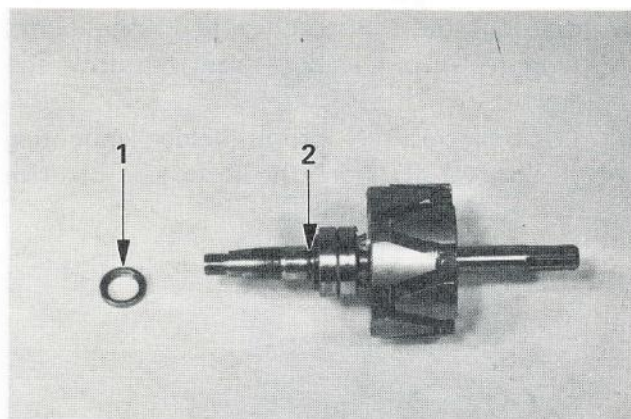


Fig. 6-71 Rotor Disassembled

INSPECTION

BRUSHES

1. Brush length
Check the brush length and replace if worn over the limit.

Standard length 12.5 mm (0.492")

Service limit 5.5 mm (0.217")

2. Check the brushes to see if they move freely in the brush holders. Also check for continuity between the brush holders and end frame. If continuity is indicated, the insulation is defective, necessitating replacement.

3. Brush replacement

Insert the new brush in the holder so that it protrudes out about 12.5 mm (0.5") and then solder on the brush lead wire. After soldering, cut off the surplus wire.

Note

1. In replacing the brush, do not solder it drawn in too deep.
2. After soldering, check the brush to see if it moves freely in the holder.

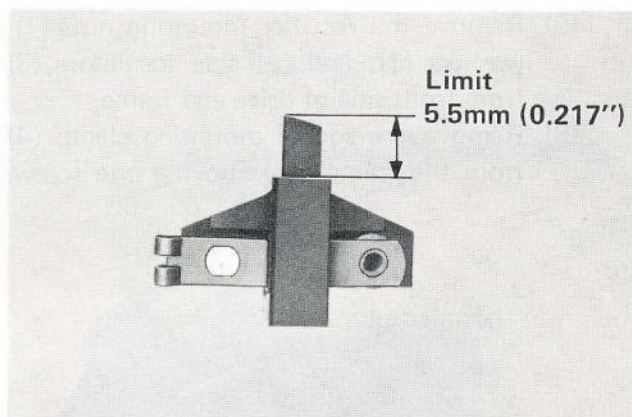


Fig. 6-72 Brush Length

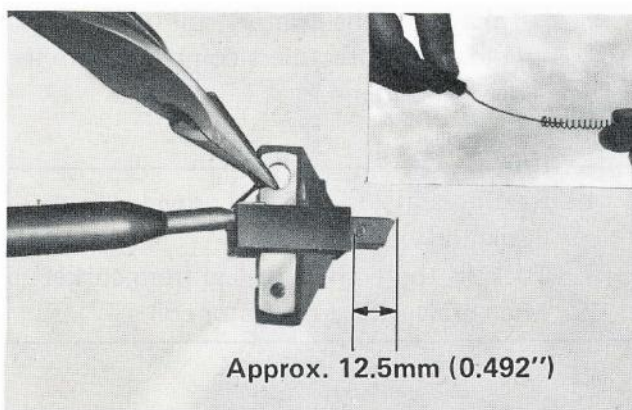


Fig. 6-73 Replacing Brush

STATOR COIL

Stator coil ground test can be performed while the rectifiers are still installed, but for the open-circuit test, the rectifier leads must be disconnected.

1. Stator coil ground test

Using a circuit tester, check the continuity between the stator coil and stator core. If tester indicates continuity, the coil is grounded and should be repaired or replaced.

Resistance Infinity

2. Stator coil open-circuit test

Check the continuity between the stator coil four leads. If tester does not indicate continuity, the coil has open-circuit and should be repaired or replaced.

Resistance 0

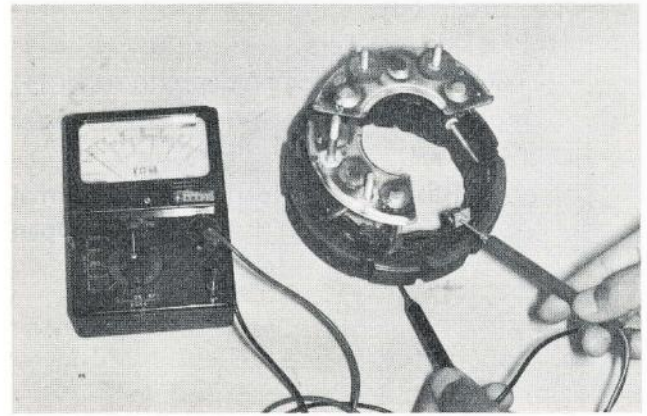


Fig. 6-74 Stator Coil Ground Test

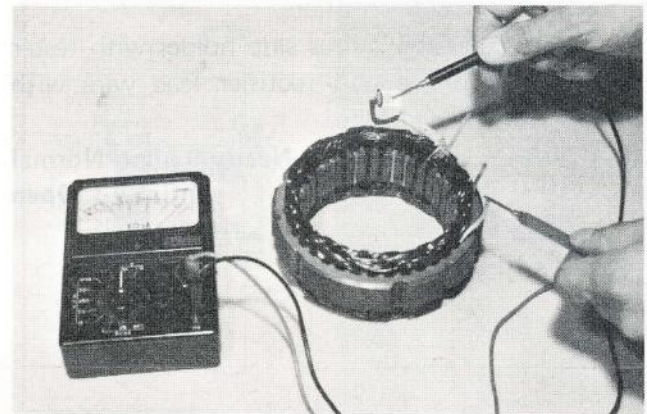


Fig. 6-75 Stator Coil Open Circuit Test

RECTIFIERS

Rectifier short-circuit test can be performed between the N and B terminals, but for the open-circuit test, the rectifier must be disconnected from stator coil. In case of defect, the entire assembly must be replaced.

1. Short-circuit test

(1) Plus side rectifiers

Touch the B terminal with tester (–) probe and stator coil N terminal with tester (+) probe.

Resistance Infinity: Normal
Nearly 0 ohm: Shorted

(2) Minus side rectifiers

Touch the E terminal with tester (+) probe and stator coil N terminal with tester (–) probe.

Resistance Infinity: Normal
Nearly 0 ohm: Shorted

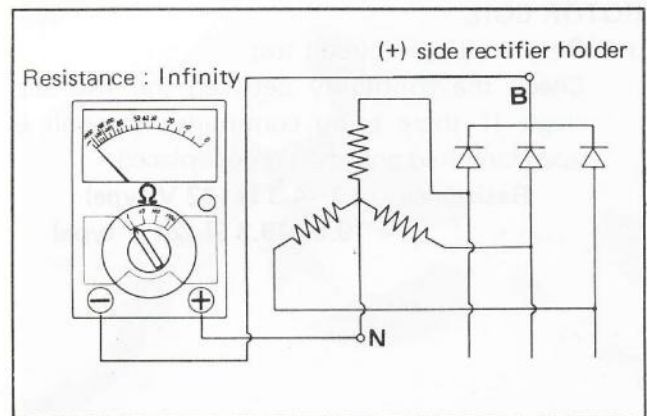


Fig. 6-76 (+) Rectifier Short-Circuit Test

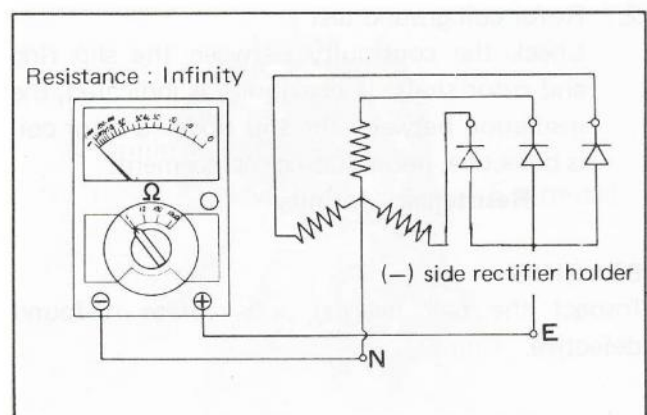


Fig. 6-77 (–) Rectifier Short-Circuit Test

2. Open circuit test

(1) Plus side rectifiers

Touch the plus side holder with tester (+) probe and rectifier lead wire with tester (-) probe.

Resistance **Nearly 0 ohm: Normal**
Infinity: Open

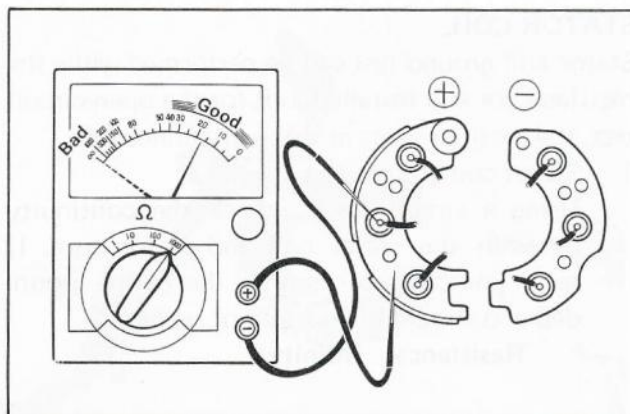


Fig. 6-78 (+) Rectifier Open-Circuit Test

(2) Minus side rectifiers

Touch the minus side holder with tester (-) probe and rectifier lead wire with tester (+) probe.

Resistance **Nearly 0 ohm: Normal**
Infinity: Open

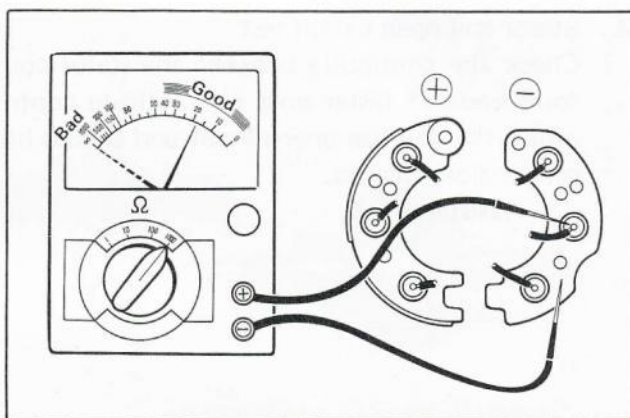


Fig. 6-79 (-) Rectifier Open-Circuit Test

ROTOR COIL

1. Rotor coil open-circuit test

Check the continuity between the two slip rings. If there is no continuity, the coil is open-circuited and should be replaced.

Resistance **4.1~4.3 Ω (12 V type)**
19.0~19.5 Ω (24 V type)

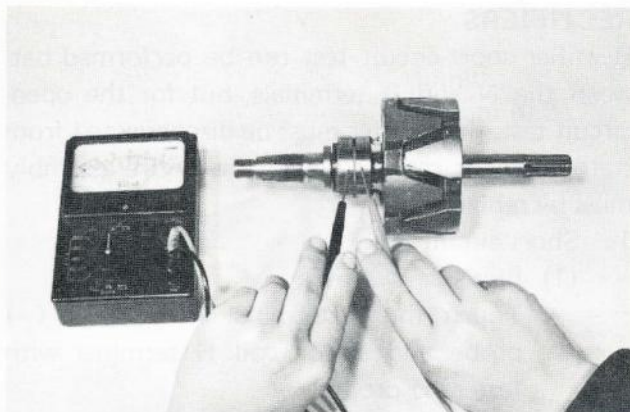


Fig. 6-80 Rotor Coil Open-Circuit Test

2. Rotor coil ground test

Check the continuity between the slip ring and rotor shaft. If continuity is indicated, the insulation between the slip ring and rotor coil is defective, necessitating replacement.

Resistance **Infinity**

BEARING

Inspect the ball bearing and replace if found defective.

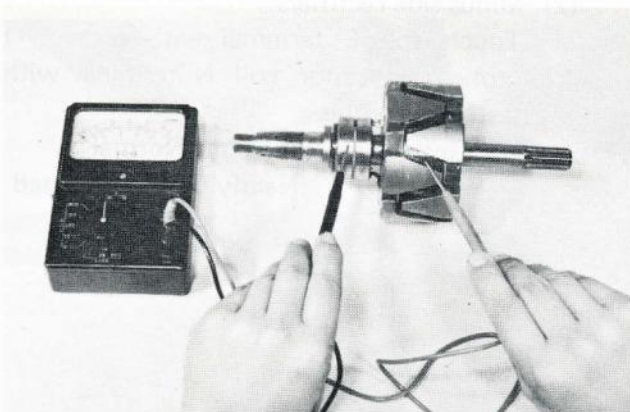


Fig. 6-81 Rotor Coil Ground Test

REAR END FRAME AND VACUUM PUMP

1. Inspect the rear end cover (1), felt washer (2), and rear end frame (3).

-Note

If dirty with oil or grease, check the vacuum pump oil seal and bearing.

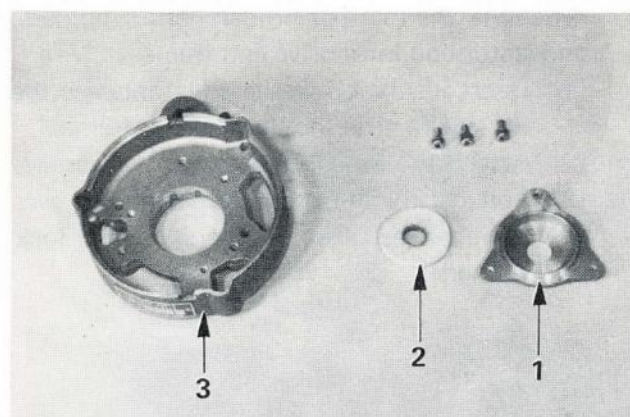


Fig. 6-82 Felt Washer & Rear End Frame Inspection

2. The vacuum pump oil seal should be inserted in fully as shown in Fig. 6-83.
3. Measure the vacuum pump bearing inside diameter.

Limit 16.14 mm (0.6354")

Standard 16.04~16.06

(0.6315"~0.6323")

Note

If over the limit, replace the vacuum pump assembly.

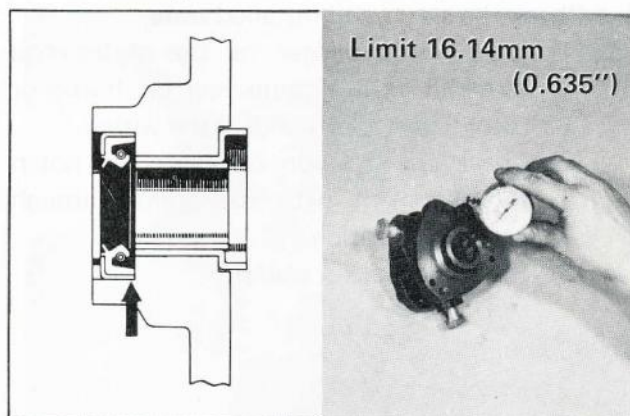


Fig. 6-83 Oil Seal & Bearing Inspection

ASSEMBLY

1. Solder on the rectifier lead wires to the stator coil.

Note

Solder by holding the rectifier lead wire with long nose plier and applying the soldering iron quickly to prevent overheating.

2. Assemble the brushes in to the brush holders.
(Refer to P6-27)
 - (1) Solder the F terminal to brush holder.
 - (2) Connect the E terminal to the F terminal side over terminal insulation washer.
 - (3) Solder the N terminal socket side to the stator side N terminal and push in to brush holder over terminal insulation washer.

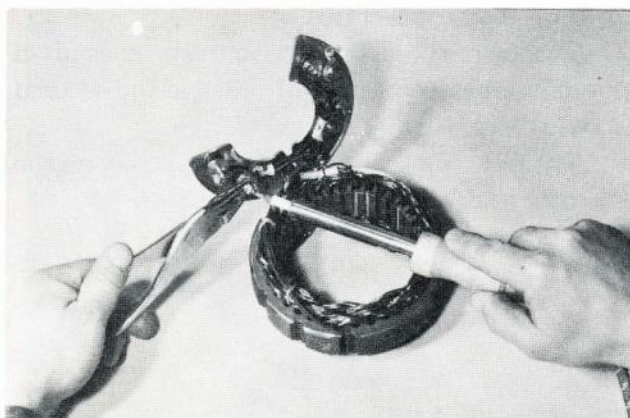


Fig. 6-84 Soldering Rectifier to Stator Coil

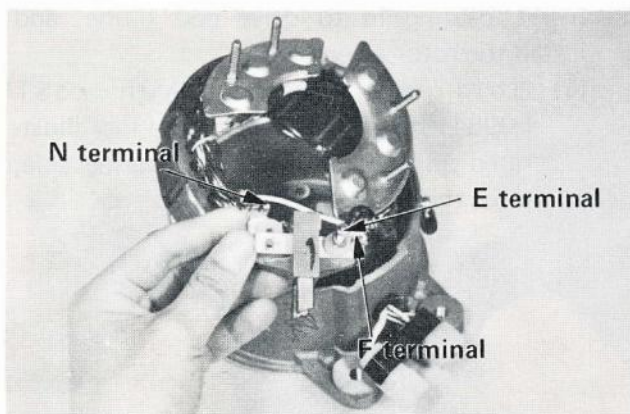


Fig. 6-85 Assembling Brush Holder

3. Assemble the rectifier holders, brush holders, and stator coil in to drive end frame.
 - (1) Insert insulation washers (1) between the (+) side rectifier holder and end frame.
 - (2) Attach the brush holder with two screws.
 - (3) Bolt on the (+) side rectifier holder over terminal insulation washers (2) and lock washer.

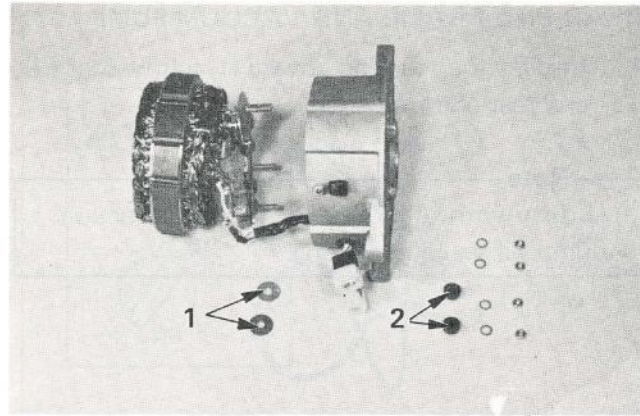


Fig. 6-86 Assembling Stator Coil

4. Check the stator coil installed state.
 - (1) If there is danger of the stator coil terminal wiring contacting on frame or rotor, correct by bending the wiring.
 - (2) Check the position of stator coil notch for alignment with end frame through bolt hole position.
 - (3) Install the socket clamp.

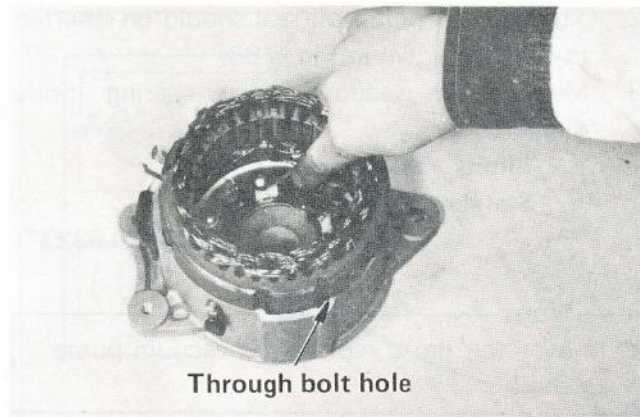


Fig. 6-87 Checking Stator Coil Installed State

5. Have the brushes lifted up.

As shown in Fig. 6-88, have the brushes lifted up from the end frame front side and secured with wire or other means.
6. Assemble the snap ring and spacer ring on the rotor shaft.

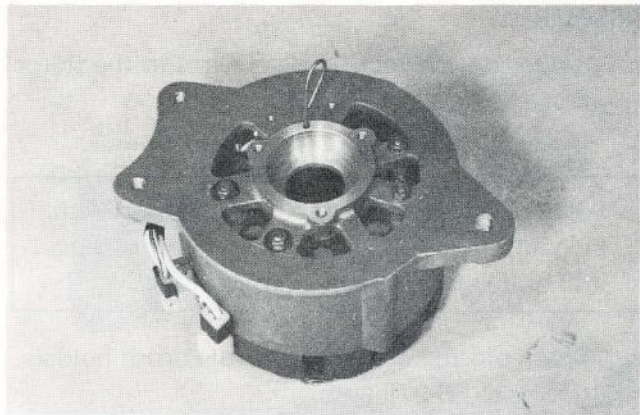


Fig. 6-88 Lifting Up Brushes

7. Insert bearing in to drive end frame, and install the rotor assembly.
 - (1) Hold the rotor with SST [09841-56010] and using the tool illustrated in Fig. 6-89, at the bearing side, press the end frame on to rotor.

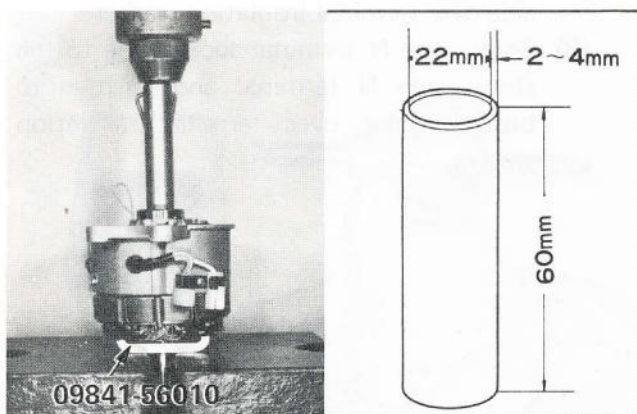


Fig. 6-89 Installing Rotor Assembly

8. Install the bearing lock nut.

Utilize SST [09841-56010] and [0933-55011] 32 mm wrench.

**Tightening torque 5.6~8.0 kg-m
(40.5~57.9 ft-lb)**

Caution

1. Lock nut has left-hand thread.
2. Be careful not to have the stator coil contacting on vise when clamping on the alternator stand in vise.

9. Remove the wires holding up the brushes and install the bearing plate retainer with three screws.
10. Install the pulley with fan attached.
- (1) Install the fan on the pulley with three screws.
 - (2) Fit the key into the rotor shaft, and after aligning the key-way, install the pulley on the shaft.
11. Mount the vacuum pump on the rear end frame with three through bolts.

Note

Coat the oil seal lightly with grease.

12. Insert the felt washer in the rear end frame and install the rear end cover with three screws.

13. Bolt together the rear end frame and drive end frame with three through bolts.

Note

Align the vacuum pump rotor spline hole against the rear cover hole and then fit in the alternator rotor shaft spline.

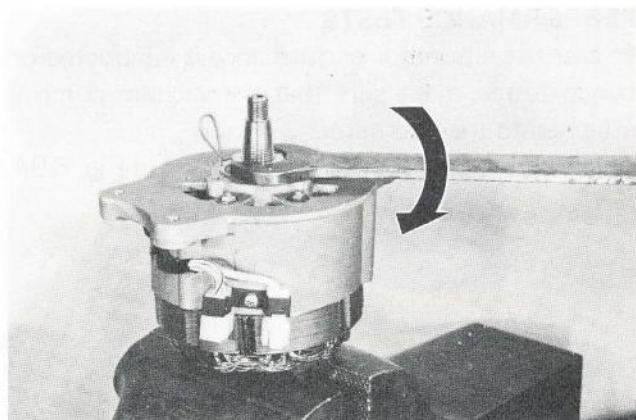


Fig. 6-90 Tightening Bearing Lock Nut

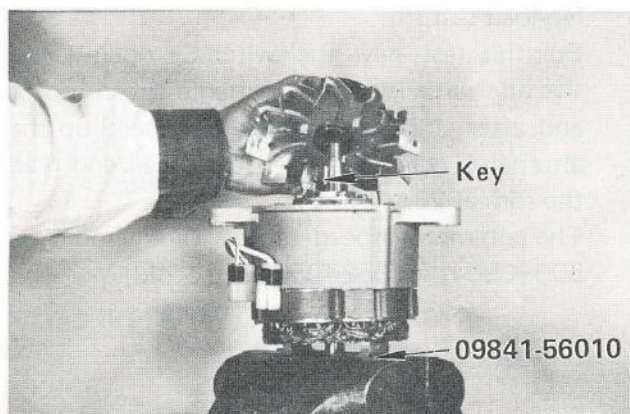


Fig. 6-91 Installing Pulley with Fan

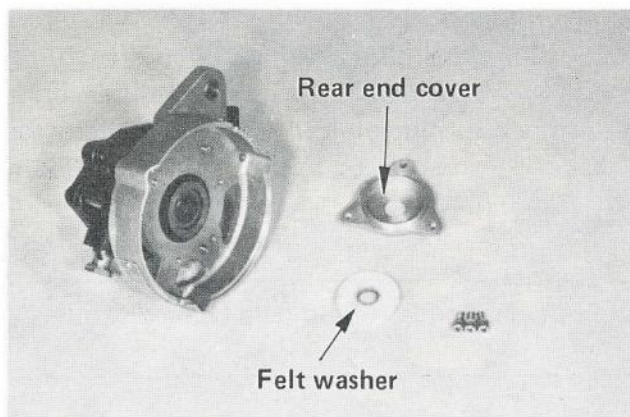


Fig. 6-92 Installing Felt Washer

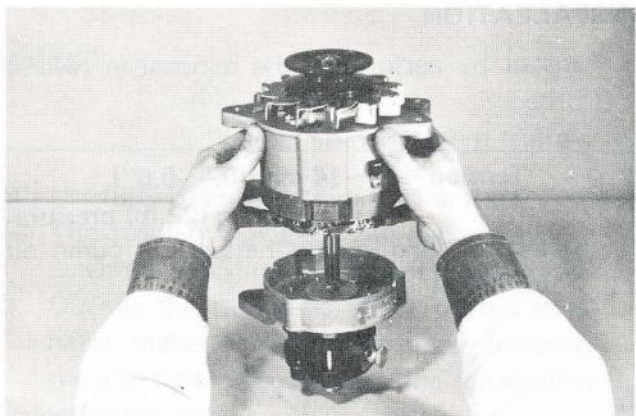


Fig. 6-93 Installing Rear End Frame to Drive End Frame

PERFORMANCE TESTS

In case the alternator performance is conducted on bench tester, make sure that the vacuum pump is attached to the alternator.

Then, connect the oil pipes as shown in Fig. 6-94.

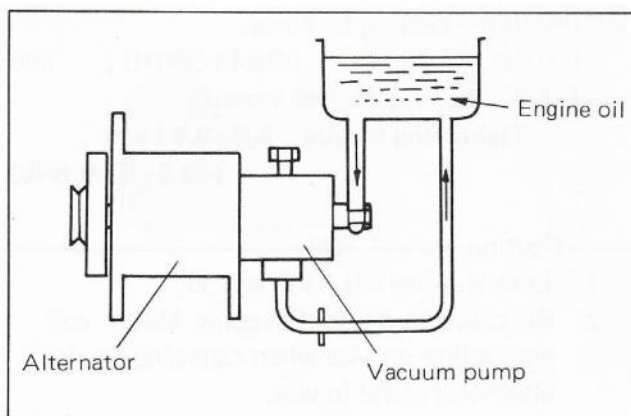


Fig. 6-94 Alternator Performance Test

Conduct the performance tests by hooking up the alternator as shown in Fig. 6-95.

1. No-load test

For this test, have the switch S_2 open. Drive the alternator with the variable speed motor and after closing the switch S_1 , speed up the alternator gradually from low speed and read the rpm at 28 V (14 V).

The alternator speed at this time should be 500~850 rpm (650~950 rpm) (cold).

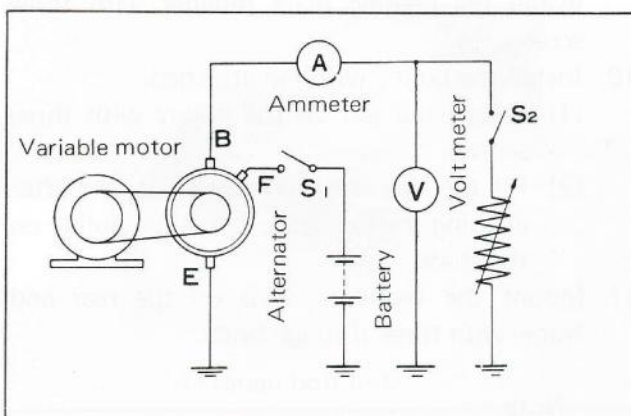


Fig. 6-95 No-Load Test

2. Output test

Maintain the output voltage at constant 28 V (14 V) by adjusting the variable resistance. At output current of 15 A (30 A) the alternator speed should be less than 2,000 rpm (2,500 rpm) (cold)

Note

Fully charged battery should be used for the tests.

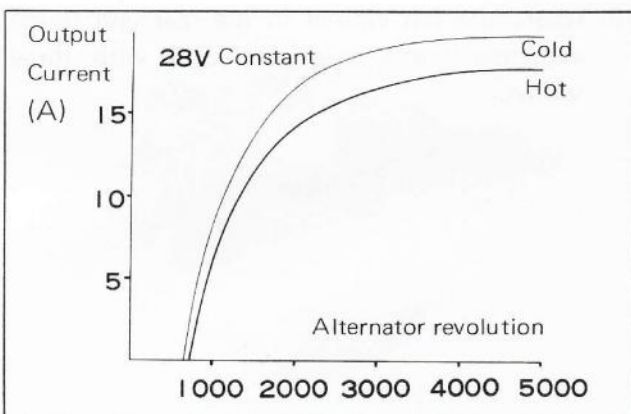


Fig. 6-96 Alternator Output Characteristics (24 V Type)

INSTALLATION

1. Install by performing the removal in reverse order.
2. Adjust the fan belt deflection.
Tension 11~14 mm (0.4~0.6")
at 10 kg (22 lb) pressure
3. After installing, check the vacuum pump oil hoses for oil leakage.

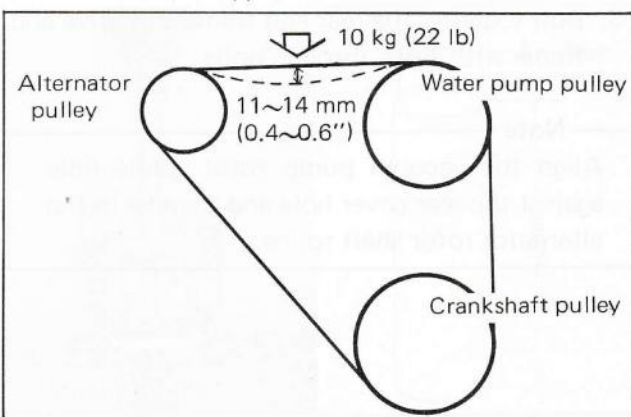


Fig. 6-97 Fan Belt Tension

GENERATOR REGULATOR

Table 6-4 Generator Regulator Specifications

Type	12 V Type	24 V Type
Regulating voltage	13.8~14.8V	27.8~28.6V
Field relay cutout voltage	4.5~5.8V	5.2~5.8V
Polarity	(-) ground	(-) ground

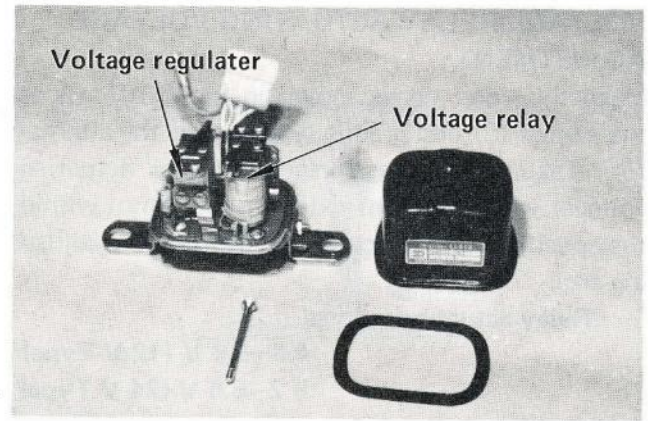


Fig. 6-98 Generator Regulator

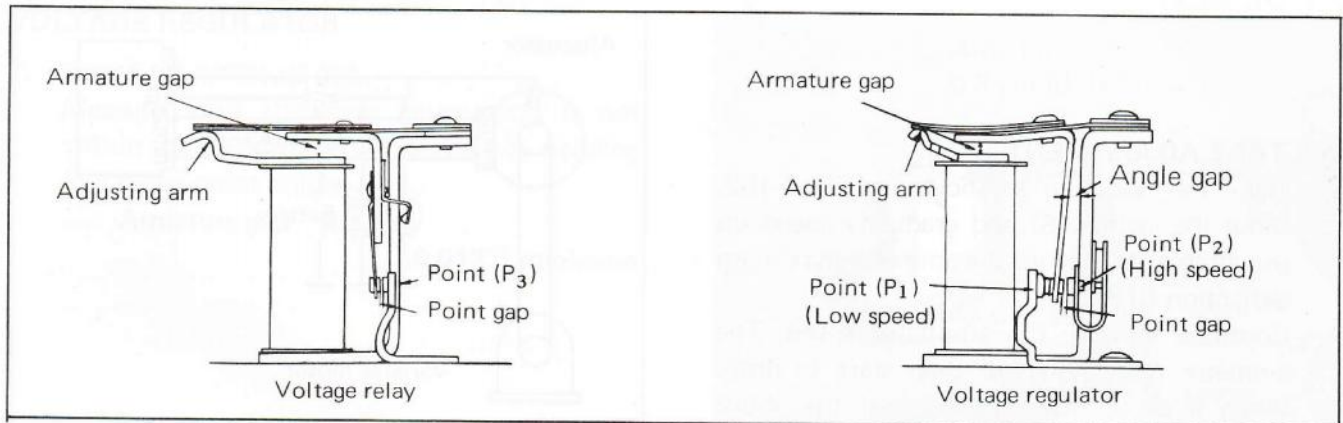


Fig. 6-99 Relay and Regulator Part Names (24 V Type)

REMOVAL

1. Remove the shelf panel.
2. Disconnect the generator regulator wiring by pulling out the connector.
3. Remove the generator regulator by removing its mounting screws.

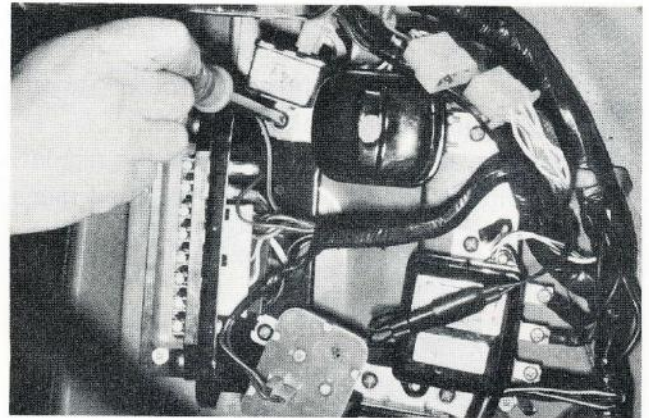


Fig. 6-100 Removing Generator Regulator

ADJUSTMENT**GENERATOR REGULATOR ELECTRICAL ADJUSTMENTS****Precautions of Performing Electrical Adjustments**

1. Be sure to open switch before starting tests.
2. In adjusting the regulator on-vehicle, it should be noted that when the engine is idling, the generated voltage will be higher than the relay actuating voltage. Therefore, in this case, check the voltage regulator to see that its points are closed.
3. Use fully charged battery for the tests.
4. The regulating voltage will become higher when the adjusting arm is bent upward.
5. Due to the hysteresis effect of the alternator, make each measurement by lowering the alternator speed and taking the reading when the speed is rising.

VOLTAGE RELAY ACTUATING VOLTAGE ADJUSTMENT

Make the hook up as shown in Fig. 6-101. Close the switch (S) and gradually speed up the alternator. Take the voltage reading (relay actuating voltage) when the light extinguishes. If not within the specified values, correct by bending the adjusting arm.

Relay actuating voltage

4.5~5.8 V (12 V Type)

5.2~5.8 V (24 V Type)

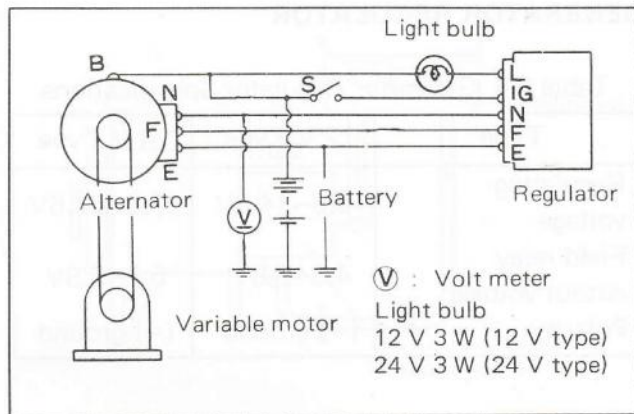


Fig. 6-101 Relay Actuating Voltage

VOLTAGE ADJUSTMENT

1. Make the hook up as shown in Fig. 6-102. Close the switch (S) and gradually speed up the alternator. Record the ammeter maximum deflection (If max).
2. Continue to raise the alternator speed. The ammeter deflection will then start to drop. When it drops down to one-half the above maximum deflection (alternator speed will be about 1,200 rpm at 1/2 If max), read the voltage.

Raise the speed still further. When it reaches about 3,000 rpm (engine speed about 1,600 rpm) read the voltage.

3. Bend the adjusting arm such that the regulating voltage will be within the specified range at both 1/2 If and 3,000 rpm.

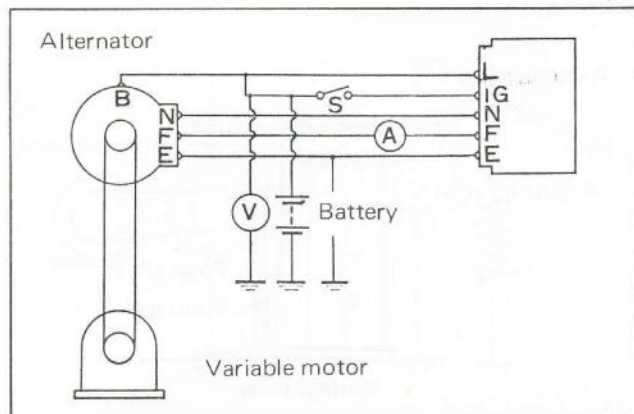


Fig. 6-102 Regulator Actuating Voltage Adjustment

Regulating voltage

13.8~14.8 V (12 V Type)

27.8~28.6 V (24 V Type)

If the voltage cannot be adjusted to within the standard limits, repair or replace the regulator.

GENERATOR REGULATOR MECHANICAL ADJUSTMENTS

Perform the mechanical adjustments after removing the regulator from the vehicle.

VOLTAGE RELAY

1. Check the contact spring deflection. Press down the armature and measure with thickness gauge.

Contact spring deflection (actuated)

0.2~0.6 mm (0.008"~0.024")

If adjustment cannot be made to within the standard limits, adjust by bending the point holder A.

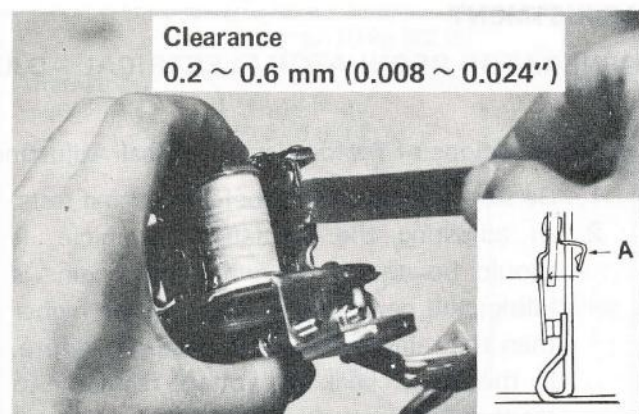


Fig. 6-103 Checking Contact Spring Deflection

2. Measure the point gap.
Measure with thickness gauge, and if not within the specified values, correct by bending the point P₃.

Point gap 0.4~1.2 mm
(0.016"~0.047")

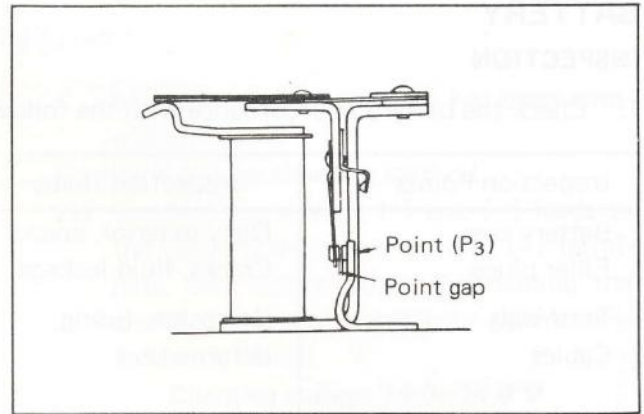


Fig. 6-104 Checking Point Gap

VOLTAGE REGULATOR

1. Check the armature gap.
Measure with thickness gauge, and if not within the specified values, correct by bending low speed point holder (A).

Armature gap 0.3 mm
(0.012") minimum

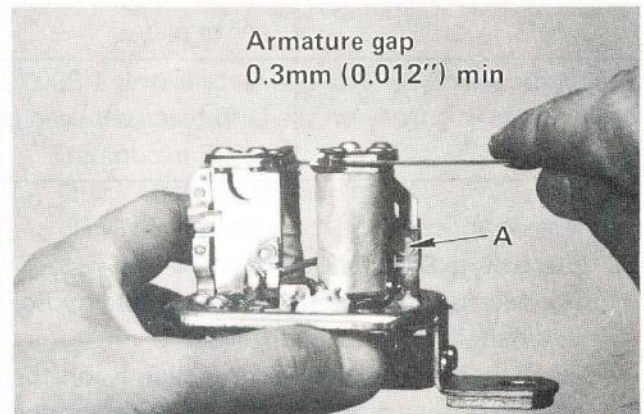


Fig. 6-105 Checking Armature Gap

2. Check the point gap.
If not within the specified values, correct by bending the high speed point holder P₂.

Point gap 0.3~0.45 mm
(0.012"~0.018") (12 V Type)
Point gap 0.5~0.7 mm
(0.020"~0.028") (24 V Type)

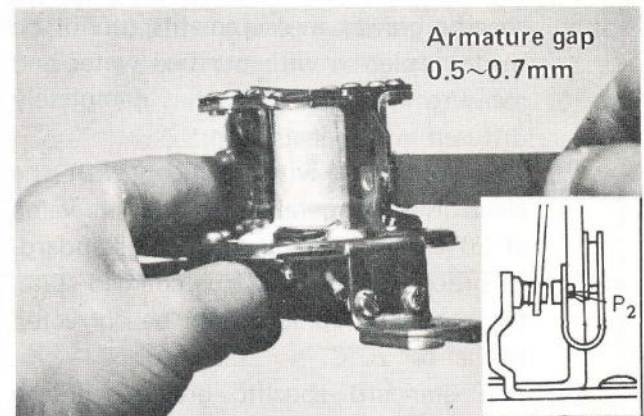


Fig. 6-106 Checking Point Gap

3. Check the angle gap.
Press down the armature and check with thickness gauge.
If gap is smaller than specified value, replace.

Angle gap standard 0.2 mm
(0.008") minimum

INSTALLATION

Perform the removal procedures in reverse order.

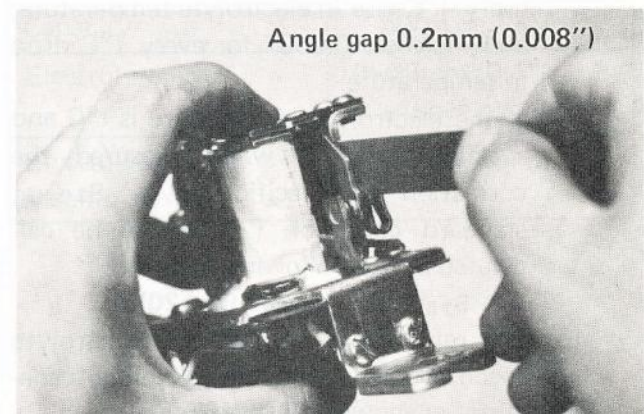


Fig. 6-107 Checking Angle Gap

BATTERY

INSPECTION

1. Check the battery in accordance with the following chart.

Inspection Points	Inspection Items	Remedies
Battery case Filler plugs Terminals Cables	Dirty exterior, cracks Cracks, fluid leakage Corrosion, fusing, deformation	Wash off dirt with warm water. For other defects, repair or replace. Fog light corrosion, wash with warm water and clean with wire brush or sandpaper. For other defects, replace.
Voltage	Above 12 volts	Recharge
Electrolyte level	10~25 mm (0.4"~1") above plates	Replenish with purified water
Specific gravity	All cells over 1.200 (20°C) Difference between cells 0.025 maximum	After full charge, adjust specific gravity.

2. Electrolyte Specific Gravity

- (1) Measure the specific gravity with a hydrometer.

The electrolyte level rises slightly on the float due to surface tension, but read the raised part.

- (2) If the electrolyte level is low so that specific gravity measurements cannot be made, replenish with purified water and measure after the water has completely diffused in the electrolyte.*

- (3) The specific gravity changes with the electrolyte temperature so that its value at 20°C has been taken as the standard. In order to know the true charged state, the measured value should be corrected to that for 20°C.

- (4) The standard specific gravity of the electrolyte is that at 20°C.

The specific gravity decreases 0.0007 for every 1°C rise in electrolyte temperature, and increases 0.0007 for every 1°C drop in temperature.

If the electrolyte temperature is $t^{\circ}\text{C}$ and specific gravity S_t when measured, the correction to specific gravity S_{20} at standard condition (20°C) can be calculated by the following equation.

$$S_{20} = S_t + 0.0007 (t - 20)$$

- (5) The relationship between the electrolyte specific gravity and the remaining capacity is as shown in Table 6-5.

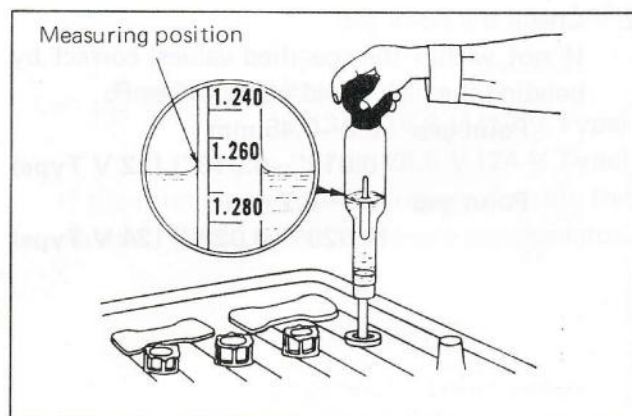


Fig. 6-108 Measuring Specific Gravity

Table 6-5 Electrolyte Sp. Gr. and Remaining Capacity

Electrolyte Sp. Gr. (20°C)	Remaining Capacity (%)
1.260	100
1.210	75
1.160	50
1.110	25
1.060	0 (fully discharged)

CHARGING

Precautions before Charging

1. If a quick charger is to be employed in charging the battery, be sure to disconnect the battery-to-ground cable from the battery minus terminal in order to prevent high voltage from being impressed on the alternator and damaging its rectifiers.
2. Be sure to have all filler plugs removed while charging.
3. If electrolyte heats up above 45°C, stop charging temporarily.
4. Flammable gas will be produced while charging, making it extremely dangerous to have open flame or sparking near by.

1. Constant current charging method.

- (1) Connect the charger (+) and (–) leads to the respective battery (+) and (–) terminals, and charge while maintaining the charging current constantly at the following value.

Charging current

5 A (50 Ah capacity)

7 A (70 Ah capacity)

- (2) The voltage and specific gravity gradually rises as the charging progresses until they reach maximum values. If these values remain nearly unchanged for over an hour and all cells are gassing vigorously, it can

be assumed that charging has been completed.

2. Constant voltage charging method

- (1) Connect the charger (+) and (–) leads to the respective battery (+) and (–) terminals, and charge while maintaining the charging voltage constantly within the following values.

Charging voltage 14.0~14.8 V

- (2) After the charging starts, the current gradually decreases and when it reaches nearly zero, the charging is considered as completed.
- (3) Unlike the constant current charging method, there is no gassing as completion of charge.

3. Quick charging method

- (1) This is a method in which the discharged battery is charged with large current to restore the capacity as much as possible in a short time. This method is usually employed as temporary measure when the engine cannot be started due to battery having been over-discharged.
- (2) In this method, a quick charger is used, and there is no necessity of removing the battery from the vehicle.
- (3) For charging procedures, refer to the instruction manual for the charger employed.

SPECIFIC GRAVITY ADJUSTMENT

If the specific gravity differs from the standard value after completing the charge, make the adjustments as follows :

Specific gravity standard

1.250~1.270 (20°C)

Difference between cells

0.025 max.

1. If above the standard value ... Add purified water
2. If below the standard value ... Add dilute sulfuric acid of less than 1.400 (20°C) specific gravity

Table 6-6 Battery Specifications

Nominal voltage	12V x 1, 12 V x 2
Capacity	50Ah or 70Ah
Electrolyte level	10~25mm (0.4"~1") (Above plates)
Electrolyte specific gravity	1.260 (20°C)