Delco Remy

DELCOTRON® GENERATORS
(10-SI, 15-SI, AND 27-SI SERIES, 100 TYPE)

Date 12-1-78
Supersedes Bulletins
Dated 10-1-77, 11-1-76
and 7-1-74

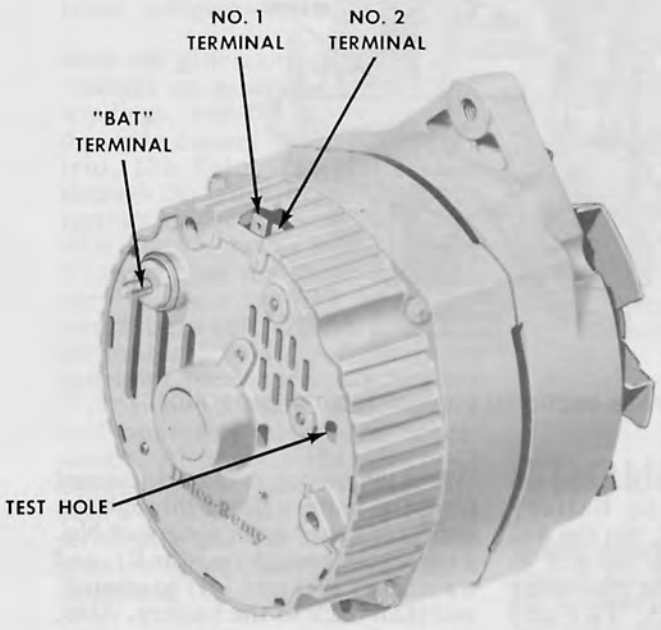

Figure 1—Typical 10-SI Series generator.

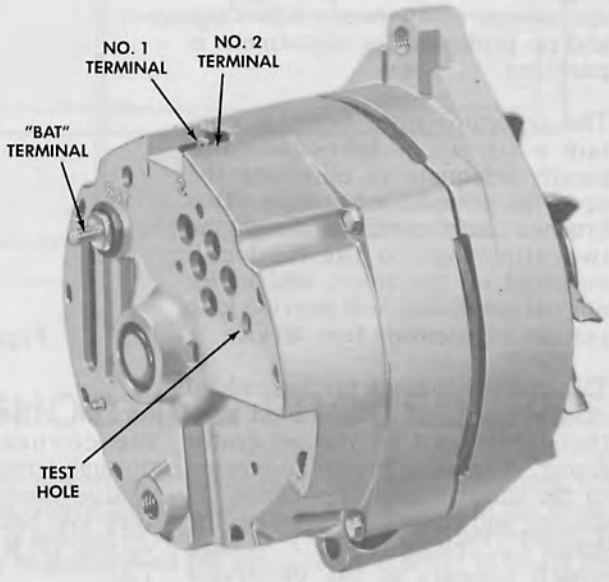

Figure 2—Typical 15-SI Series generator.

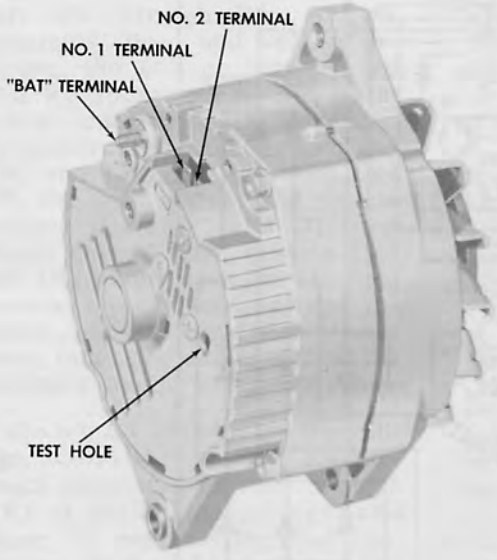

Figure 3—Typical 27-SI Series generator.

THIS BULLETIN IS DIVIDED INTO FOUR SECTIONS

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INTRODUCTION

The Delcotron® generators illustrated in Figures 1, 2, 3 and 4 feature a solid state regulator that is mounted inside the generator slip ring end frame. The regulator voltage setting never needs adjusting, and no provision for adjustment is provided.

The generator rotor bearings contain a supply of lubricant sufficiently adequate to eliminate the need for periodic lubrication. Two brushes carry current through the two slip rings to the field coil mounted on the rotor, and under normal conditions will provide long periods of attention-free service.

The stator windings are assembled on the inside of a laminated core that forms part of the generator frame. A rectifier bridge connected to the stator windings contains six diodes, and electrically changes the stator a.c. voltages to a d.c. voltage which appears at the generator output terminal. Generator field current is supplied through a diode trio which also is connected to the stator windings. A capacitor, or condenser, mounted in the end frame protects the rectifier bridge and diode trio from high voltages, and suppresses radio noise.

No periodic adjustments or maintenance of any kind are required on the entire generator assembly.

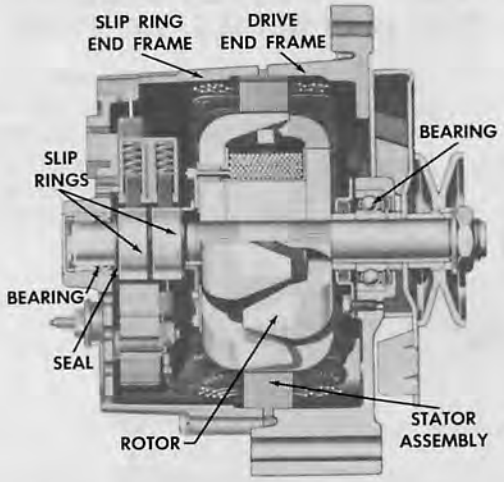

Figure 4—Cross-sectional view of typical generator.

OPERATING PRINCIPLES

A typical 10-SI Series wiring diagram is illustrated in Figure 5. The basic operating principles are explained as follows.

The No. 2 terminal is connected to the battery, and the base-emitter of transistors TR3 and TR1 is connected to the battery through resistor R5, thus turning these transistors on. Also, resistors R2 and R3 are connected to the battery through terminal No. 2, but the discharge current of the battery is very low because of the resistance values of R2, R3, R5, TR1 and TR3.

When the switch is closed, current from the battery flows through the indicator lamp to the generator No. 1 terminal, through resistor R1, and transistors TR3 and TR1 to ground, and then back to the battery. Also, current flows through the generator

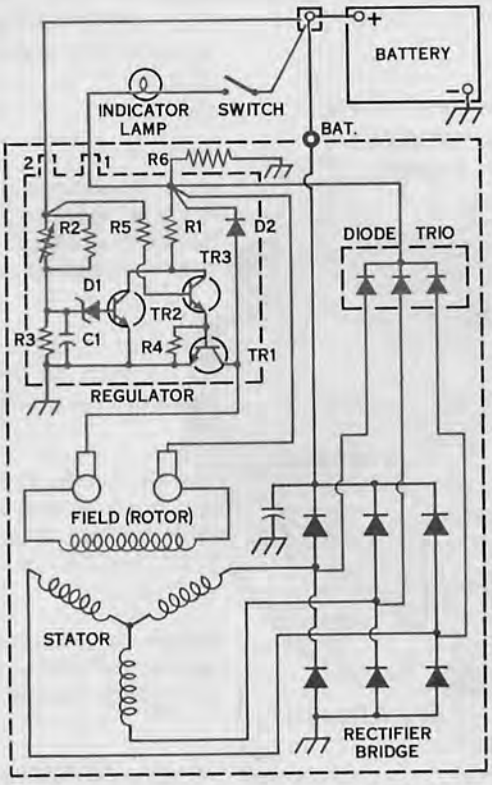

Figure 5—Typical 10-SI wiring diagram showing internal circuits (15-SI and 27-SI Series are identical except stator is a delta.)

field coil and TR1 back to the battery. The indicator lamp then turns on. Resistor R6 carries some of the indicator lamp current, and is identified in Figures 9, 11, and 13.

With the generator operating, a.c. voltages are generated in the stator windings, and the stator supplies d.c. field current through the diode trio, the field, TR1, and then through the grounded diodes in the rectifier bridge back to the stator. Also, the six diodes in the rectifier bridge change the stator a.c. voltages to a d.c. voltage which appears between ground and the generator "BAT" terminal. As generator speed increases, current is provided for charging the battery and operating electrical accessories. Also, with the generator operating, the same voltage appears at the "BAT" and No. 1 terminals, and the indicator lamp goes out to indicate the generator is producing voltage.

If an open should occur in the No. 2 terminal circuit, TR3 and TR1 will turn off, no field current will flow to prevent overcharge, and indicator lamp current will flow to ground through R6 to indicate a defect. Also, an open in the field circuit will cause the indicator lamp to turn on through R6. As the generator speed and voltage increase, the voltage between R2 and R3 increases to the point where zener diode D1 conducts. Transistor TR2 then turns on and TR3 and TR1 turn off. With TR1 off, the field current and system voltage decrease, and D1 then blocks current flow, causing TR3 and TR1 to turn back on. The field current and system voltage increase, and this cycle then repeats many times per second to limit the generator voltage to a preset value.

Capacitor C1 smooths out the voltage across R3, resistor R4 prevents excessive current through TR1 at high temperatures, and diode D2 prevents high-induced-voltages in the field windings when TR1 turns off. Resistor R2 is a thermister which causes the regulated voltage to vary with temperature, thus providing the optimum voltage for charging the battery.

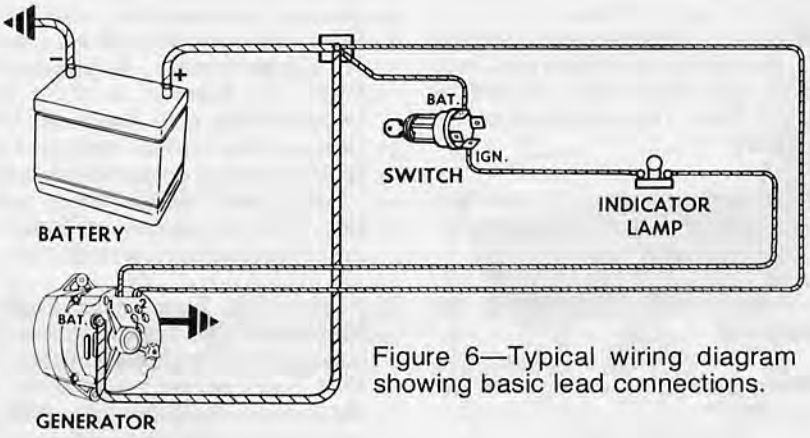

Figure 6—Typical wiring diagram showing basic lead connections.

TROUBLESHOOTING PROCEDURES

(Close adherence to the following procedures in the order presented will lead to the location and correction of charging system defects in the shortest possible time. Only a portion of these procedures need be performed. It will never be necessary to perform all the procedures in order to locate the trouble.)

Either one of two methods may be used to troubleshoot the charging system. One method uses generator tester Model J-26290 available from:

Kent-Moore Corporation
1501 S. Jackson Street
Jackson, Michigan 49203

The other method follows:

A basic wiring diagram showing lead connections is shown in Figure 6. To avoid damage to the electrical equipment, always observe the following precautions:

- Do not polarize the generator.
- Do not short across or ground any of the terminals in the charging circuit, except as specifically instructed herein.
- NEVER operate the generator with the output terminal open-circuited.
- Make sure the generator and battery have the same ground polarity.
- When connecting a charger or a booster battery to the vehicle battery, connect negative to negative, and positive to positive. The correct jump start procedure is covered in the applicable Delco Remy Battery Service Bulletin.

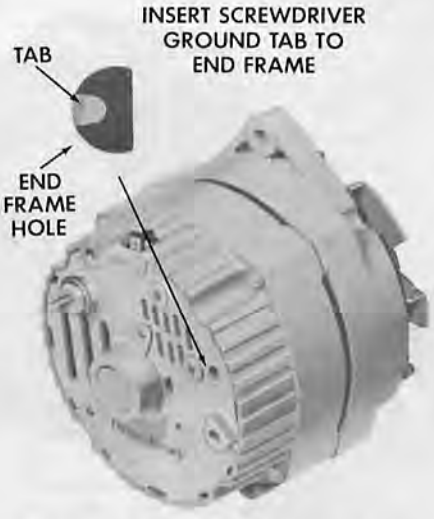

Figure 7—Grounding generator field winding. (Wiring connections not shown.)

NOTE: In some circuits, an ammeter may be used instead of an indicator lamp. In this case, Section "A" pertaining to abnormal indicator lamp operation, should be omitted from the troubleshooting procedure.

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

A. Abnormal indicator lamp operation.

B. Abnormal charging system operation.

A. ABNORMAL INDICATOR LAMP OPERATION

Check the indicator lamp for normal operation as shown below.

Switch	Lamp	Engine
OFF	OFF	STOPPED
ON	ON	STOPPED
ON	OFF	RUNNING

If the indicator lamp operates normally, proceed to "ABNORMAL CHARGING SYSTEM OPERATION." Otherwise, proceed to **either one** of the following three **abnormal** conditions.

1. **Switch Off, Lamp On** —In this case, disconnect the two leads from the generator No. 1 and No. 2 terminals. If the lamp stays on, there is a short between these two leads. If the lamp goes out, replace the rectifier bridge as covered in the "GENERATOR REPAIR" section. This condition will cause an undercharged battery.

2. **Switch On, Lamp Off, Engine Stopped**—This condition can be caused by the defects listed in Part 1 above, or by an open in the circuit. To determine where an open exists, proceed as follows:

a. Check for a blown fuse, a burned out bulb, defective bulb socket, or an open in No. 1 lead circuit between generator and ignition switch.

b. If no defects have been found, proceed to "ABNORMAL CHARGING SYSTEM OPERATION."

3. **Switch On, Lamp On, Engine Running** check for blown fuse (where used) between indicator lamp and switch.—The other possible causes of this condition are covered in the "ABNORMAL CHARGING SYSTEM OPERATION" section.

If a defect has been found and corrected at this point, no further checks need be made.

B. ABNORMAL CHARGING SYSTEM OPERATION

1. Insure that an undercharged condition has not been caused by accessories having been left on for extended periods.

2. Check the drive belt for proper tension.

3. If a battery defect is suspected, check per applicable Delco-Remy Service Bulletin.

4. Inspect the wiring for defects. Check all connections for tightness and cleanliness, including the slip connectors at the generator and firewall. and connections at the battery.

5. With ignition switch on and all wiring harness leads connected, connect a voltmeter from:

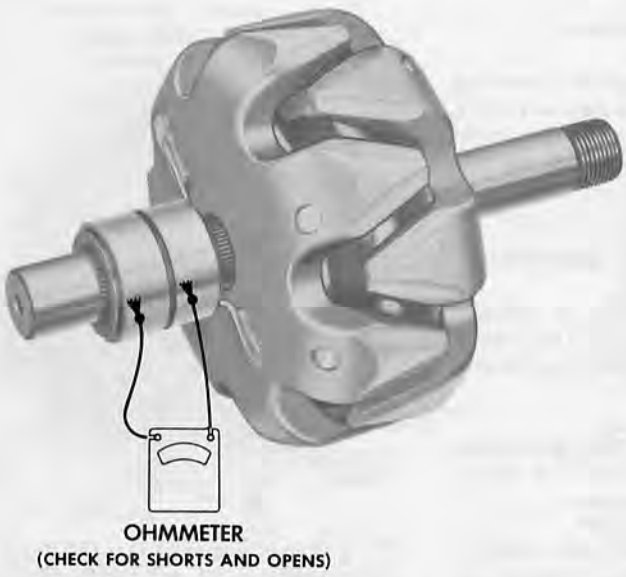

Figure 8—Checking rotor winding.

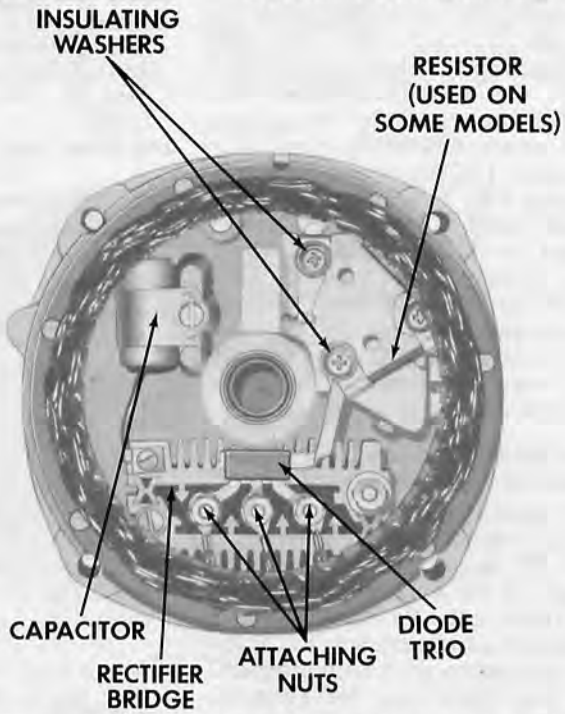

Figure 9—Inside view 10-SI end frame assembly.

a. generator "BAT" terminal to ground.

b. generator No. 1 terminal to ground.

c. generator No. 2 terminal to ground.

A zero reading indicates an open between voltmeter connection and battery. Repair if required.

6. With all accessories turned off, connect a voltmeter across the battery. Operate engine at moderate speed. If voltage is 15.5 or more on a 12-volt system, or 31 volts on a 24-volt system, remove generator for repair.

7. If previous Steps 1 thru 6 check satisfactorily, check generator as follows:

a. Disconnect battery ground cable.

b. Connect an ammeter in the circuit at the "BAT" terminal of the generator.

c. Reconnect battery ground cable.

d. Turn on radio, windshield wipers, lights high beam and blower motor high speed. Connect a carbon pile across the battery.

e. Operate engine at moderate speed as required, and adjust carbon pile as required to obtain maximum current output.

f. If ampere output is within 10 amperes of rated output as stamped on generator frame, generator most likely is not defective; recheck Steps 1 thru 6. IMPORTANT: If output in amperes is OK, but indicator lamp stays on, check diode trio and rectifier bridge in "GENERATOR REPAIR" section.

g. If ampere output is not within 10 amperes of rated output, determine if test hole (Fig. 7) is accessible. If accessible go to Step h. If not accessible go to Step 1.

h. Ground the field winding by inserting a screwdriver into the test hole (Fig.7). CAUTION: Tab is within ¾ inch of casting surface. Do not force screwdriver deeper than one inch into end frame.

i. Operate engine at moderate speed as required, and adjust carbon pile as required to obtain maximum current output.

j. If output is within 10 amperes of rated output, check field winding

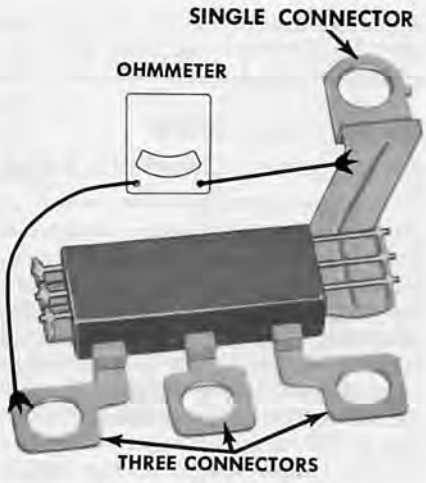

Figure 10—Diode trio check.

as covered in "GENERATOR REPAIR" section, and test regulator with an approved regulator tester.

k. If output is not within 10 amperes of rated output, check the field winding, diode trio, rectifier bridge, and stator as covered in "GENERATOR REPAIR" section.

l. If test hole is not accessible disassemble generator and make tests listed in "GENERATOR REPAIR" section.

GENERATOR REPAIR

To repair the generator, observe the following procedure:

DISASSEMBLY

To disassemble the generator, take out the four thru-bolts, and pry apart with a screwdriver at the stator slot. After disassembly, place a piece of tape over the slip ring end frame bearing to prevent entry of dirt and other foreign material, and also place a piece of tape over the shaft on the slip ring end. If brushes are to be reused, clean with a soft dry cloth.

To remove the drive end frame from the rotor, place the rotor in a vise and tighten only enough to permit removal of the shaft nut.

ROTOR FIELD WINDING CHECKS

To check for opens, connect the test lamp or ohmmeter to each slip ring. If the lamp fails to light, or if the ohmmeter reading is high (infinite), the winding is open (Fig. 8).

Connect test lamp or ohmmeter from one slip ring to shaft. If lamp lights, or if reading is low, the rotor winding is grounded (not illustrated).

The winding is checked for short-circuits or excessive resistance by connecting a battery and ammeter in series with the edges of the two slip rings. Note the ammeter reading and refer to Delco Remy Service Bulletin 1G-187 or 1G-188 for specifications. An ammeter reading above the specified value indicates shorted windings; a reading below the specified value indicates excessive resistance. An alternate method is to check the resistance of the field by connecting an ohmmeter to the two slip rings (Fig. 8). If the resistance reading is below the specified value, the winding is shorted; if above the specified value the winding has excessive resistance. The specified resistance value can be determined by dividing the voltage by the current given in Bulletin 1G-187 or 1G-188. Remember that the winding resistance and ammeter readings will vary slightly with winding temperature changes. If the rotor is not defective, but the generator fails to

supply rated output, the defect is in the diode trio, rectifier bridge, stator, or regulator.

DIODE TRIO CHECK

The diode trio is identified in Figure 9.

To check the diode trio, remove it from the end frame assembly by detaching the three nuts, the attaching screw, and removing the stator assembly. Note that the insulating washer on the screw is assembled over the top of the diode trio connector. Connect an ohmmeter having a 1½ volt cell, and using the lowest range scale, to the single connector and to one of the three connectors (Fig. 10). Observe the reading. Then reverse the ohmmeter leads to the same two connectors. If both readings are the same, replace the diode trio. A good diode trio will give one high and one low reading. Repeat this same test between the single connector and each of the other two connectors. Also, connect the ohmmeter to each pair of the three connectors (not illustrated). If any reading is zero, replace the diode trio.
NOTE: Diode trios may differ by appearance, but are completely interchangeable.

RECTIFIER BRIDGE CHECK

To check the rectifier bridge, connect the ohmmeter to the grounded heat sink and one of the three terminals (Fig. 11). IMPORTANT: If rectifier bridge is constructed as shown in Fig. 12 or 13, connect ohmmeter pressing down very firmly onto flat metal connector, and not onto threaded stud as in Figure 11. Then reverse the lead connections to the grounded heat sink and same terminal. If both readings are the same, replace the rectifier bridge. A good rectifier bridge will give one high and one low reading. Repeat this same test between the grounded heat sink and the other two terminals, and between the insulated heat sink and each of the three terminals. This makes a total of six checks, with two readings taken for each check.

To replace the rectifier bridge, remove the attaching screws, and disconnect the capacitor lead. Note the capacitor lead clip is attached with a screw or press fit (Figs. 11, 12 and 13). Rectifier bridges may vary in appearance but are completely interchangeable.

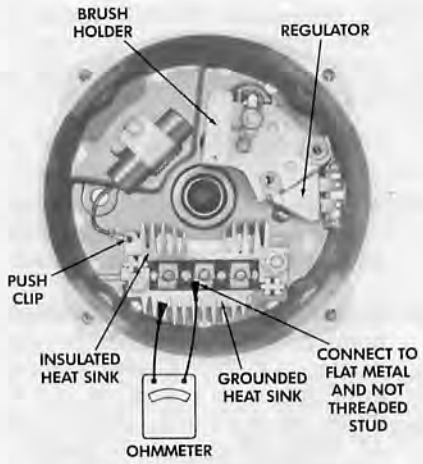

Figure 12—Rectifier bridge check, 15-SI.

STATOR CHECKS

The stator windings may be checked with a 110-volt test lamp or an ohmmeter. If the lamp lights, or if the meter reading is low when connected from any stator lead to the frame, the windings are grounded. If the lamp fails to light, or if the meter reading is high when successively connected between each pair of stator leads on 10-SI Series, the windings are open (Fig. 14).

NOTE: Delta windings on 15-SI and 27-SI Series cannot be checked for opens with an ohmmeter.

A short circuit in the stator windings is difficult to locate without laboratory test equipment due to the low resistance of the windings.

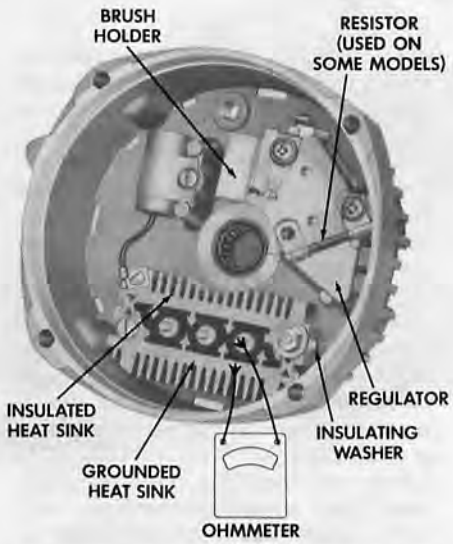

Figure 11—Rectifier bridge check, 10-SI

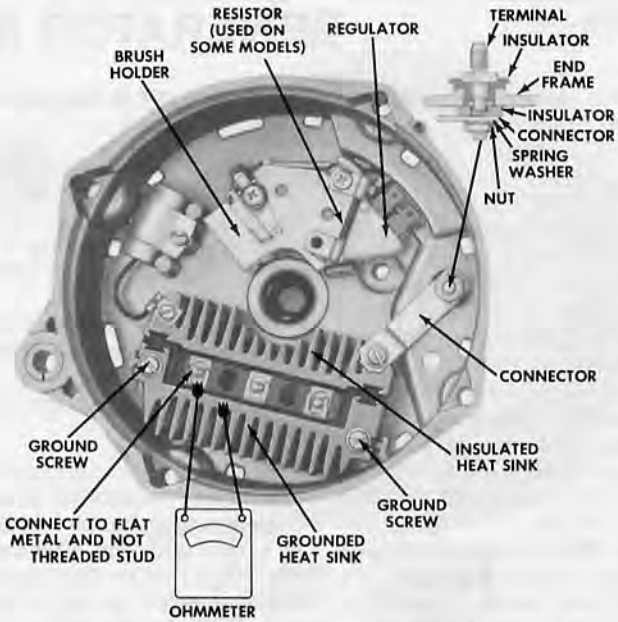

Figure 13—Rectifier bridge check, 27-SI.

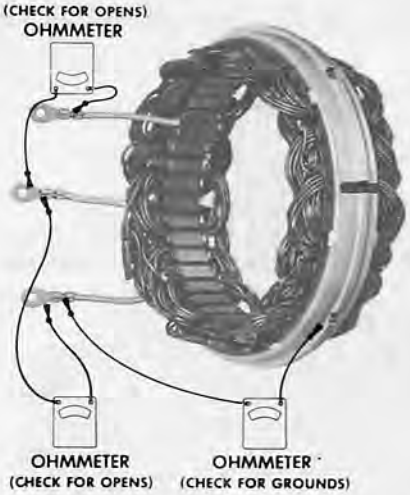

Figure 14—Checking stator windings.

However, if all other electrical checks are normal and the generator fails to supply rated output, shorted stator windings or an open delta winding are indicated. Also, a shorted stator can cause the indicator lamp to be on with the engine at low speed. Check the regulator in next section before replacing stator.

BRUSH HOLDER AND REGULATOR REPLACEMENT

To determine if the regulator is defective, an approved regulator tester must be used.

After removing the three attaching nuts, the stator, and diode trio screw (Figs. 11, 12 and 13), the brush holder and regulator may be replaced by removing the two remaining screws. Note the two insulators located over the top of the brush clips in Figure 9 and that these two screws have special insulating sleeves over the screw body above the threads. The third mounting screw may or may not have an insulating sleeve. If not, this screw must not be interchanged with either one of the other two screws, as a ground may result, causing no output or uncontrolled generator output. Regulators may vary in appearance but are completely interchangeable in these generators.

SLIP RING SERVICING

If the slip rings are dirty, they may be cleaned and finished with 400 grain or finer polishing cloth. Spin the rotor, and hold the polishing cloth against the slip rings until they are clean. CAUTION: The rotor must be rotated in order that the slip rings will be cleaned evenly. Cleaning the slip rings by hand without spinning the rotor may result in flat spots on the slip rings, causing brush noise.

Slip rings which are rough or out of round should be trued in a lathe to .002 inch maximum indicator reading. Remove only enough material to make the rings smooth and round. Finish with 400 grain or finer polishing cloth and blow away all dust.

BEARING REPLACEMENT AND LUBRICATION

The bearing in the drive end frame can be removed by detaching the retainer plate screws, and then pressing the bearing from the end frame. If the bearing is in satisfactory condition, it may be reused, and it should be filled one-quarter full with Delco Remy lubricant No. 1948791 before reassembly. CAUTION: Do not overfill, as this may cause the bearing to overheat, and use only 1948791 lubricant.

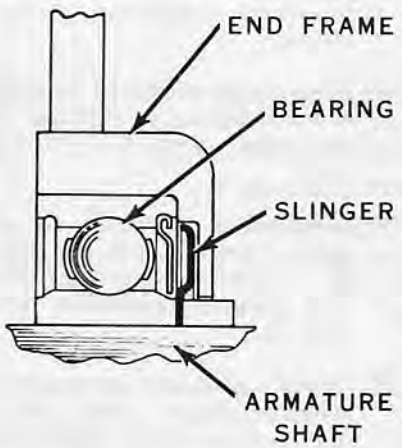

Figure 15—Drive end bearing assembly; 10-SI and 27-SI Series **(Some models use flat washer instead of slinger)**

To install a new bearing, press in with a tube or collar that just fits over the outer race, with the bearing assembled into the end frame as shown in Figure 15 or 16. It is recommended that a new retainer plate be installed if the felt seal in the retainer plate is hardened or excessively worn. Fill the cavity between the retainer plate and bearing with 1948791 lubricant.

The bearing in the slip ring end frame should be replaced if its grease supply is exhausted. No attempt should be made to relubricate and reuse the bearing. To remove the bearing from the slip ring end frame, press out with a tube or collar that just fits inside the end frame housing. Press from the outside of the housing towards the inside.

To install a new bearing in 10-SI and 27-SI only, place a flat plate over the bearing and press in from the outside towards the inside of the frame until the bearing is flush with the outside of the end frame. For 15-SI, see Fig. 17. Support the inside of the frame with a hollow cylinder to prevent breakage of the end frame. Use extreme care to avoid misalignment or otherwise placing undue stress on the bearing.

If the seal is separate from the bearing, it is recommended that a new seal be installed whenever the bearing is replaced. Press the seal in with the lip of the seal toward the rotor when assembled, that is, away from the bearing. Lightly coat the seal lip with oil to facilitate assembly of the shaft into the bearing.

REASSEMBLY

Reassembly is the reverse of disassembly.

Remember when assembling the pulley to secure the rotor in a vise only tight enough to permit tightening the shaft nut to 40-60 lb. ft. If excessive pressure is applied against the rotor, the assembly may become distorted. To install the slip ring end frame assembly to the rotor and drive end frame assem-

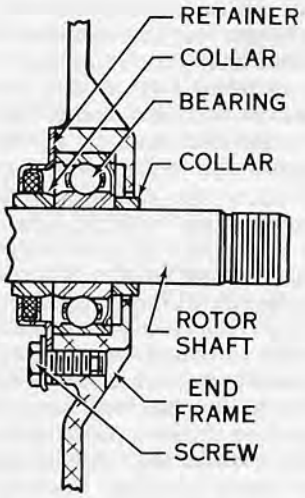

Figure 16—Drive end bearing assembly, 15-SI.

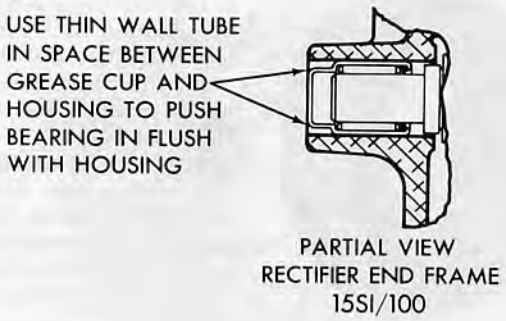

Figure 17—Slip ring end frame bearing assembly, 15-SI.

bly, remove the tape over the bearing and shaft, and make sure the shaft is perfectly clean after removing the tape. Insert a pin through the holes to hold up the brushes. Carefully install the shaft into the slip ring end frame assembly to avoid damage to the seal. After tightening the thru-bolts remove the brush retaining pin to allow the brushes to fall down onto the slip rings.

GENERATOR BENCH CHECK

To check the generator in a test stand, proceed as follows:

1. Make connections as shown in Figure 18, except leave the carbon pile disconnected. IMPORTANT—Ground polarity of battery and generator must be the same. Use a fully charged battery, and a 10 ohm resistor rated at six watts or more between the generator No. 1 terminal and the battery.
2. Slowly increase the generator speed and observe the voltage.
3. If the voltage is uncontrolled with speed and increases above 15.5 volts on a 12-volt system, or 31 volts on a 24-volt system, test regulator with an approved regulator tester, and check field winding. NOTE: The battery must be fully charged when making this check.
4. If voltage is below 15.5 volts on a 12-volt system, or 31 volts on a 24-volt system, connect the carbon pile as shown.
5. Operate the generator at moderate speed as required and adjust the carbon pile as required to obtain maximum current output.
6. If output is within 10 amperes of rated output as stamped on generator frame, generator is good.
7. If output is not within 10 amperes of rated output, keep battery loaded with carbon pile, and ground generator field (Fig. 7).
8. Operate generator at moderate speed and adjust carbon pile as required to obtain maximum output.
9. If output is within 10 amperes of rated output, test regulator with an approved regulator tester, and check field winding.
10. If output is not within 10 amperes of rated output, check the field winding, diode trio, rectifier bridge, and stator as previously covered.

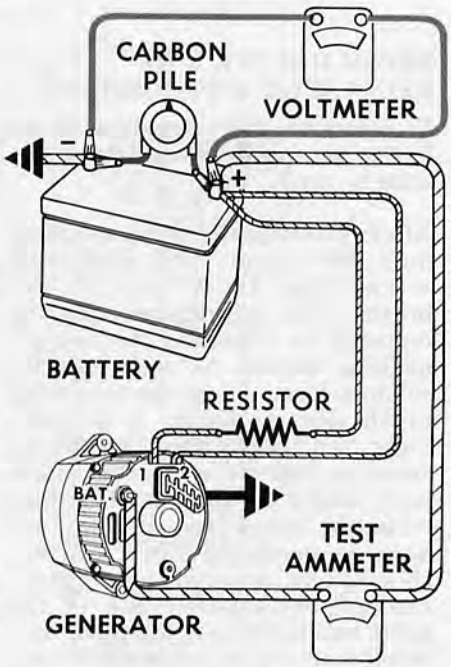

Figure 18—Connections for bench check of generator.

1G-266: REF.: 1G-187, 1G-188
CO: 1.2, IWDS & PS, 1.2X, 131, 132; 16, 1.2-52, 1FD

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