SECTION D

Generating System 49000 Series

CONTENTS

DIVISION I

TROUBLE DIAGNOSIS

68-35 TROUBLESHOOTING PROCEDURES

NOTE: *(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.)*

A basic wiring diagram showing lead connections is shown in Figure 68-54. To avoid damage to the electrical equipment, always observe the following precautions:

1. Do not polarize the generator.

2. Do not short across or ground any of the terminals in the charging circuit, except as specifically instructed herein.

3. Never operate the generator with the output terminal open-circuited.

4. Make sure the generator and Energizer have the same ground polarity.

5. When connecting a charger or a booster Energizer to the vehicle Energizer, connect negative to negative and positive to positive.

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

1. Faulty indicator lamp operation.

2. An undercharged Energizer, as evidenced by slow cranking and low specific gravity readings.

3. An overcharged Energizer, as evidenced by excessive water usage.

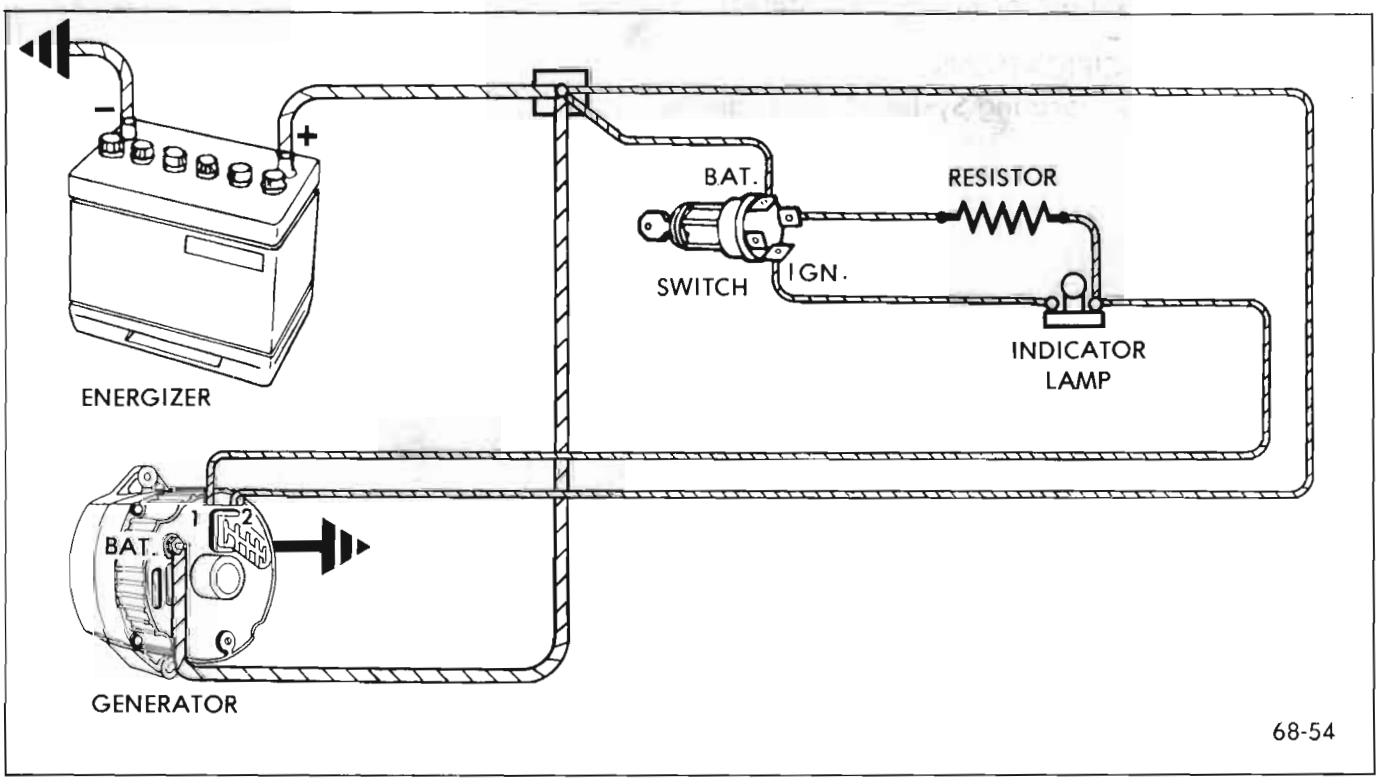
68-36 FAULTY INDICATOR LAMP OPERATION

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 "Undercharged Energizer" or "Overcharged Energizer" section. Otherwise, proceed to either one of the following three abnormal conditions.

1. *Switch Off, Lamp On* - In this case, disconect 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



- Figure 68-54 - Delcotron Generator Wiring

in the "Generator Repair" section. This condition will cause an undercharged Energizer.

2. *Switch On, Lamp Off, Engine Stopped* - This condition can be caused by the defects listed in Part I above, by reversal of the No. 1 and No. 2 leads at these two terminals, or by an open in the circuit. This condition can cause an undercharged Energizer. To determine where an open exists, proceed as follows:

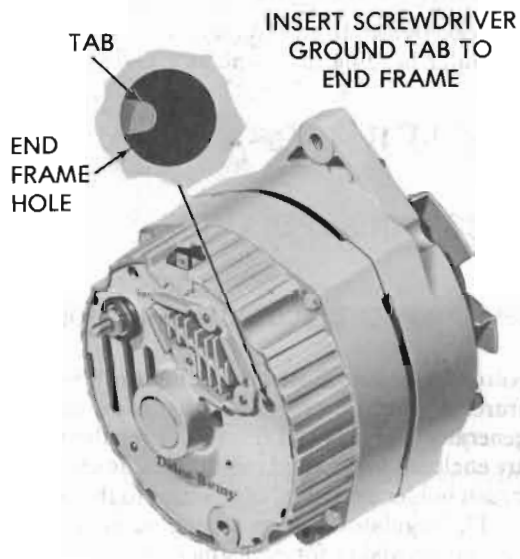
a. Connect voltmeter from No. 2 generator terminal to ground. If reading is obtained, go to Step b. If reading is zero, repair open circuit between No. 2 terminal and Energizer. If lamp now comes on, no further checks need be made.

b. With ignition switch on and with No. 1 and No. 2 terminal leads connected or disconnected, at generator, momentarily ground No. 1 terminal lead.

CAUTION: *Do not ground No. 2 lead.*

c. If lamp does not light, 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.

d. If lamp lights, remove ground at No. 1 terminal and with No. 1 and No. 2 terminal leads connected at generator, insert screwdriver into test hole (Figure 68-55) to ground field winding.



68-55

- Figure 68-55 - Grounding Generator Field Winding

e. If lamp does not light, check connection between wiring harness and No. 1 terminal of generator, and check brushes, slip rings, and field winding for opens, as covered in "Generator Repair" section.

f. lamp lights and voltmeter reading is obtained in Step "a" preceding, replace regulator, as covered in "Generator Repair" section, and check field winding.

3. *Switch On, Lamp On, Engine Running* - The possible causes of this condition are covered in the "Undercharged Energizer" section.

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

68-37 UNDERCHARGED ENERGIZER

This condition, as evidenced by slow cranking and low specific gravity readings, can be caused by one or more of the following conditions, even though the indicator lamp may be operating normally. The following procedure also applies to circuits with an ammeter.

1. Insure that the 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 or Energizer defect is suspected, check "Battery" section in this Manual.

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

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

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 Energizer.

NOTE: *Generators have a built-in feature which avoids overcharge and accessory damage by preventing the generator from turning on if there is an* open *in the wiring harness connected to the No. 2 generator terminal. Opens in the wiring harness connected between the No. 2 generator terminal and Energizer may be between the terminals, at the crimp between the harness wire and terminal, or in the wire.*

6. If previous Steps 1 through 5 check satisfactorily, check Delcotron generator as follows:

a. Check generator belt condition and tension. Adjust to 80 lbs., using Gage J-23600.

b. Install a battery post adapter at the positive post, as shown in illustration 68-38.

NOTE: *Illustration shows "top" terminals. Adapters are available for side terminals also.*

c. Connect ammeter leads, as shown in illustration: Red lead toward generator; black lead to battery positive post; and ground lead to battery negative post.

d. Connect voltmeter across the battery: Red lead at generator side of battery post adapter; and black lead to battery negative post.

e. Make sure all electrical accessories are turned off. Start engine with battery post adapter switch closed. Open switch as soon as engine is started.

f. Place carburetor on highest step of fast idle cam.

g. Turn tester control knob to "LOAD" position and adjust knob to obtain highest possible ammeter reading. Highest ammeter reading must be at least two-thirds amperes of output rating stamped on generator (i.e., 37A, 42A, 55A).

h. If output is low, by-pass voltage regulator to cause full generator output as follows: Ground the field winding by inserting a screwdriver into the test hole (Figure 68-55).

CAUTION: *Tab is within 3/4" of casting surface. Do not force screwdriver deeper than 1" into end frame.*

i. Retest as described in Steps f and g. If output is still low, generator is faulty and must be removed for repairs.

j. If output (using screwdriver) is now okay, defect is in regulator. Replace regulator, as covered in "Generator Overhaul".

k. Remove battery post adapter and turn accessories off.

68-38 OVERCHARGED ENERGIZER

1. To determine Energizer or battery condition, check "Battery" section in this Manual.

2. Connect a voltmeter from generator No. 2 terminal to ground. If reading is zero, No. 2 lead circuit is open.

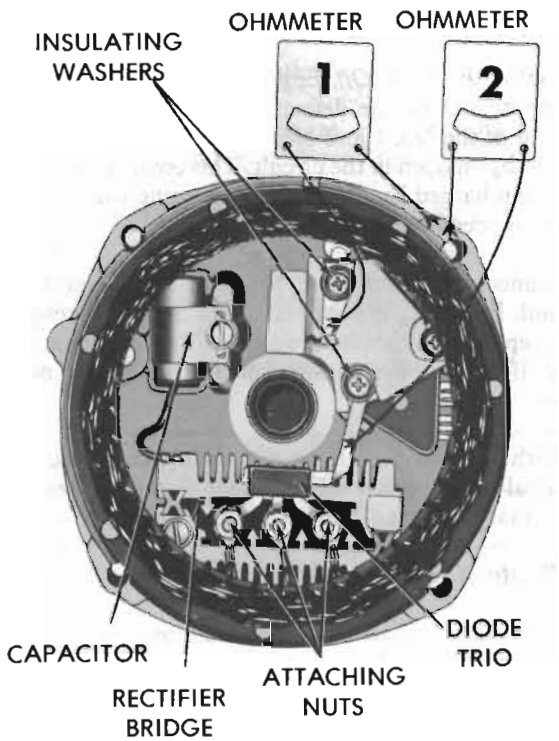
3. If Energizer and No. 2 lead circuit check good but an obvious overcharge condition exists, as evidenced by excessive Energizer water usage, proceed as follows:

a. Separate end frames, as covered in "Disassembly" section under heading of "Generator Overhaul". Check field winding for shorts. If shorted, replace rotor and regulator.

b. Connect ohmmeter using lowest range scale from brush lead clip to end frame, as shown in Step 1, Figure 68-56; then reverse lead connections.

c. If both readings are zero, either the brush lead clip is grounded or regulator is defective.

d. A grounded brush lead clip can result from omission of insulating washer (Figure 68-56), omission of insulating sleeve over screw, or damaged insulating sleeve. Remove



- Figure 68-56 - Inside View End Frame Assembly

screw to inspect sleeve. If satisfactory, replace regulator, as covered under heading of "Generator Overhaul" section.

DIVISION II

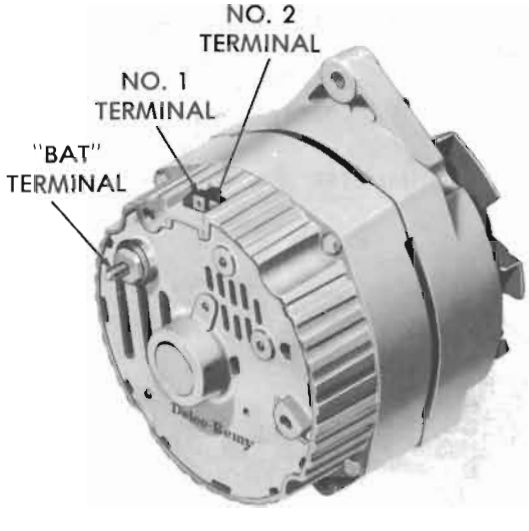
DESCRIPTION AND OPERATION

68-39 DESCRIPTION OF DELCOTRON GENERATOR

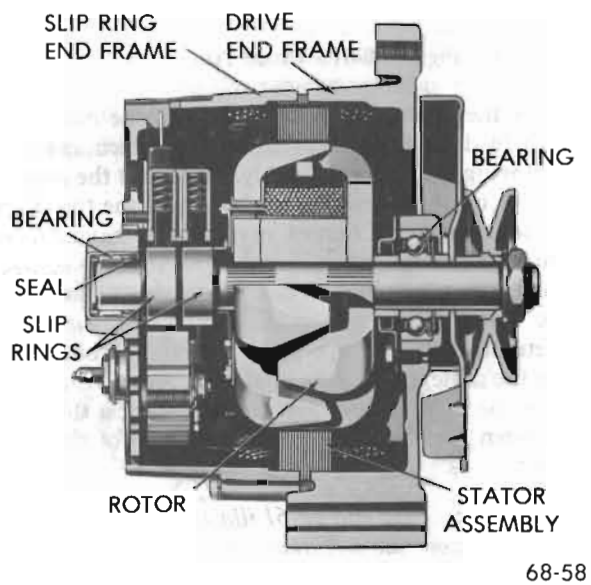
The Delcotron generator illustrated in Figures 68-57 and 68-58 features a solid state regulator that is mounted inside the generator slip ring end frame. All regulator components are enclosed into a solid mold, and this unit, along with the brush holder assembly, is attached to the slip ring end frame. The regulator voltage setting 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



- Figure 68-57 - Delcotron Generator With Solid State Regulator



- Figure 68-58 - Sectional View

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.

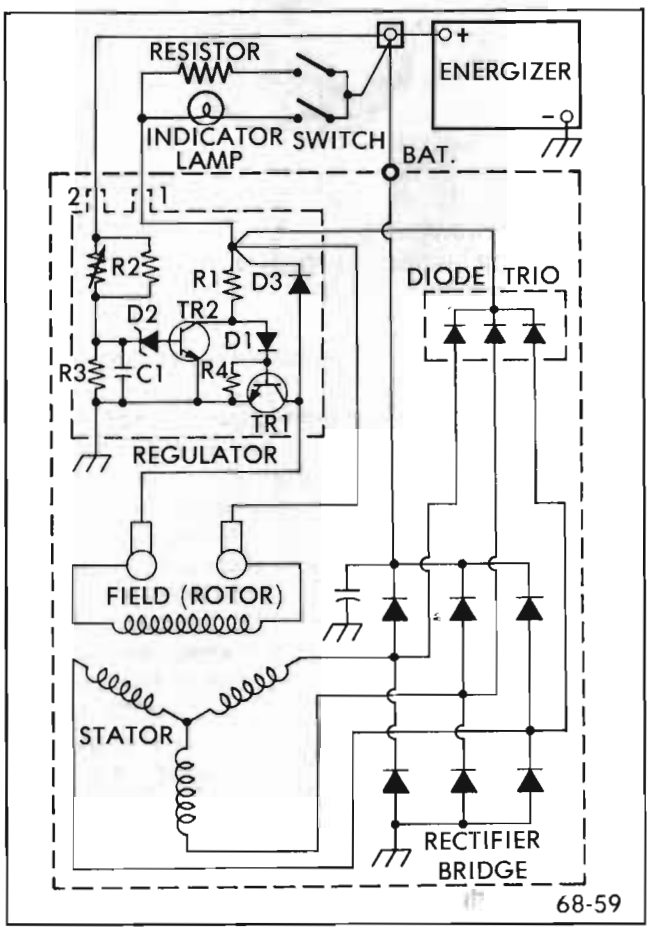
No periodic adjustments or maintenance of any kind are required on the entire generator assembly.

68-40 OPERATION OF DELCOTRON GENERATOR

A typical wiring diagram is illustrated in Figure 68-59. The basic operating principles are explained as follows:

When the switch is closed, current from the Energizer flows through the indicator lamp and resistor to the generator No. 1 terminal, through resistor R1, diode D1, and the base-emitter of transistor TR1 to ground, and the back to the Energizer. This turns on transistor TR1 and current flows through the generator field coil and TR1 back to the Energizer. The resistor in parallel with the indicator lamp reduces total circuit resistance to provide higher field current for initial voltage build-up when the engine starts.

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 Energizer 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.



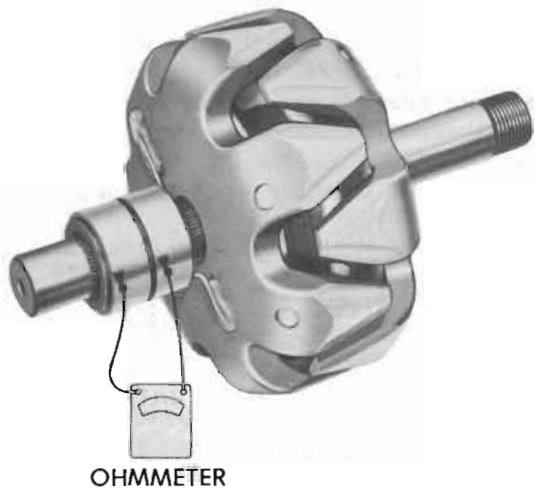
- Figure 68-59 - Delcotron Generator Wiring Circuit Diagram

The No. 2 terminal on the generator is always connected to the Energizer but the discharge current is limited to a negligible value by the high resistances of R2 and R3. As the generator speed and voltage increase, the voltage be-

CAUTION: *Avoid excessive tightening, as this may cause distortion of the rotor. Remove the shaft nut, washer pulley, fan, and the collar, and then separate the drive end frame from the rotor shaft.*

B. 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 (Figure 68-60).

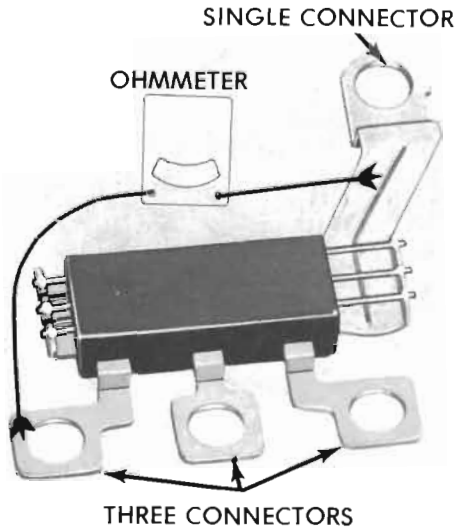


- Figure 68-60 - Checking Rotor Field Windings

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. 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 (Figure 68-60). 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 Specifications. 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, or stator.

C. Diode Trio Check

The diode trio is identified in Figure 68-61. First, connect an ohmmeter using lowest range scale from brush lead clip to end frame, as shown in Step 2, Figure 68-56, then reverse lead connections. If both readings are the same, check for grounded brush lead clip caused by omission of insulating washer (Figure 68-56), omission of insulating sleeve over screw, or damaged insulating sleeve. Remove screw to inspect sleeve. *If screw assembly is correct and both ohmmeter readings are the same, replace regulator.*



- Figure 68-61 - Diode Trio Check

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 one and one-half volt cell, and using the lowest range scale, to the single connector and to one of the three connectors (Figure 68-61). 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.

NOTE: *Figures 68-56 and 68-61 illustrate two diode trios differing in appearance. Either one of these diode trios may be used in these generators and the two are completely interchangeable.*

D. Rectifier Bridge Check

Note that the rectifier bridge has a grounded heat sink and an insulated heat sink connected to the output terminal. Also, note the insulating washer located between the insulated heat sink and end frame (Figure 68-62).

To check the rectifier bridge, connect the ohmmeter to the grounded heat sink and one of the three terminals (Figure 68-62). 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.

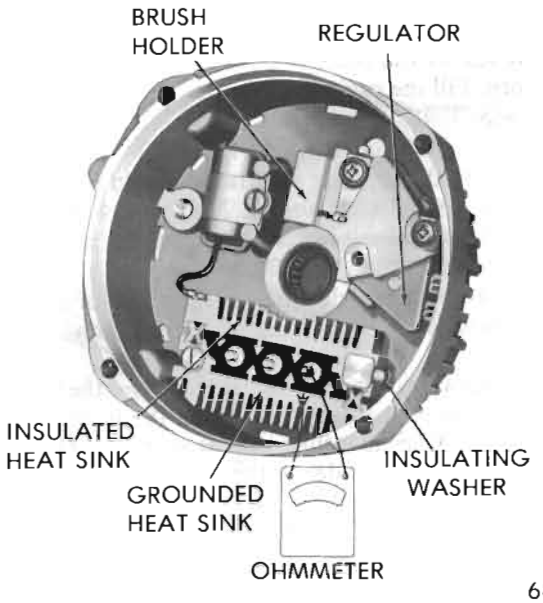
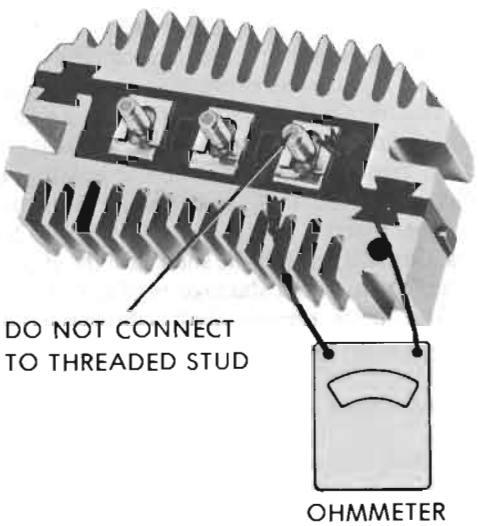


Figure 68-62 - Rectifier Bridge Check

IMPORTANT: *If rectifier bridge is constructed, as shown in Figure 68-63, check with the rectifier bridge mounted in the end frame in the same manner as Figure 68-62, except* connect ohmmeter pressing down very firmly onto flat metal connector and not onto threaded stud (Figure 68-63).



- Figure 68-63 Rectifier Bridge Check

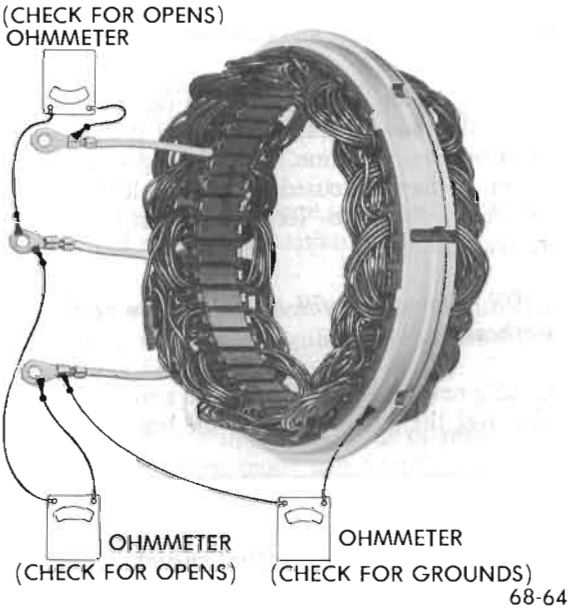
The ohmmeter check of the rectifier bridge and of the diode trio, as previously covered, is a valid and accurate check. *Do not* replace either unit unless at least one pair of readings is the same.

CAUTION: *Do not use high voltage to check these units such as a 110-volt test lamp.*

To replace the rectifier bridge, remove the attaching screw and the "BAT" terminal screw and disconnect the capacitor lead. Note the insulator between the insulated heat sink and end frame (Figure 68-62). Rectifier bridges may vary in appearance but are completely interchangeable in these generators.

E. 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, the windings are open (Figure 68-64).



- Figure 68-64 - Checking Stator Windings

A short circuit in the stator windings is difficult to locate without laboratory test equipment due to the low resistance of the windings. However, if all other electrical checks are normal and the generator fails to supply rated output, shorted stator windings are indicated. Also, a shorted stator can cause the indicator lamp to be on with the engine at low speed.

F. Brush Holder and Regulator Replacement

After removing the three attaching nuts, the stator , and diode trio screw (Figure 68-62), 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 68- 56 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.

G. 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.*

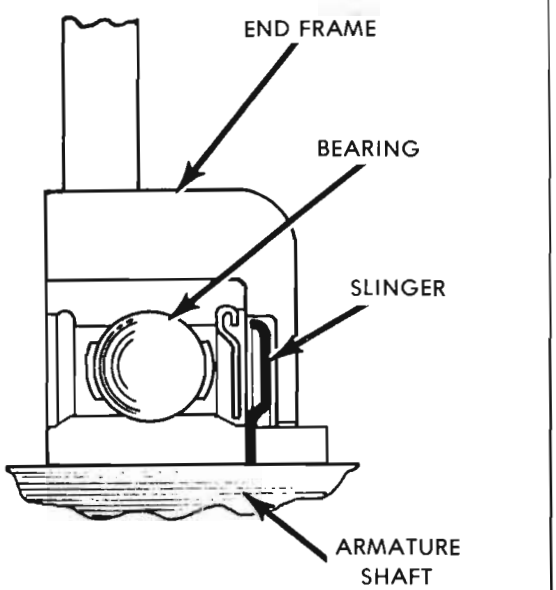
Slip rings which are rough or out of round should be trued in a lathe to .002 inch maximum indicator reading. Remove only enough material to make the rings smooth and round. Finish with 400 grain or finer polishing cloth and blow away all dust.

H. 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, or equivalent, before reassembly.

CAUTION: *Do not overfill, as this may cause the bearing to overheat.*

To install a new bearing, press in with a tube or collar that just fits over the outer race with the bearing and slinger



- Figure 68-65 - Drive End Bearing Assembly

assembled into the end frame, as shown in Figure 68-65. 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, or equivalent.

The bearing in the slip ring end frame should be replaced if its grease supply is exhausted. No attempt should be made to re-lubricate 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, 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. 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.

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.

H. 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 assembly, 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.

I. Generator Bench Check

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

1. Make connections, as shown in Figure 68-66, except leave the carbon pile disconnected.

IMPORTANT: *Ground polarity of Energizer and generator must be the same. Use a fully-charged Energizer or battery and a 10 ohm resistor rated at six watts or more between the generator No. 1 terminal and the Energizer.*

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, check for a grounded brush lead clip, as

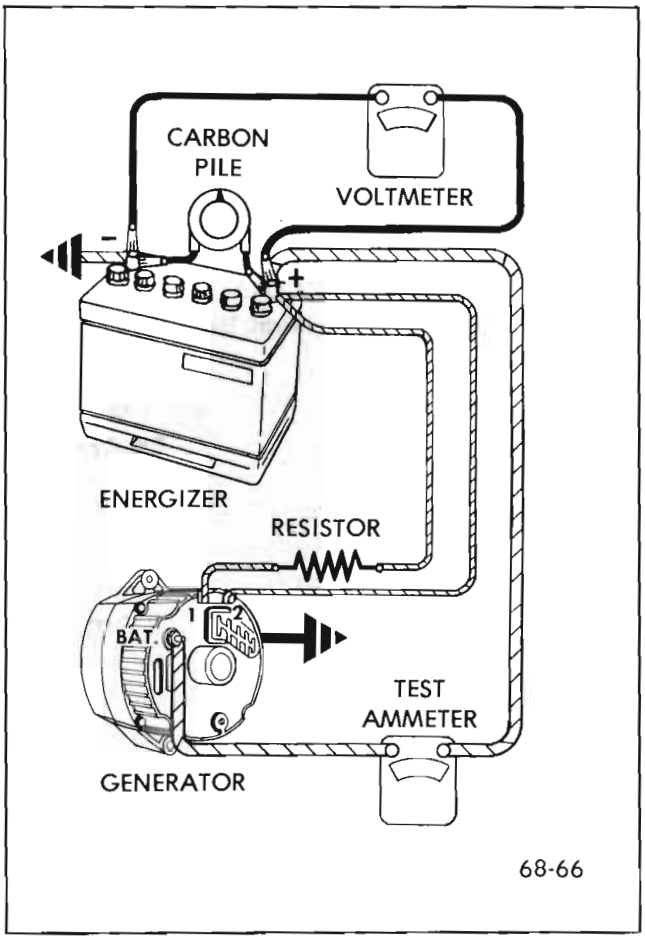


Figure 68-66 - Connections For Bench Check of Generator

covered under heading of "Overcharged Energizer," Step 3. If not grounded, replace the regulator and check field winding.

NOTE: *The Energizer or 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 percent of rated output, as stamped on generator frame, generator is good.

7. If output is not within 10 percent of rated output, keep Energizer or battery loaded with carbon pile and ground generator field (Figure 68-55).

8. Operate generator at moderate speed and adjust carbon pile as required to obtain maximum output.

9. If output is within 10 percent of rated output, replace regulator, as covered in "Regulator Replacement" section, and check field winding.

10. If output is not within 10 percent of rated output, check the field winding, diode trio, rectifier bridge, and stator, as previously covered.

Division VI Specifications

68-43 GENERATING SYSTEM SPECIFICATIONS

a. Generator

Make and Type ..... Delco-Remy, Delcotron
Location Side of Engine ..... Upper Right
Drive and Rotation (Viewing Drive End) ..... Fan Belt, Clockwise

	Standard 42 Amp.	Air Condition 55 Amp.
Generator Number	1100926	1100924
Field Current Draw (Amps) at 80°F. and 12 Volts	4-4.5 Amp.	4-4.5 Amp.
Bench Test at 14 Volts and 80°F. (Amps at Gen RPM)	42 at 6500	55 at 6500
Min. Current Output at 500 Eng. RPM	9 Amps	9 Amps
Min. Current Output at 1,500 Eng. RPM	32 Amps	44 Amps
Belt Tension	80 Lbs.	80 Lbs.

b. Generator Regulator

Make and Type ..... Delco-Remy, Integral W/Delcotron
Regulator Number 1116384
Voltage Regulator Setting at 2000 Eng. RPM ..... 14 ± .5 Volts
(After 15 Minutes Warm-Up at 1,500 Eng. RPM)

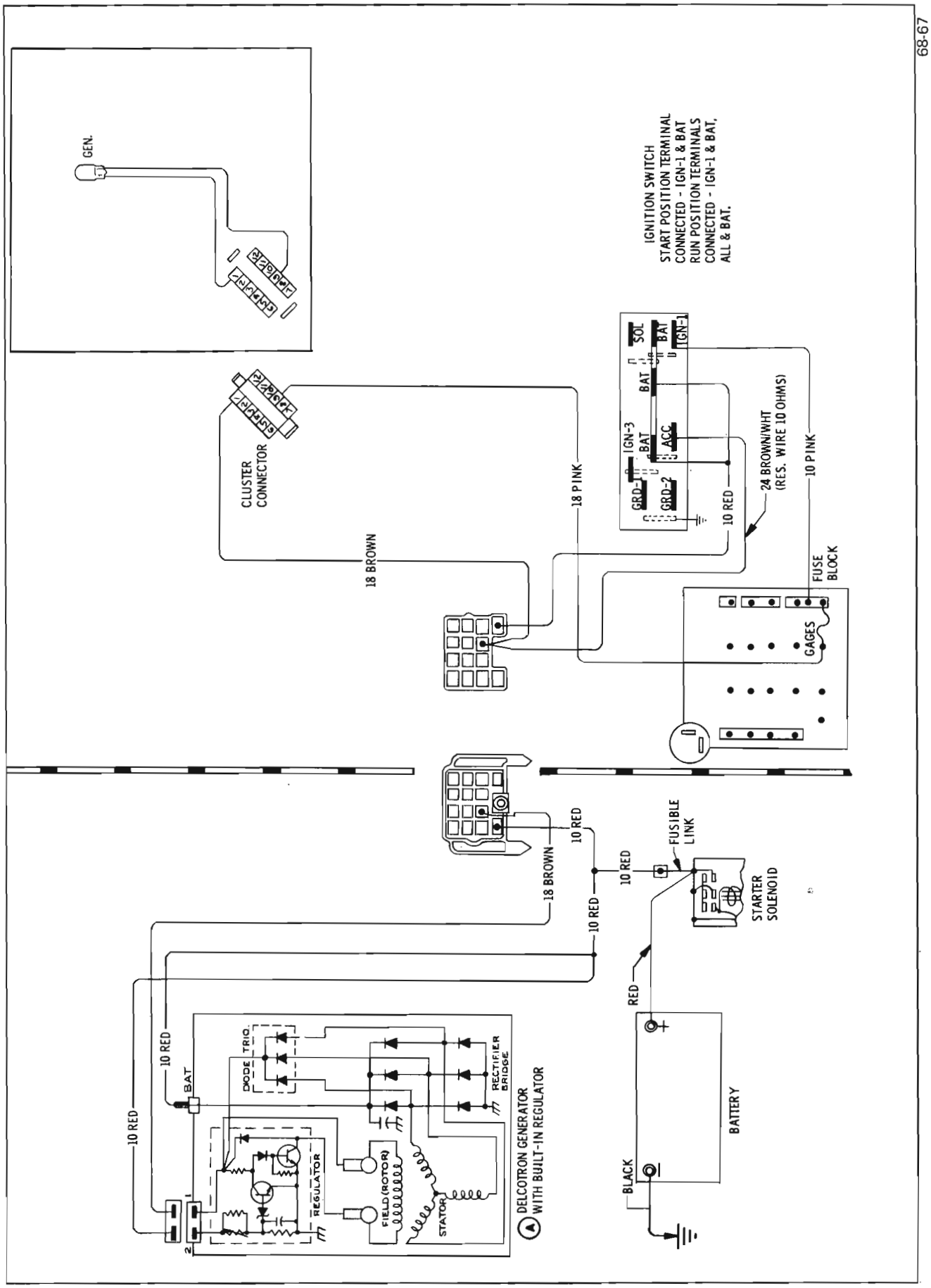


Figure 68-67 - Charging Circuit Wiring, 49000 Series