CHARGING SYSTEM

CONTENTS

DESCRIPTION AND OPERATION

The Delcotron is a continuous output alternating generator that features a built in solid state diode rectified voltage regulator. It is belt driven by the crankshaft pulley and supplies D.C. voltage for charging the Energizer (battery) and operating electrical accessories even at idle speeds. The Delcotron assembly does not require periodic maintenance.

A typical wiring diagram is illustrated in Figure 1D-1.

When the ignition switch is closed, current from the battery 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 then back to the battery. This turns on transistor TR1 and current flows through the generator field coil and TR1 back to the battery. The resistor in parallel with the indicator lamp reduces total circuit resistance to provide higher field current for initial voltage buildup 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 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

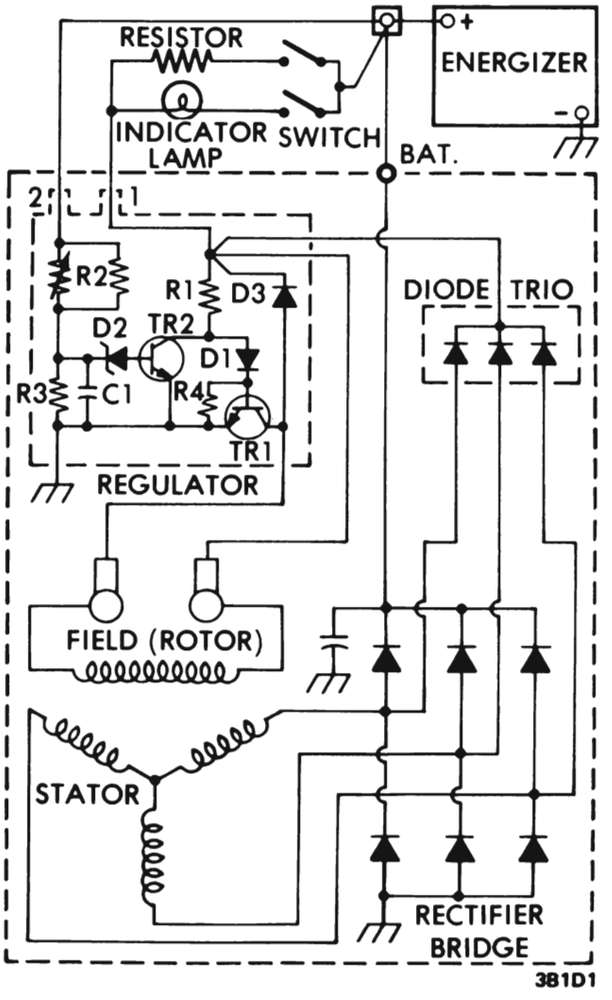

Figure 1D-1 Delcotron Wiring Schematic

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.

The No. 2 terminal on the generator is always connected to the battery 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 between R2 and R3 increases to the point where zener diode D2 conducts. Transistor TR2 then turns on and TR1 turns off. With TR1 off, the field current and system voltage decrease, and D2 then blocks current flow causing TR1 to turn back on. As the field current and system voltage increases, this cycle repeats many times per second to limit the generator voltage to a preset value.

DIAGNOSIS

TROUBLE SHOOTING PROCEDURES

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. It will never be necessary to perform all the procedures to locate the trouble.

A basic wiring diagram illustrating lead connections is shown in Figure 1D-2.

To avoid damage to the electrical equipment, 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 unless the field circuit is also open-circuited.

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

5. When connecting a charger or booster battery to the vehicle battery, connect the positive cable from booster battery to discharged battery first, then connect one end of the negative cable to the booster battery and the other end to a point on the engine remote from the discharged battery such as the generator brace to prevent arcing at the battery.

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

> **NOTE:** *When testing the generator, all accessories must be shut off and the blower motor lead disconnected.*

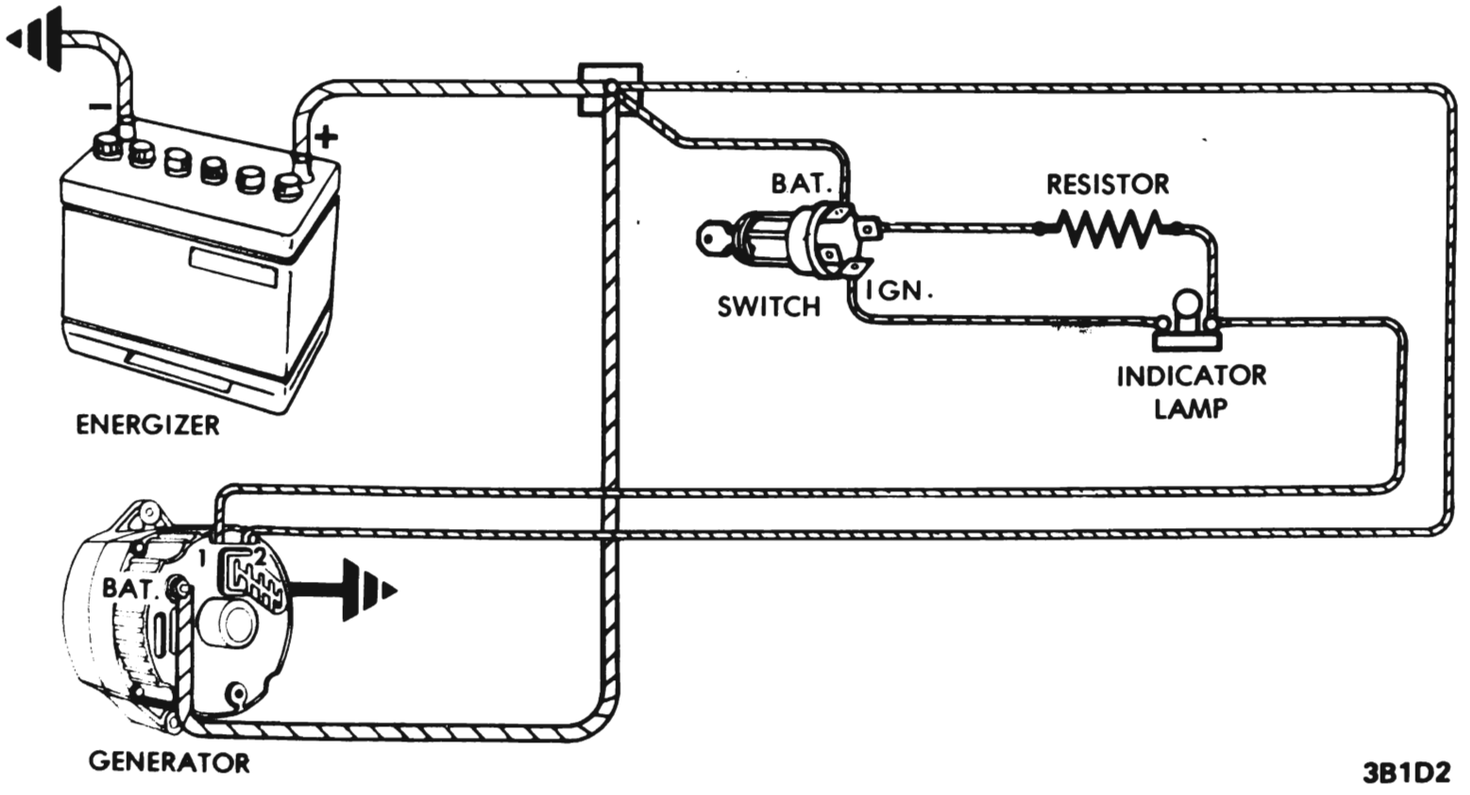

Figure 1D-2 Generating System Wiring

1. Faulty indicator lamp operation.

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

3. An overcharged battery, as evidenced by excessive water useage.

DIAGNOSIS CHART

Complaint	Possible Causes	Correction
Generator light on - engine running.	A. Generator belt loose or broken	1. Replace belt as required. Tighten belt tension to 80 pounds.
	B. Blown gauges fuse	1. Stop engine and turn ignition back on. If all indicator lights are now off, replace GAUGES fuse.
	C. No generator output	1. Insert test light in generator No.1 terminal (brown with white stripe wire). If test light is only 1/2 bright, this indicates that generator is receiving initial field current but has not output. Ground generator field through hole in back of case (by-passing voltage regulator). If test light is now full bright, generator is okay and voltage regulator is defective. Replace voltage regulator. If test light is still only 1/2 bright, repair generator.
Generator light off - ignition on but engine not running.	A. Blown gauges fuse	1. If all indicator lights are off, replace GAUGES fuse. If fuse again blows, check for pinched or grounded No.18 pink indicator light feed wire. If fuse does not blow but indicator lights are still off, check for an open in indicator light feed wire.
	B. Burned out generator indicator bulb	1. Replace generator bulb and socket assembly. If bulb still does not light, proceed to C.
	C. Open between generator bulb and ground in generator	1. At generator, ground small brown with white stripe wire. If generator bulb is now on, remove generator for repair. If bulb still does not light, check for an open between bulb and generator.
Generator light on - ignition off	A. Shorted positive diode	1. Replace diode bridge.

Battery undercharged	A. Accessories left on	1. Question owner make sure no driver has accidentally left any accessories on.
	B. Continuous small drain on battery	1. Disconnect positive cable from battery. Connect your test light between cable and battery post. If test light does not glow visibly, there is no significant current drain. If test light lights, make sure clock is wound by tapping cable against battery post. If light is still lit, trace and correct continuous drain on battery.
	C. Generator belt loose or broken	1. Replace belt as required. Adjust belt tension to 80 pounds.
	D. Low generator current output	1. Connect a voltmeter across the battery. Record voltage reading. Place carburetor on high step of fast idle cam. (This will provide a generator speed fast enough for a maximum charging rate). Start engine. (Do not touch accelerator pedal). Turn on the following continuous use accessories: high beam headlights, A/C and high blower, radio and rear window defogger high blower. If voltage across battery reads higher than open circuit voltage just recorded, generator current output is okay.
	E. Low voltage regulator setting	1. With voltmeter still across battery, and with engine still running on high step of fast idle cam as in step above, turn off all accessories. When upper radiator inlet is hot and voltmeter needle stops moving, any reading between 13.5 and 15.0 volts means that voltage regulator is okay. If voltage reads out of these limits, replace voltage regulator.
	F. High resistance in starting circuit or ignition resistor by-pass	1. Connect a jumper from the negative terminal of the coil to ground to prevent engine from starting. Connect a voltmeter from

		the positive terminal of the coil to ground. Crank engine long enough to get a stabilized voltage reading. Any reading above 9.0 volts with good cranking speed means that the battery, the starting circuit and resistor by-pass circuit are okay. If voltage reading at coil is below 9.0 volts, check voltage across the battery posts during cranking. If voltage at battery is within .5 volt of voltage at coil, this means that the starting circuit and the resistor bypass circuit are okay, but battery must be too low for a proper test.
	G. Defective battery	1. Test battery using the Battery Load Test Procedure. If battery tests okay, charge as specified by test. Replace defective battery.
	H. Owner's driving	1. Re-educate owner on excessive idling, slow, or short distance driving with all accessories on.
Battery over-charged (uses too much water)	A. Shorted battery cell	1. Test battery using Battery Load Test Procedure. A shorted cell will cause excessive water usage. Replace a defective battery.
	B. High voltage regulator setting	1. Connect a voltmeter across the battery. Place carburetor on high step of fast idle cam. (This will provide a generator speed high enough for a maximum charging rate). Start engine. (Do not touch accelerator pedal). Turn off all accessories. When upper radiator inlet is hot and voltmeter needle stops moving, any reading between 13.5 and 15.0 volts is okay. If voltage reads over 15.0 volts, replace voltage regulator.

MAJOR REPAIR

OVERHAUL PROCEDURES

Removal (Without A/C)

1. Disconnect negative battery cable.
2. Disconnect electrical connections.
3. Remove tensioner bracket bolt.
4. Remove pivot bolt.

On some models it may be necessary to loosen and rotate fan shroud to completely remove pivot bolt from bracket.

5. Remove Delcotron.

Removal (With A/C)

1. Disconnect negative battery cable.

Remove air cleaner on cars equipped with the dual-snorkel air cleaner.

2. Remove compressor mounting brace.

3. Loosen fan shroud by removing mounting bolts.

4. Remove Delcotron tensioner bracket bolt. Loosen bolt that attached Delcotron to front of engine and swing bracket up and out of way.

5. Remove Delcotron pivot bolt.

On some models it may be necessary to loosen and rotate fan shroud to completely remove pivot bolt from bracket.

6. Remove Delcotron belt.

7. Turn Delcotron up on end and remove electrical connection.

8. Remove Delcotron.

Disassembly

1. Scribe a mark across end frames and stator ring for ease of reassembly.

2. Remove four thru-bolts and separate the drive end frame and rotor assembly from the stator and slip ring end frame assembly by prying apart with a screwdriver at the stator slot. Brushes and brush springs will pop out of brush holder.

3. Place a piece of plastic type tape over the slip ring end frame bearing to prevent entry of dirt or other foreign material.

(If bearing is not to be removed).

4. Remove drive end frame from rotor by placing the rotor in a vise only tight enough to permit removal of shaft nut (excessive tightening may cause distortion of the rotor).

5. Remove shaft nut, washer, pulley, fan and collar, then slide drive end frame off the rotor shaft.

6. Remove bearing, retainer and seal from drive and frame.

7. Support inside of drive end frame and press ball bearing and slinger out of end frame.

8. Remove retaining nuts and pry stator from slip ring end frame.

9. Remove capacitor.

10. Remove diode trio.

11. Remove rectifier bridge and battery terminal stud.

12. Remove brush holder and regulator.

13. Support inside end of end frame and press seal and roller bearing out of end frame.

Inspection and Testing

1. Rotor and Slip rings.

Visually inspect the rotor assembly for damage and-/or wear. The rotor field windings can be tested for "OPENS", "SHORTS", or "GROUNDS" by using an Ohmmeter or "Continuity Test Lamp". Touch the continuity lamp or ohmeter leads to the slip rings. See Figure 1D-3.

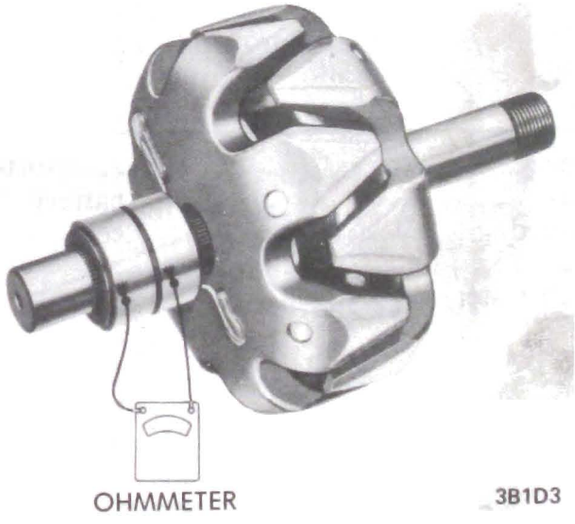

Figure 1D-3 Checking Rotor for Opens and Shorts

If the lamp does not light or the ohmeter needle does not move, there is an "Open" in the windings. If there is an ohmmeter reading and the reading is below the specied value, the winding is shorted. A reading above the specified value indicates excessive resistance in the winding. The specified resistance value can be determined by dividing the voltage by the current given in Specifications. To check for a ground, connect one lead of (Continuity Lamp or Ohmmeter) to a slip ring and the other lead to the rotor shaft. If there is a reading on the Ohmmeter or the Continuity lamp lights, there is a ground in the circuit. 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.

If the slip rings are dirty or worn, spin the rotor and clean up with 400 grain or finer polishing cloth or true up in a lathe removing only the necessary material to within .002 maximum indicator reading and finish with the polishing cloth. Remove any dust with compressed air.

2. Stator windings.

Visually inspect stator for damage, a loose connection, or discolored windings.

Test the windings for "OPENS" or "GROUNDS" with a continuity light or ohmmeter as shown in Figure 1D-4.

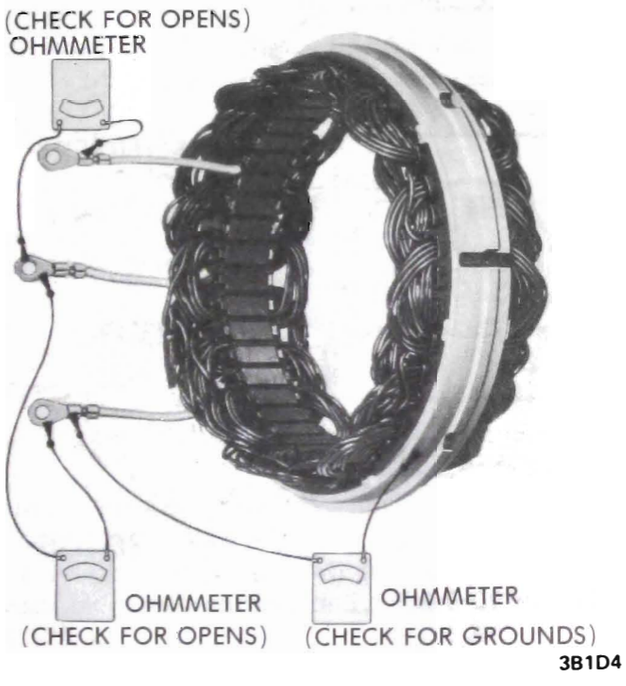

Figure 1D-4 Checking Stator Windings

If the lamp lights or the ohmmeter reading is low when connected from any stator lead to the frame, the windings are grounded. If the lamp does not light or the ohmeter reading is high when successively connected between each pair of stator leads, the windings are "OPEN". See Figure 1D-4. Shorted stator windings are difficult to locate. However, if all other electrical tests are normal and the generator fails to work, the windings are shorted.

A shorted stator can cause the indicator lamp to be on with the engine running at low speed.

3. Diode trio.

Visually inspect for cracks in case or terminal connectors. Test diode trio by connecting one ohmmeter lead to the single connector and the other lead successively to each of the three connectors as in Figure 1D-5.

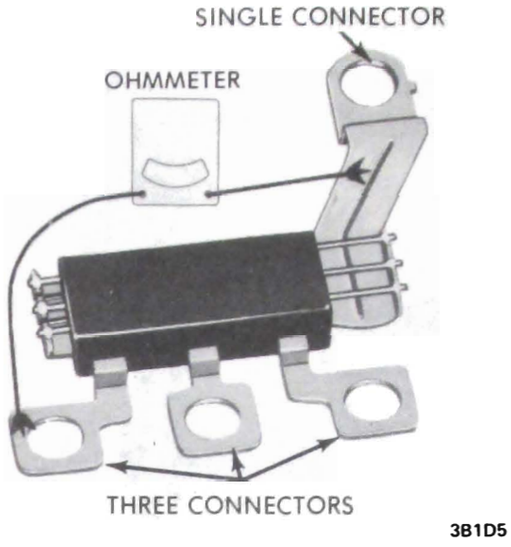

Figure 1D-5 Checking Diode Trio

Observe reading on lowest scale. Reverse leads to the same connectors. If both readings are the same, the diode trio is defective. A good diode trio will allow current to pass in one direction but not in the other.

4. Rectifier bridge.

Visually inspect for carcks or burnt terminals. The rectifier bridge has grounded heat sink and insulated heat sink.

Test rectifier bridge by attaching one ohmeter lead to the grounded heat sink and the other to each of the three terminals and observe readings. Reverse the leads and take another reading. If both readings are the same, replace recetifier bridge. Repeat this test using the insulated heat sink. A good rectifier bridge will have one high and one low reading on both the grounded and the insulated sides.

Assembly

1. Support inside of slip ring end frame.

2. Lightly lubricate seal lip and press seal part way in the end frame with the lip of the seal toward the rotor.

3. Lubricate roller bearing with Delco-Remy lubricant or equivalent and install in the slip ring end frame.

4. Position bearing end plug on bearing and press end plug bearing and seal until plug is flush with the end frame.

5. Position the regulator in the end frame.

6. Load brush springs and brushes in the brush holder and install pin to hold springs and brushes in a compressed position, then install brush holder in the end frame.

7. Install rectifier bridge and battery terminal stud. Check with test light or ohmeter to make sure that current is flowing only one way through the diodes. See Figure 1D-6.

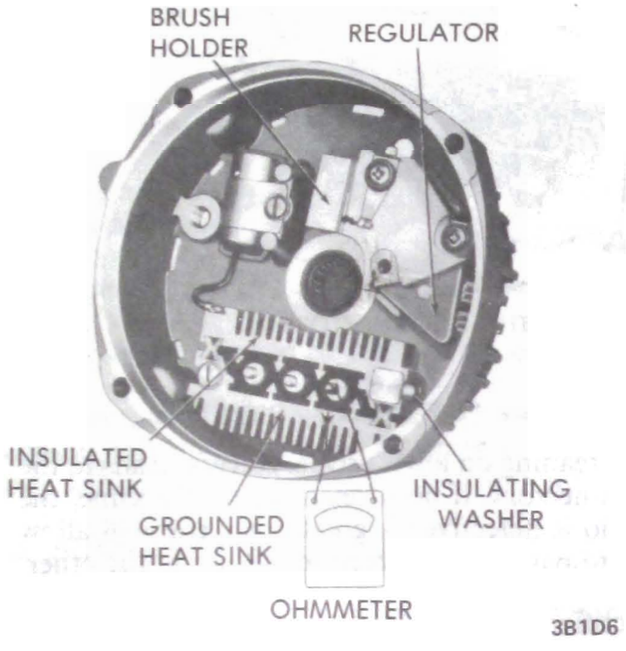

Figure 1D-6 Checking Rectifier Bridge

8. Install diode trio. Make sure that current flows only one way through the single connector using a test light or ohmmeter. See Figure 1D-7.

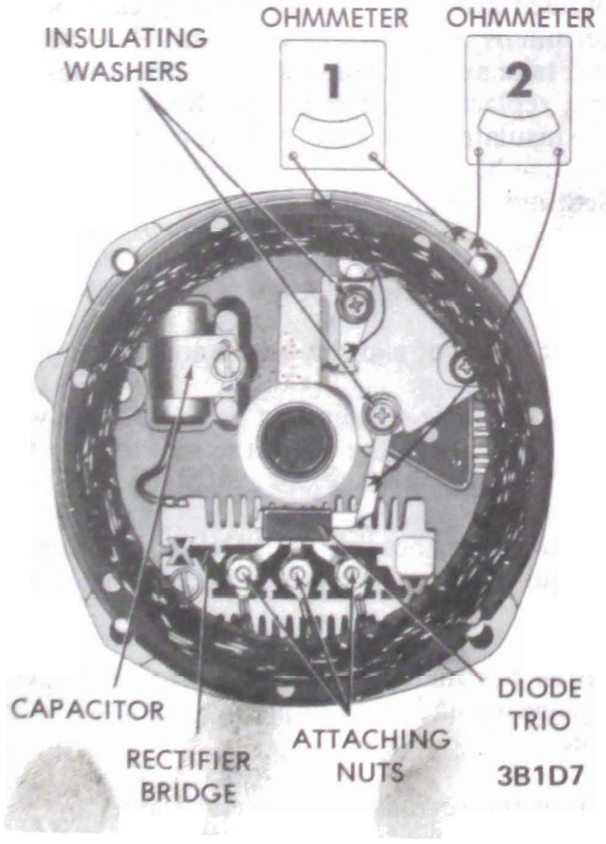

Figure 1D-7 Checking Diode Trio

9. Install capacitor.

10. Install stator. Test the three wires with the test light for continuity. Also check any wire against the case and holder to insure there being no ground.

11. Support inside center of drive end frame.

12. Insert slinger and press ball bearing in. See Figure 1D-8.

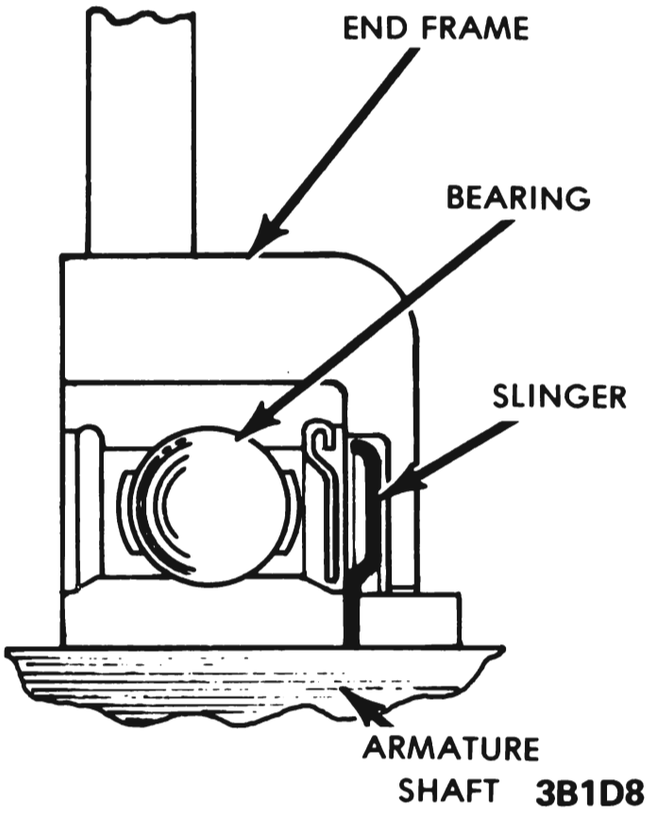

Figure 1D-8 Drive End Bearing Assembly

13. Fill seal cavity 1/4 full with Delco-Remy lubricant or equivalent and install ball bearing retainer. (Do not overfill, as this may cause the bearing to overheat.)

14. Position rotor in vise. Assemble drive end frame collar, fan, puller washer, and nut. Torque nut to 40-60 ft.lbs.

15. Assemble end frame assemblies, observing the scribe mark and install four through bolts.

16. Remove brush restraining pin.

Generator Bench Check

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

1. Make connections as shown in Figure 1D-9, except leave the carbon pile disconnected.

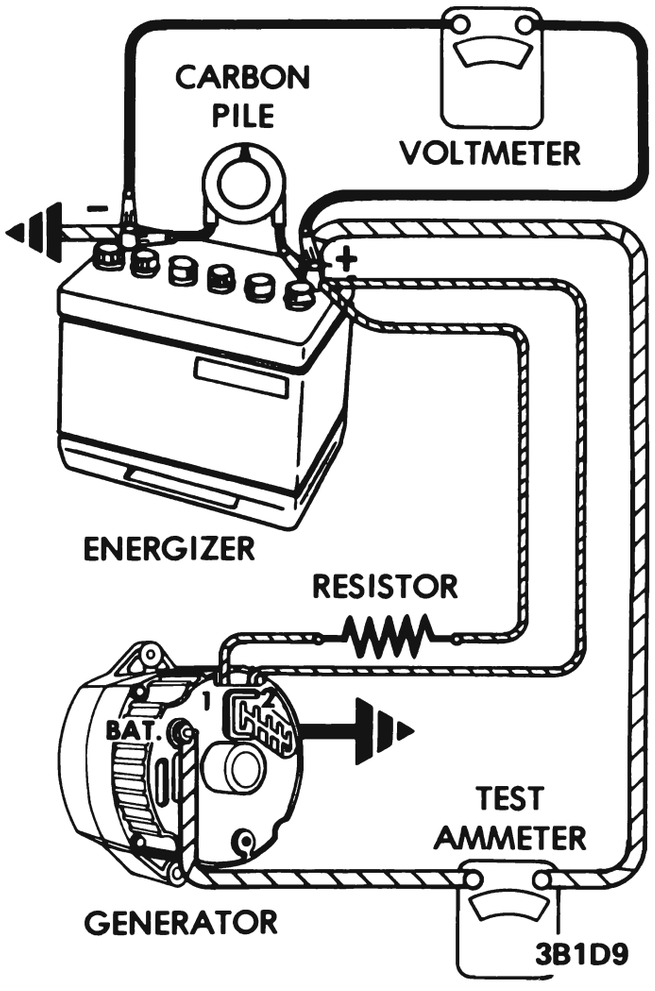

Figure 1D-9 Bench Check Connections

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, check for a grounded brush lead clip, as covered under heading of "Overcharged Energizer," Step 3. If not grounded, replace the regulator and check field winding. The Energizer or battery must be fully charged when making this check.

4. If voltage is below 15.5 volts, connect the carbon pile as shown in Figure 1D-9.

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, see Figure 1D-10.

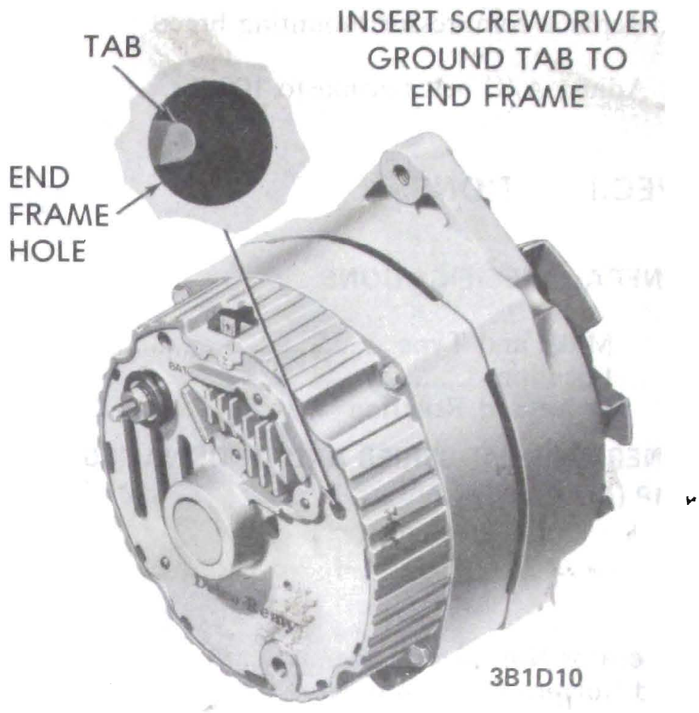

Figure 1D-10 Grounding Field Windings

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.

Installation (Without A/C)

1. Install Delcotron.

2. Replace pivot bolt.

3. Install tensioner bracket bolt.

4. Adjust Delcotron belt tension to 80 lbs.

5. Hook up electrical connections.

6. Install battery cable.

Installation (With A/C)

1. Install Delcotron.
2. Hook up electrical connections.

3. Install Delcotron pivot bolt.

4. Install Delcotron drive belt.

5. Install tension bracket and adjust belt tension to 80 lbs.

6. Replace compressor mounting brace.

7. Adjust A/C belt tension to 100 lbs.

8. Install fan shroud bolts.

9. Install air cleaner.

10. Connect negative battery cable.

SPECIFICATIONS

GENERAL SPECIFICATIONS

Make and Type	Delco-Remy, Delcotron
Location	Right Upper Front of Engine
Drive and Rotation	Fan Belt, Clockwise

GENERATOR "A" SERIES AND OPTIONAL 80 AMP (ALL)

	STANDARD 37 AMP.	AIR CONDITION 42 AMP.	*OPTIONAL 80 AMP.
Generator Number	1100947	1100926	1101018
Field Current Draw (Amps.) at 80° and 12 Volts	4-4.5 amps.	4-4.5 amps.	4-4.5 amps.
Bench Test at 14 Volts and 80° F (Amps. at Gen. RPM)	32 at 5000	37 at 5000	74 at 5000
Belt Tension	80 lbs.	80 lbs.	80 lbs.

* Police Option Available on All Series

GENERATOR B,C AND E SERIES

	55 AMP.	61 AMP.	63 AMP.
Generator Number	1100946	1100948	1100925
Field Current Draw (Amps) at 80° and 12 Volts	4-4.5 amps.	4-4.5 amps.	4-4.5 amps.
Bench Test at 14 Volts and 80° F (Amps. at Gen. RPM)	50 at 5000	55 at 5000	58 at 5000
Belt Tension	80 lbs.	80 lbs.	80 lbs.

* Used with A/C, Standard Heater and Electric B/L Defogger

* * Used with Auto A/C and Electric B/L Defogger

VOLTAGE REGULATOR

Make and Type	Delco-Remy, Integral W/Delcotron
Regulator Number	1116384
Voltage Regulator Setting at 2000 Eng. RPM (After 15 Minutes Warm-Up at 1500 Eng. RPM)	14± .5 Volts

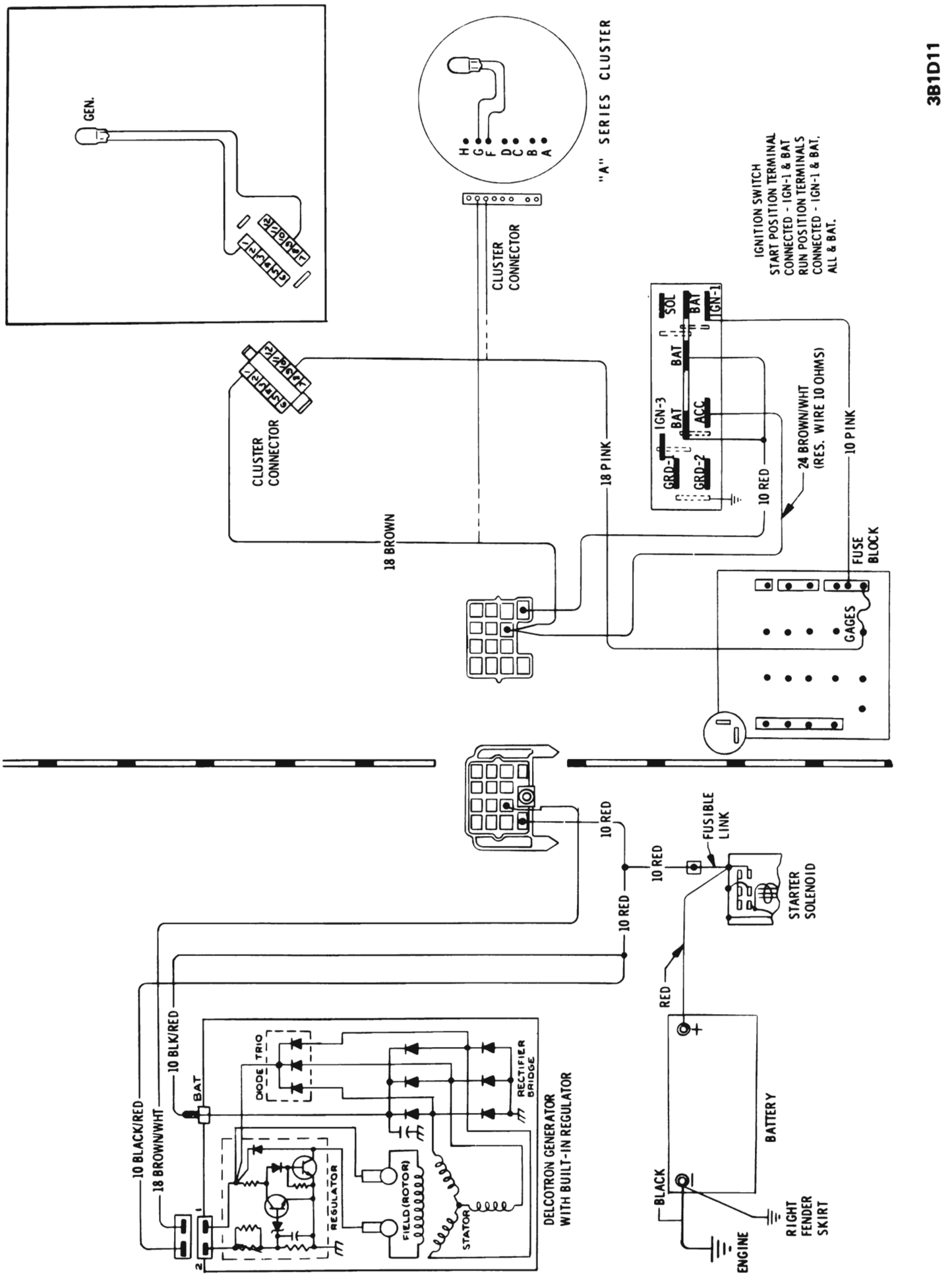

Figure 1D-11 Charging Circuit Wiring - All Series