

# BATTERY AND CHARGING SYSTEM

GROUP  
**14**  
(10000)

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## SECTION 14-00 Battery and Charging System—Service

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### VEHICLE APPLICATION

Capri.

### DESCRIPTION AND OPERATION

The generator charging system is a negative ground system consisting of a generator with an integral regulator, a charge indicator lamp, a storage battery, and associated wiring.

The integral regulator is solid-state. It is mounted onto the rear of the generator and contains the generator brushes.

### DIAGNOSIS AND TESTING

Battery and charging system trouble is frequently due to physical rather than electrical factors including loose or corroded wiring connections, damaged wiring, slipping drive belts, dirty battery surfaces and terminals, or poor maintenance.

Thoroughly inspect the system.

1. Make sure battery terminals and cable connections are clean and tight. Refer to Section 14-01.
2. Inspect battery cable connections to starter and engine ground for surface dirt or foreign matter.

## DIAGNOSIS AND TESTING (Continued)

3. Check generator drive belt for glazing or cracking which may have been caused by belt slippage. If sides of belt are shiny or feel slick, replace them. Check belt tension. Refer to Section 03-05 for belt replacement or tension adjustment.
4. Make sure that top surface of battery is clean and free of moisture or foreign matter.

Charging system troubles such as low generator output, no generator output (indicated by the indicator lamp being on while the engine is running), or generator output voltage too high, require testing of both the generator and the voltage regulator.

Voltage regulator failures are usually not recognized except by the direct effect on the generator output, and eventual battery discharge. The voltage regulator is the control valve for the generator. It protects the battery by preventing excessive voltage output.

Discharge of the battery to ground through the generator is prevented by the diodes of the generator which permit current flow in one direction (to the battery) only.

A discharged battery is not always due to a problem in the charging system. Excessive use of lamps and accessories while the engine is either off or running at low idle, corroded battery cables and connectors, low acid level in the battery, or prolonged disuse of the battery, which would permit self-discharge are all possible reasons which should be considered when a battery is run down or low in charge.

NOTE: Always determine the cause of failure as well as servicing the concern.

1. **Polarity and Connections:** The generator is for use on negative ground electrical systems only. Polarity cannot be reversed and any attempt to do so will damage the generator.
2. **Installing Vehicle Battery:** Reversed battery connections will damage the generator rectifiers. When installing, first connect the positive connector to the battery positive terminal and then connect the negative connector to the negative battery terminal.
3. **Battery Charging:** Disconnect the battery negative cable to isolate the generator from the battery and external charging equipment.
4. **Battery Connections:** Never disconnect the battery while the engine is running. Damage to the rectifier and /or other electrical components may occur. Using a slave battery to start the engine and then reconnecting the original battery while the engine is running must not be attempted. Do not break or make any other connections in the generator circuit while the engine is running.
5. **Generator Main Output Cable:**
  - The cable connecting the generator and the battery has constant battery voltage even when the engine is not running. Care must be taken not to ground this cable if it should ever be removed, or damage to the cable will occur.

- Never run the generator with the main output cable disconnected either at the generator or battery end while the field remains energized or the rectifiers may be damaged.
6. **Arc Welding:** Isolate the control box and generator by disconnecting their wiring connectors prior to performing any arc welding on the vehicle.
  7. **Lamps and Fuses Fail Prematurely, Short Battery Life:** Other systems covered under this heading are: battery uses excessive amount of water; high battery charging rate. Check all charging system wiring connections including the voltage regulator ground and battery sensing wire. Tighten or service as required. Check the generator voltage limiter setting. Replace if not to specification.
  8. **Generator Noisy:** When diagnosing the complaint of generator noise, isolate the noise area and make sure that the generator is at fault rather than the generator belt, water pump, or another part of the vehicle. Start the engine and use a stethoscope or similar tool to isolate the noise. A generator bearing, water pump bearing or belt noise is usually evident by a squealing sound.

A generator with a shorted diode will normally whine (magnetic noise) and will be most noticeable at idle speeds. Perform the generator output tests. If the output is approximately 10 amperes less than that specified, a shorted diode is usually indicated.

To eliminate the belt(s) as the cause of noise, check the belt(s) for bumps, apply a light spray of water to the belt(s). If the generator belt is at fault, adjust the belt to specification, or replace the belt if necessary.

**If the belt(s) is satisfactory and the noise is believed to be in the generator or water pump, remove the generator belt. Start the engine and listen for the noise to be sure that the noise is not caused by another component. Use this test and the sound detector test to isolate the noisy component. If the noise is traced to the generator, remove it and check bearings for play or roughness.**

9. **Charge Warning Indicator Lamp Flickers:** This condition may be caused by loose or damaged connections in the charging system wiring harness, worn brushes, or improper brush tension.

### On-Vehicle Charging System Tests

#### Generator Load Test

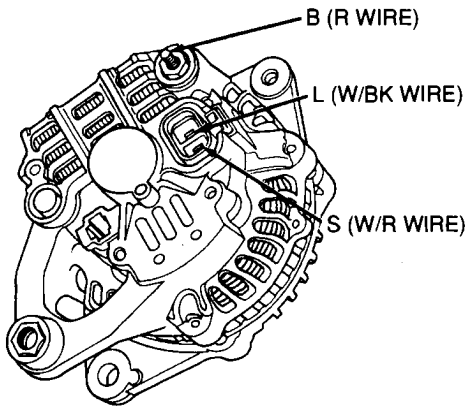
1. Start the engine and verify that the charge warning indicator lamp goes out. If the indicator goes, out, refer to Step 6. If the indicator does not go out, refer to Step 2.

**CAUTION: Do not ground the B- terminal.**

**DIAGNOSIS AND TESTING (Continued)**

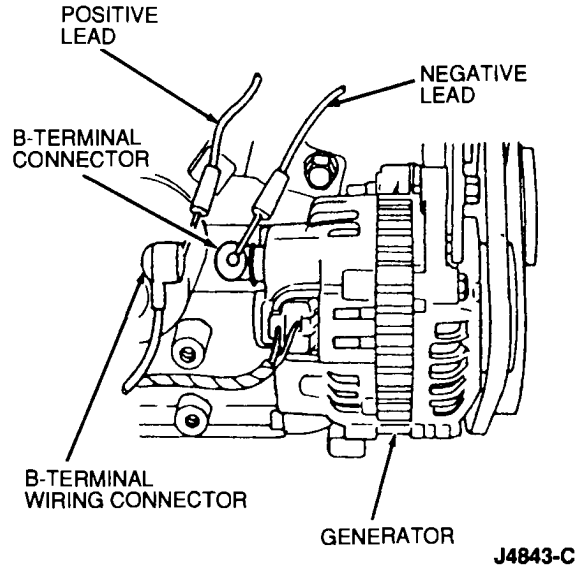
2. With the ignition switch in the ON position and the engine not running, verify that the voltage at the generator wiring connector terminals are as follows:
  - B-terminal = Battery Voltage
  - L-terminal = Approximately 1 volt
  - S-terminal = Battery Voltage
3. Start engine.
4. With the engine running and at normal curb idle, verify that the voltage at the generator wiring connector terminals are as follows:
  - B-terminal = 14.1 - 14.7 volts
  - L-terminal = 14.1 - 14.7 volts
  - S-terminal = 14.1 - 14.7 volts

Generator Terminal	Ignition ON/ Engine OFF	Engine at Idle
B	Approximately 12 volts	14.1-14.7 volts
L	Approximately 1 volts	14.1-14.7 volts
S	Approximately 12 volts	14.1-14.7 volts



J4439-A

5. If the voltages are as specified, check the wiring harness between the battery and B-terminal. If the voltages are below specification, check the wiring harness. If wiring harness is in good condition, service or replace the generator.
6. Using Rotunda Starting / Charging Tester 078-00005 (VAT-40) or equivalent, connect the positive lead to the generator B-terminal connector and the negative lead to the B-terminal wiring connector.



7. Switch the tester to the ammeter function.
8. Connect Rotunda Inductive Dwell-Tach-Volts Ohms Tester 059-00010 or equivalent.
9. With the engine running, turn on all lamps, lights, accessories and press the brake pedal.
10. With an engine speed of 2500-3000 rpm check that the generator output current is 70 amps or more. If output current is as specified, the charging system is functioning properly. If the output current is below specification, check the accessory belt. Refer to Section 03-05. If the belt tension is at specification, service or replace the generator.

**CONDITION CHART—CHARGING SYSTEM**

CONDITION	POSSIBLE SOURCE	ACTION
<ul style="list-style-type: none"> <li>● Battery Does Not Stay Charged—Engine Starts OK</li> </ul>	<ul style="list-style-type: none"> <li>● Battery.</li> <li>● Loose or worn generator belt.</li> <li>● Wiring or cables.</li> <li>● Generator.</li> <li>● Other vehicle electrical systems.</li> </ul>	<ul style="list-style-type: none"> <li>● Test battery, replace if necessary. Refer to Section 14-01.</li> <li>● Adjust or replace belt. Refer to Section 03-05.</li> <li>● Service as required. Refer to Section 03-05.</li> <li>● Test and / or replace components as required. Refer to Section 14-02.</li> <li>● Check other systems for current draw. Service as required.</li> </ul>

**DIAGNOSIS AND TESTING (Continued)**

**CONDITION CHART—CHARGING SYSTEM (Continued)**

CONDITION	POSSIBLE SOURCE	ACTION
<ul style="list-style-type: none"> <li>Generator Noisy</li> </ul>	<ul style="list-style-type: none"> <li>Loose or worn generator belt.</li> <li>Bent pulley flanges.</li> <li>Generator.</li> </ul>	<ul style="list-style-type: none"> <li>Adjust tension or replace belt. Refer to Section 03-05.</li> <li>Replace pulley. Refer to Section 14-02.</li> <li>Service or replace generator. Refer to Section 14-02.</li> </ul>
<ul style="list-style-type: none"> <li>Lamps and/or Fuses Burn Out Frequently</li> </ul>	<ul style="list-style-type: none"> <li>Wiring.</li> <li>Generator.</li> <li>Battery.</li> </ul>	<ul style="list-style-type: none"> <li>Service as required.</li> <li>Test, service, replace if necessary.</li> <li>Test, replace if necessary. Refer to Section 14-01.</li> </ul>
<ul style="list-style-type: none"> <li>Charge Warning Indicator Lamp Flickers After Engine Starts or Comes On While Vehicle is Being Driven</li> </ul>	<ul style="list-style-type: none"> <li>Loose or worn generator belt.</li> <li>Generator.</li> <li>Field circuit ground.</li> <li>Lamp circuit wiring and connector.</li> </ul>	<ul style="list-style-type: none"> <li>Adjust tension or replace. Refer to Section 03-05.</li> <li>Service or replace. Refer to Section 14-02.</li> <li>Service or replace worn or damaged wiring.</li> <li>Service as required.</li> </ul>
<ul style="list-style-type: none"> <li>Charge Warning Indicator Lamp Flickers While Vehicle is Being Driven</li> </ul>	<ul style="list-style-type: none"> <li>Loose or worn generator belt.</li> <li>Loose or improper wiring connections.</li> <li>Generator.</li> </ul>	<ul style="list-style-type: none"> <li>Adjust tension or replace belt. Refer to Section 03-05.</li> <li>Service as required.</li> <li>Service or replace. Refer to Section 14-02.</li> </ul>
<ul style="list-style-type: none"> <li>Voltmeter Pointer Reads in the Red Area (High or Low)</li> </ul>	<ul style="list-style-type: none"> <li>Loose or worn generator belt.</li> <li>Damaged or worn wiring (battery to generator for ground or open).</li> <li>Field circuit ground.</li> <li>Generator.</li> <li>Voltmeter indicator gauge wiring and connections.</li> <li>Damaged or worn gauge.</li> <li>Other vehicle electrical system malfunction.</li> </ul>	<ul style="list-style-type: none"> <li>Adjust tension or replace. Refer to Section 03-05.</li> <li>Service or replace wiring.</li> <li>Service or replace wiring.</li> <li>Service or replace. Refer to Section 14-02.</li> <li>Service as required.</li> <li>Replace gauge.</li> <li>Service as required.</li> </ul>

The following pinpoint tests have been arranged in a series to isolate the component or cause of a charging system complaint.

Start at the beginning and continue through the test steps even after the cause of the complaint is found. This will rule out the possibility that the original condition was not caused by more than one charging system condition.

**PINPOINT TEST A—CHARGING SYSTEM DIAGNOSIS**

TEST STEP	RESULT	ACTION TO TAKE
<b>A1</b> CHECK CHARGE LAMP FUNCTION <ul style="list-style-type: none"> <li>Without starting engine, turn ignition switch to RUN position. Charge warning indicator lamp should come on.</li> <li>Key OFF.</li> <li>Disconnect the generator connector.</li> <li>Key ON.</li> <li>Ground L terminal of generator connector. Charge warning indicator lamp should come on.</li> </ul> <p>NOTE: Testing to be performed on wiring harness side.</p>	Lamp functions properly Lamp does not come on Lamp does not go off Lamp comes on only with L-terminal grounded	<ul style="list-style-type: none"> <li>GO to A2.</li> <li>REPLACE meter fuse or lamp bulb or SERVICE open in lamp feed circuit.</li> <li>SERVICE short to ground in lamp feed circuit.</li> <li>SERVICE open circuit. CHECK rotor, brushes, or voltage regulator. Refer to bench tests. Section 14-02.</li> </ul>

## DIAGNOSIS AND TESTING (Continued)

## PINPOINT TEST A—CHARGING SYSTEM DIAGNOSIS (Continued)

TEST STEP		RESULT	ACTION TO TAKE
A2	CHECK BATTERY CONDITION		
	<ul style="list-style-type: none"> <li>Perform sealed battery voltage / load test. Refer to Section 14-01.</li> <li><b>Does battery pass load test?</b></li> </ul>	Yes No	GO to A3. REPLACE battery.
A3	CHECK B+ WIRING		
	<ul style="list-style-type: none"> <li>With ignition switch in OFF position, use a voltmeter, such as Rotunda Digital Volt-Ohmmeter 014-00407 or equivalent to test for battery voltage at generator B+ terminal.</li> <li><b>Is voltage within 0.2 volts of battery voltage?</b></li> </ul> NOTE: Test step must be performed with generator installed and all wiring connected.	Yes No	GO to A4. SERVICE loose, corroded or damaged B+ wire.
A4	CHECK BATTERY GROUND		
	<ul style="list-style-type: none"> <li>Use a voltmeter to check voltage drop from battery negative post to ground.</li> <li>Voltage drop should be less than 0.2 volts.</li> </ul>	Within 0.2 volts Greater than 0.2 volts	GO to A5. SERVICE loose or corroded connections or damaged ground cable.
A5	CHECK GENERATOR GROUND		
	<ul style="list-style-type: none"> <li>Use a voltmeter to check voltage drop from generator frame to engine ground.</li> <li>Voltage drop should not exceed 0.2 volts.</li> </ul>	Within 0.2 volts Greater than 0.2 volts	GO to A6. SERVICE excessive resistance in generator mounting.
A6	PERFORM BATTERY DRAIN TEST—KEY OFF		
	<ul style="list-style-type: none"> <li>Turn ignition switch to OFF position.</li> <li>Disconnect battery positive cable.</li> <li>Connect an ammeter or test lamp between battery positive terminal and positive cable.</li> <li>Current draw should be no more than .05 amps (clock draw). Test lamp should not light.</li> <li><b>Does test lamp illuminate?</b></li> </ul>	Yes No	CHECK vehicle circuits for drain by pulling fuses from fuse panel one at a time until affected circuit is found. SERVICE as necessary. GO to A7.
A7	PERFORM BASE VOLTAGE AND NO-LOAD TEST		
	<ul style="list-style-type: none"> <li>Connect a voltmeter across battery terminals. Read and record voltage (this is base reading).</li> <li>Start engine, run at 1500 rpm with no electrical load. Voltage should increase from base reading, but not more than 2.5 volts.</li> </ul> NOTE: Test step must be performed with generator installed. Engine should be running at approximately 1500 rpm.	Voltage increase but less than 2.5 volts No voltage increase or increase greater than 2.5 volts.	GO to A8. SERVICE or REPLACE generator. REFER to this Section.
A8	PERFORM LOAD TEST		
	<ul style="list-style-type: none"> <li>Increase engine speed to 2000 rpm.</li> <li>Turn A / C, blower and headlamps on HIGH.</li> <li>The voltage should read a minimum of 0.5 volt over the base voltage.</li> </ul>	Increases 0.5 volt or more Increases less than 0.5 volt	The concern is not in the charging system. CHECK other vehicle systems for a constant or intermittent current overload by repeating the battery drain test with various auxiliary circuits on. REPLACE or SERVICE generator for shorted or open stator and field windings or diodes breaking down under load. REFER to Bench Tests as outlined.

**DIAGNOSIS AND TESTING (Continued)**

Whenever the generator assembly is removed from the vehicle and disassembled, a thorough inspection of the components should be performed as outlined in the Component Visual Inspection chart.

**NOTE:** Clean all parts thoroughly before inspecting. **Do not** wash the rotor, stator, voltage regulator, rectifier or bearings in cleaning solvent.

**GENERATOR  
COMPONENT VISUAL INSPECTION CHART**

COMPONENT	CHECK FOR
ROTOR	<ul style="list-style-type: none"> <li>● Thread stripped or damaged at pulley end.</li> <li>● Scored bearing surfaces indicating the bearing has spun on the shaft.</li> <li>● Scuff marks on the pole fingers indicating a bent shaft which allows the rotor to rub against the stator frame.</li> <li>● Dirty or contaminated slip rings.                             <ul style="list-style-type: none"> <li>● Slip rings can be cleaned using a No. 400 silicon carbide paper and finish polished using crocus cloth (DO NOT USE EMERY PAPER). The best cleaning method is to spin the rotor in a lathe or drill press to prevent flat spots.</li> </ul> </li> </ul>
STATOR	<ul style="list-style-type: none"> <li>● Burned or discolored windings indicating insulation breakdown from excessive heat.</li> <li>● Scuff marks on the inside of stator frame indicating a bent rotor shaft.</li> <li>● Damage to the stator frame.</li> </ul>
HOUSINGS	<ul style="list-style-type: none"> <li>● Cracked or damaged mountings.</li> <li>● Scoring in the bearing bores indicating the bearings have spun in the housing.</li> <li>● Lubricant in the bearing bores indicating damaged bearings.</li> </ul>
DRIVE PULLEY	<ul style="list-style-type: none"> <li>● Bent, broken or cracked pulley groove.</li> <li>● Wear or damage to the pulley bore which could prevent a tight fit on the shaft.</li> </ul>

(Continued)

**GENERATOR  
COMPONENT VISUAL INSPECTION CHART (Cont'd)**

COMPONENT	CHECK FOR
BRUSHES	<ul style="list-style-type: none"> <li>● Burn spots or discoloration indicating arcing.</li> <li>● Dirt or contamination.</li> <li>● Wear                             <ul style="list-style-type: none"> <li>● If brush length is less than 5mm (3/8 inch), replace the brushes.</li> </ul> </li> </ul>
BEARINGS	<ul style="list-style-type: none"> <li>● Roughness or flat spots:                             <ul style="list-style-type: none"> <li>● To determine this condition, slowly rotate the bearing on the shaft or between fingers. A flat spot will appear as a sudden tightening and then loosening of the outer race. Roughness will have a general uneven feel as the bearing is rotated.</li> </ul> </li> <li>● Leakage of lubricant past the bearing seals.</li> <li>● Scoring on the inner or outer races, indicating the bearing has spun on the shaft or in the housing.</li> </ul>

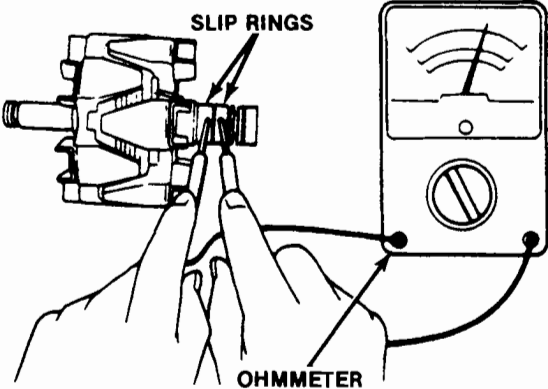
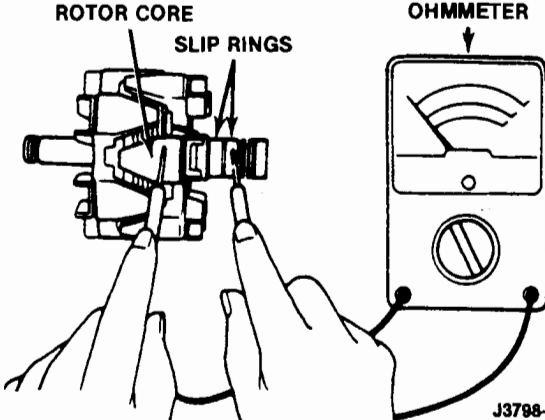
Generator and voltage regulator testing is broken down into on-vehicle testing and bench testing. Refer to On-Vehicle Charging System Tests before proceeding to On-Bench testing.

**On-Bench Testing**

In order to perform the component testing in the following charts, it will be necessary to partially or completely disassemble the generator as outlined. Use Rotunda Inductive Dwell-Tach-Volts-Ohms Tester 059-000 10 for on-bench testing procedures.

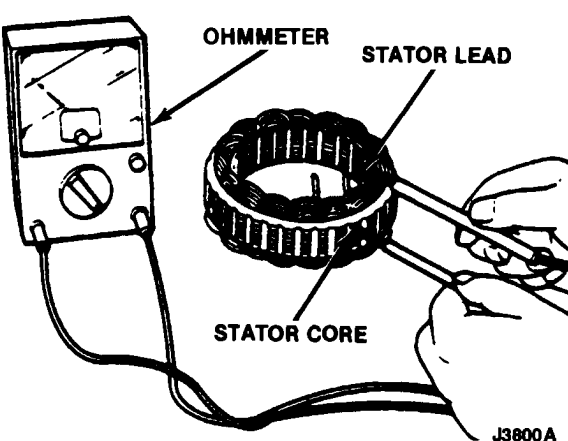
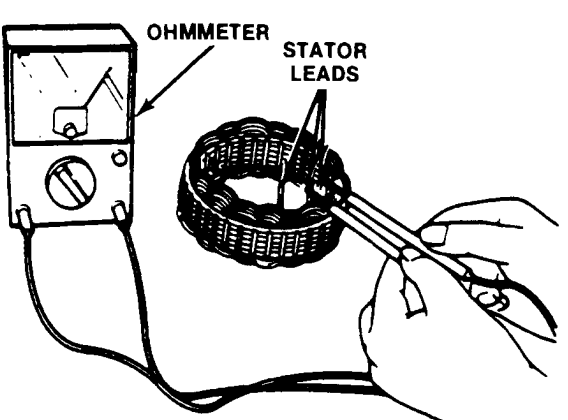
**DIAGNOSIS AND TESTING (Continued)**

**PINPOINT TEST B—GENERATOR COMPONENT DIAGNOSIS AND TESTING**

TEST STEP		RESULT	ACTION TO TAKE
<b>B1</b>	<p><b>CHECK ROTOR COIL RESISTANCE</b></p> <ul style="list-style-type: none"> <li>Set ohmmeter on X1 scale. Connect meter leads across rotor slip rings. Resistance should be 2-6 ohms.</li> </ul>  <p style="text-align: center;">OHMMETER</p> <p style="text-align: right;">J3797-A</p>	<p>Rotor coil resistance 2-6 ohms</p> <p>Rotor coil outside specified tolerance</p>	<p>▶ Rotor coil OK. GO to B2.</p> <p>▶ REPLACE rotor.</p>
<b>B2</b>	<p><b>CHECK ROTOR COIL GROUND</b></p> <ul style="list-style-type: none"> <li>Set ohmmeter on X1 scale. Place one meter test lead on rotor slip ring, and the other meter lead on a rotor pole. Repeat for other rotor slip ring. Ohmmeter reading should be infinite.</li> </ul>  <p style="text-align: center;">OHMMETER</p> <p style="text-align: right;">J3798-A</p>	<p>Resistance infinite</p> <p>Continuity between slip ring and rotor pole</p>	<p>▶ Rotor coil OK. GO to B3.</p> <p>▶ REPLACE rotor assembly.</p>

DIAGNOSIS AND TESTING (Continued)

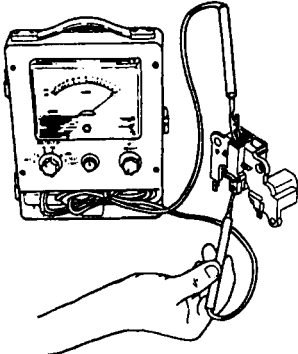
PINPOINT TEST B—GENERATOR COMPONENT DIAGNOSIS AND TESTING (Continued)

	TEST STEP	RESULT	ACTION TO TAKE
<p><b>B3</b></p>	<p><b>CHECK STATOR WINDING GROUND</b></p> <ul style="list-style-type: none"> <li>Set ohmmeter on XI scale. Clip one meter lead to a stator lead. Place other meter lead on stator frame. Resistance should be infinite.</li> </ul>  <p style="text-align: right;">J3800A</p>	<p>Resistance infinite</p> <p>Continuity between frame and stator lead: windings grounded</p>	<p>▶ Stator coil OK. GO to <b>B4</b>.</p> <p>▶ REPLACE stator.</p>
<p><b>B4</b></p>	<p><b>CHECK OPEN STATOR WINDINGS</b></p> <ul style="list-style-type: none"> <li>Set ohmmeter on XI scale. Clip one meter lead to a stator lead. Place other meter lead on each of remaining three stator leads. There should be continuity in all three positions.</li> </ul> <p><b>NOTE: SHORTED STATOR WINDINGS.</b> An internal short between adjacent windings is difficult to locate without laboratory equipment. If all other test results are normal and generator fails to supply rated output, shorted stator windings are probable.</p>  <p style="text-align: right;">J3799-A</p>	<p>Continuity in all three positions</p> <p>Infinite resistance in any of three positions: shorted stator windings.</p> <p>Shorted stator windings</p>	<p>▶ Stator windings OK. GO to <b>B5</b>.</p> <p>▶ REPLACE stator.</p> <p>▶ REPLACE stator.</p>



**DIAGNOSIS AND TESTING (Continued)**

**PINPOINT TEST B—GENERATOR COMPONENT DIAGNOSIS AND TESTING (Continued)**

TEST STEP		RESULT	ACTION TO TAKE
<b>B5</b>	<p><b>CHECK BRUSH CIRCUIT CONTINUITY</b></p> <ul style="list-style-type: none"> <li>Set ohmmeter on XI scale. Touch one meter lead to brush. Touch other meter lead to brush terminal. Check inner and outer terminals using this method. There should be continuity in both positions.</li> </ul>  <p style="text-align: right;"><b>J4444-B</b></p>	<p>Continuity in both positions</p> <p>Infinite resistance in either position: brush circuit open</p>	<ul style="list-style-type: none"> <li>Brush circuits OK. GO to <b>B6</b>.</li> <li>REPLACE brush and voltage regulator as an assembly.</li> </ul>
<b>B6</b>	<p><b>CHECK NEGATIVE RECTIFIERS</b></p> <ul style="list-style-type: none"> <li>Set ohmmeter on XI scale. Clip one meter lead to negative diode heat sink. Touch other meter lead to each negative rectifier pin. Reverse ohmmeter leads and repeat test. Rectifier should show continuity in one direction only.</li> </ul>	<p>Continuity in one direction only</p> <p>Continuity in both directions on any one rectifier: rectifier shorted</p> <p>No continuity in either direction on any one rectifier: rectifier open</p>	<ul style="list-style-type: none"> <li>Negative diodes OK. GO to <b>B7</b>.</li> <li>REPLACE rectifier assembly.</li> <li>REPLACE rectifier assembly</li> </ul>
<b>B7</b>	<p><b>CHECK POSITIVE RECTIFIERS</b></p> <ul style="list-style-type: none"> <li>Set ohmmeter on XI scale. Clip one meter lead to positive diode heat sink. Touch other meter lead to each positive rectifier pin. Reverse ohmmeter leads and repeat test. Rectifier should show continuity in one direction only.</li> </ul>	<p>Continuity in one direction only</p> <p>Continuity in both directions on any one rectifier: rectifier shorted</p> <p>No continuity in either direction on any one rectifier: rectifier open</p>	<ul style="list-style-type: none"> <li>Positive diodes OK.</li> <li>REPLACE rectifier assembly.</li> <li>REPLACE rectifier assembly.</li> </ul>

## SPECIFICATIONS

## Electrical Specifications

Description	Specification
Ground Polarity	Negative
Nominal Voltage	14 Volts
Nominal DC Output	85 amps
Stator Phases	3
Stator Winding Connection	Star
Number of Poles	12
Resistance of Rotor Windings	2.6 ± .13 ohms
Resistance of Stator Windings	.037 + 10% ohms
Brush Length (Protrusion) New	9.8mm (0.39 inch)
Minimum	3.8mm (0.15 inch)
Minimum Diameter of Slip Rings	26.7mm (1.05 inch)

CJ3485-A

## SPECIAL SERVICE TOOLS

## ROTUNDA EQUIPMENT

Model	Description
014-00407	Digital Volt-Ohmmeter
059-00010	Inductive Dwell-Tach-Volts Ohms Tester
078-00005	Starting / Charging Tester (VAT-40)