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**Battery Charging Conditions**

The following conditions may be observed during cold-start voltage tests until temperatures of electrical system components stabilize. The time it takes to reach optimum voltage and amps will vary with engine speed, load, and ambient temperature.

**Maintenance/Low Maintenance Lead-Acid Battery:**

Traditional lead acid batteries require lowest charge voltage of all vehicle battery chemistries. Battery cells must be maintained by periodically topping off with distilled water as required.

**Maintenance-free Lead-Acid Battery:**

Maintenance-free batteries are similar to Maintenance/Low Maintenance batteries, but may require slightly higher charge voltage.

**Deep-cycle/Marine Maintenance-free Battery:**

Charge acceptance of these batteries may display characteristics similar to maintenance-free batteries and may charge faster due to generally lower capacity relative to size.

**AGM (Absorbed Glass Mat) Maintenance-free Battery:**

These dry-cell batteries respond better than standard maintenance-free batteries. If battery state of charge (SOC) drops to 75% or less, batteries should be recharged to 95% or higher separately from engine charging system to avoid damaging charging system components and to provide best overall performance. Charge acceptance of these batteries may display characteristics similar to maintenance batteries, but may require higher charge voltage and will draw significant current (<100 amps) when under 50% SOC.

**Lithium Battery:**

Lithium batteries have unique charging characteristics that differ from lead acid. These batteries require charging systems configured specifically for lithium battery chemistries. Contact CEN for more information on lithium battery charging systems and components.

**Testing Guidelines**

Professional service technicians rely on the following guidelines when testing electrical components.

**Voltage testing:**

- Set meter to proper scale and type (AC or DC).
- Be sure to zero the meter scale or identify the meter burden by touching meter leads together. Meter burden must be subtracted from final reading obtained.
- Be sure the meter leads touch source area only. Prevent short circuit damage to test leads or source by not allowing meter leads to touch other pins or exposed wires in test area.
- Be sure to use CEN tools designed especially for troubleshooting CEN alternators when available.

**Resistance (ohm) testing:**

- Set meter to proper scale.
- Be sure to zero the meter scale or identify the meter burden by touching meter leads together. Meter burden must be subtracted from final reading obtained.
- Be sure meter leads touch source area only. Allowing fingers or body parts to touch meter leads or source during reading may alter reading.
- Be sure reading is taken when source is at 70°F. Readings taken at higher temperatures will increase the reading. Conversely, readings taken at lower temperatures will decrease the reading.
- Be sure to test directly at the source. Testing through extended harnesses or cable extensions may increase the reading.
- "OL" as referenced in this document refers to open circuit: "infinite" resistance, typically in very high kilo- or megaohm range depending on meter and settings.

**Diode testing:**

- Diodes allow current to flow in one direction only. Typical voltage drop in forward bias can range from 0.1-0.85V. Meter should read OL in reverse bias. Check meter user manual for meter-specific testing guidelines.

**Voltage drop testing:**

- Measure voltage between B+ on alternator or power source and B- (ground) on alternator or source. Record reading. Move to batteries or other power source and measure again between B+ and B- terminals on battery or other power source. The difference between the two readings represents voltage lost within circuit due to, but not limited to, inadequate cable gauge or faulty connections.
- Voltage drop measurements must be taken with all electrical loads or source operating.

**Dynamic/Live testing (Connecting power and ground to component to test operation/function out of circuit):**

- Connect jumper leads directly and securely to power source contacts of component being tested.
- Make any connection to power and ground at power supply or battery source terminals. Do not make connection at component source terminals, as that may create an arc and damage component source terminals.



## N1255 Alternator Description and Operation

N1255 is a negative ground, hinge mount alternator rated at 28V/260A. N1255 is internally rectified, and all windings and current-conducting components are non-moving, so there are no brushes or slip rings to wear out.

Voltage regulator allows alternator to become self-excited through internal diode trios. When engine is running, residual magnetic field within alternator shaft/core induces small voltage in stator and energizes regulator. Field coil continues receiving incremental voltage from regulator until full system charge voltage is achieved. The regulator monitors alternator shaft rotation and provides field current only when it detects the alternator shaft rotating at a suitable speed.

Refer to Figure 1 for alternator terminal locations. Refer to Figure 2 for alternator-to-regulator harness pin designations.

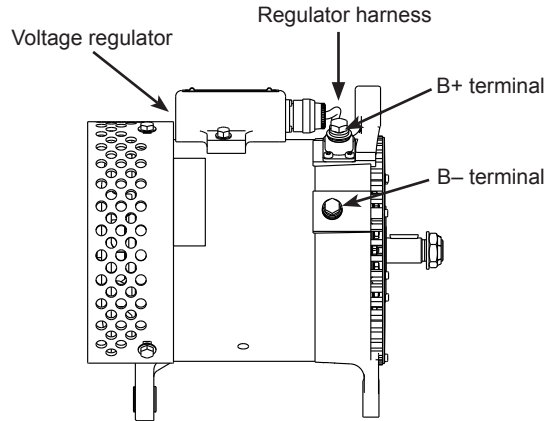


Figure 1: N1255 Alternator Terminals

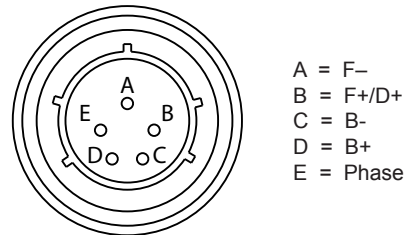


Figure 2: Alternator-to-Regulator Harness Pin Designations

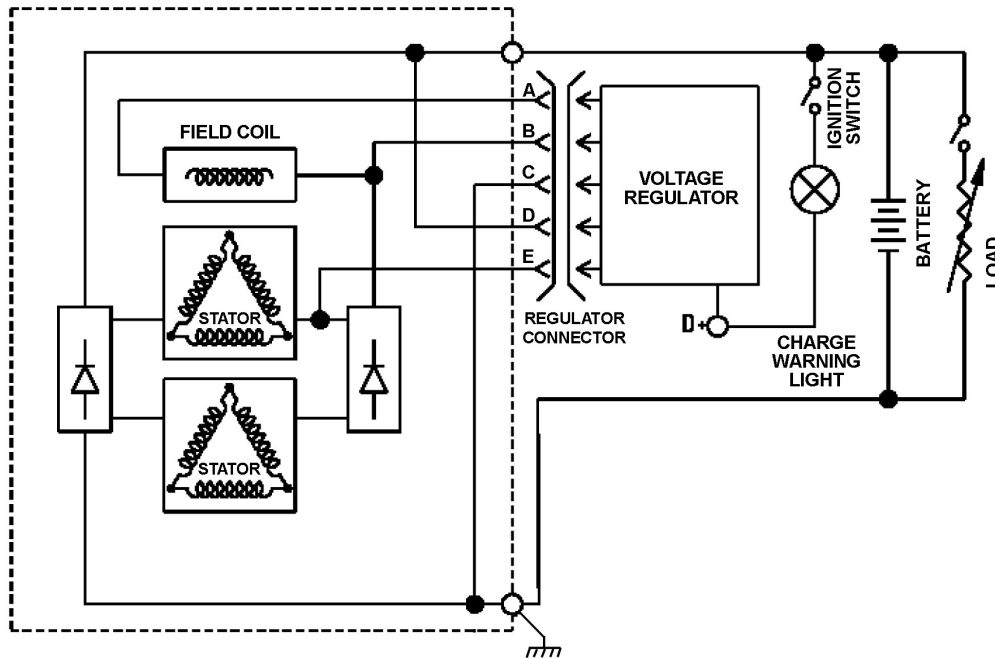


Figure 3: N1255 Alternator with Regulator Wiring Diagram

(See alternator specific characteristics drawing for notes and detailed descriptions)



**N3043 Voltage Regulator  
Description and Operation**

N3043 voltage regulator is mounted directly on alternator shell. Regulator features include D+ output terminal (see Figure 4) and adjustable set points via switch on bottom of regulator (see Figure 4 and Table 1).

D+ circuit supplies DC battery voltage for use with charge indicator light or multiplex charge warning input. D+ circuit has 2 amp maximum output protected by a resettable fuse.

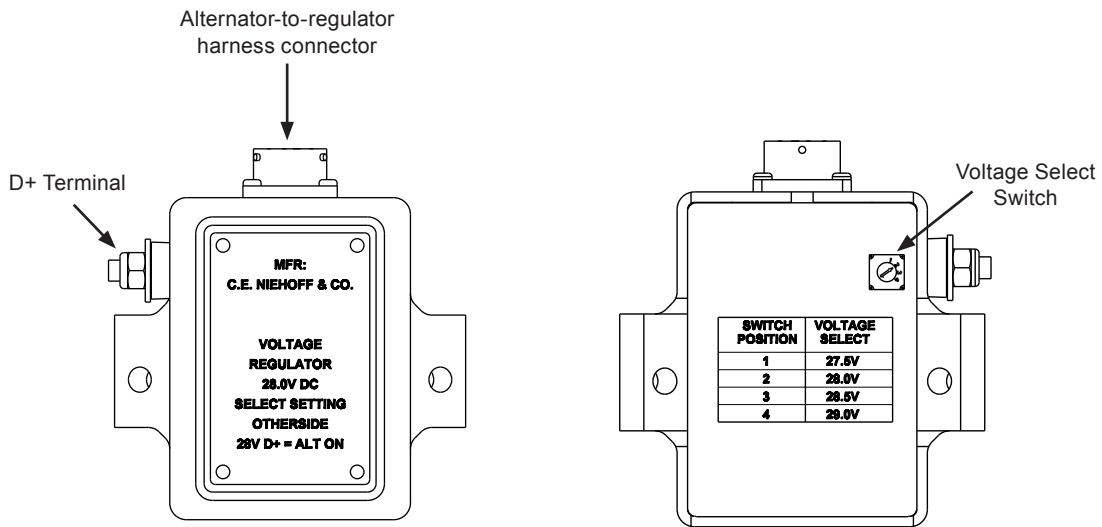


Figure 4: CEN Voltage Regulator Features

Position	Voltage Select
1	27.5V
2	28.0V
3	28.5V
4	29.0V



## Required Tools and Equipment

- Digital Multimeter (DMM)
- Ammeter (digital, inductive)
- Jumper wires

## Identification Record

Enter the following information in the spaces provided for identification records.

Alternator model number: \_\_\_\_\_

Regulator model number: \_\_\_\_\_

Voltage setpoints listed on regulator: \_\_\_\_\_

## Preliminary Check-out

Check symptoms in Table 2 below and correct if necessary.

Table 2: Preliminary Charging System Check-Out	
CONDITION:	CHECK FOR:
<b>Low Voltage Output</b>	Low battery state of charge. Load on system exceeds rated output of alternator. Faulty wiring or poor ground path. Faulty alternator or regulator. Wrong pulley installed. Wrong regulator installed.
<b>High Voltage Output</b>	Faulty regulator. Faulty alternator.
<b>No Voltage Output</b>	Faulty alternator B+ terminal connection. Faulty alternator or regulator. Alternator shaft lost residual magnetism.

## Basic Troubleshooting

1. Inspect charging system components for damage. Check connections at B- cable, B+ cable, and regulator harness. Check regulator terminal wiring from regulator to vehicle components. Repair or replace any damaged component before electrical troubleshooting.
2. Inspect vehicle battery connections. Connections must be clean and tight.
3. Inspect belt for wear and condition.
4. Determine battery type, voltage, and state of charge. Batteries must be all the same type. If batteries are discharged, recharge or replace batteries. Electrical system cannot be properly tested unless batteries are charged 95% or higher. See page 1 for details.
5. Connect meters to alternator:
  - Connect DMM red lead to alternator B+ terminal.
  - Connect DMM black lead to alternator B- terminal.
  - Clamp inductive ammeter onto alternator B+ cable.
6. Operate vehicle and observe charge voltage. Charge voltage should increase and charge amps should decrease. Battery is considered fully charged when charge voltage is at regulator set point and charge amps remain at lowest value for 10 minutes.

If voltage is at or below regulator set point, allow charging system to operate for several minutes to normalize operating temperature. If charge voltage does not increase within 10 minutes, go to Chart 1 on page 5.

**CAUTION** *If voltage exceeds 32 V, shut down system immediately. Damage to electrical system may occur if charging system is allowed to operate above 32 V for more than 3 seconds.*



## Section C: Advanced Troubleshooting (cont)

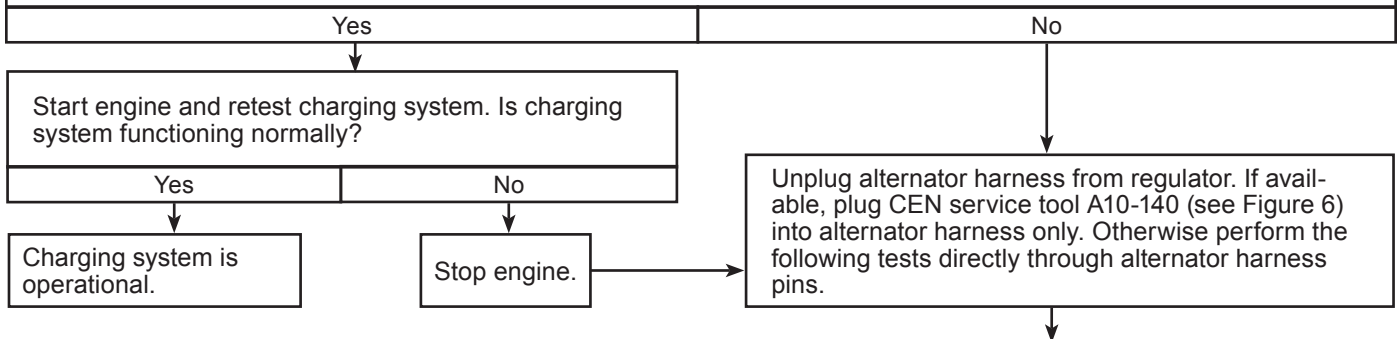
### Chart 1: No Alternator Output – Test Charging Circuit

- TEST MEASUREMENTS ARE TAKEN ON HARNESS PLUG AT ALTERNATOR. TAKING MEASUREMENTS FROM AN EXTENDED HARNESS PLUG MAY AFFECT RESULTS.
- FOR REMOTE-MOUNTED REGULATOR, CHECK CONDITION OF HARNESS/B+/B- FUSES AND WIRE/TERMINAL CONDITION BEFORE TROUBLESHOOTING.
- BEFORE STARTING DIAGNOSTIC SEQUENCE, VERIFY THE FOLLOWING AND REPAIR/REPLACE IF NOT TO SPEC:
  - BATTERIES FOR STATE-OF-CHARGE (25.0-28.0 V), CONDITION, AND SECURE CONNECTIONS.
  - MASTER BATTERY SWITCH FOR FUNCTION.
  - PIN-TO-PIN CONTINUITY OF REGULATOR EXTENSION HARNESS IF APPLICABLE.

**CAUTION** MAKE SURE METER PROBES DO NOT TOUCH OTHER PINS AND CAUSE AN ARC THAT MAY DAMAGE PINS AND HARNESS WIRING.

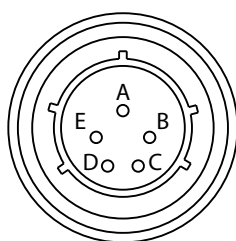
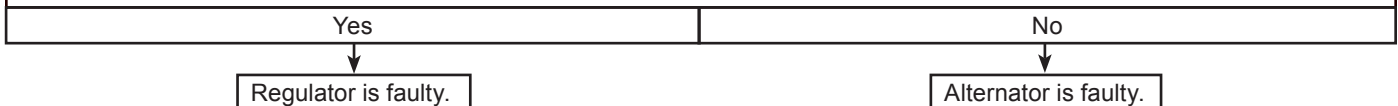
**CAUTION** When performing this test, do not allow jumper to contact B+ terminal more than a few seconds as internal resettable fuse may blow. Wait 20 minutes before repeating test to allow fuse to reset.

**MASTER BATTERY SWITCH ON, KEY ON, ENGINE OFF:** Briefly jump regulator D+ terminal to alternator B+ terminal to flash field and reinstate alternator's residual magnetism. Touch alternator shaft with a steel tool. Is shaft magnetized?



**MASTER BATTERY SWITCH ON, KEY ON, ENGINE OFF:** Alternator/regulator must pass of all four tests.

1. Battery voltage test: Set DMM to DC Voltage test. Connect DMM black lead to alternator harness pin C. Connect red lead to pin D. Battery voltage should exist.
2. Field coil resistance test: Set DMM on Ohms test. Test for resistance between alternator harness pins A and B. Resistance should measure  $1.5 \pm 0.2 \Omega$ . Field coil is defective if reading is less than  $0.5 \Omega$  or greater than  $3 \Omega$ .
3. Field coil isolation test: Set DMM on Ohms test. Test for resistance between alternator harness pin A and alternator B- terminal. Then measure resistance between pin B and alternator B+ terminal. Resistance should measure OL for both tests.
4. Phase test: Set DMM to Diode test. Connect DMM black lead to alternator harness pin E. Connect red lead to alternator B+ terminal. DMM should read OL in this direction. Reverse leads. DMM should read diode voltage drop in this direction. Repeat tests for pin E and alternator B- terminal. DMM should read OL in one direction and diode voltage drop in the other direction.



A = F-  
 B = F+/D+  
 C = B-  
 D = B+  
 E = Phase

Figure 5: Alternator Pin Designation

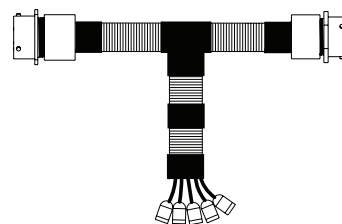


Figure 6: A10-140 Service Tool



If you have questions about your alternator or any of these test procedures, or if you need to locate a Factory Authorized Service Distributor, please contact us at:  
C. E. Niehoff & Co. • 2021 Lee Street • Evanston, IL 60202 USA  
TEL: 800.643.4633 USA and Canada • TEL: 847.866.6030 outside USA and Canada • FAX: 847.492.1242  
E-mail us at [service@CENiehoff.com](mailto:service@CENiehoff.com)