



## Hazard Definitions

These terms are used to bring attention to presence of hazard(s) of various risk levels or to important information concerning product life.

### CAUTION

Indicates presence of hazard(s) that will or can cause minor personal injury or property damage if ignored.

### NOTICE

Indicates special instructions on installation, operation or maintenance that are important but not related to personal injury hazards.

## Table of Contents

Section A: Component Description.....	2 – 3
Section B: Basic Troubleshooting.....	4
Section C: Advanced Troubleshooting.....	5 – 6

## Battery Conditions

### NOTICE

Until temperatures of electrical system components stabilize, these conditions may be observed during cold-start voltage tests.

- **Maintenance/Low Maintenance Battery**
  - Immediately after engine starts, system volts are lower than regulator setpoint, amps are medium.
  - 3–5 minutes into charge cycle, system volts increase, amps decrease.
  - 5–10 minutes into charge cycle, system volts increase to, or near, regulator setpoint and amps decrease to a minimum.
  - Low maintenance battery has same characteristics with slightly longer recharge times.
- **Maintenance-free Battery**
  - Immediately after engine starts, system volts are lower than regulator setpoint, low charging amps.
  - Once charge cycle begins, low volts and low amps are still present.
  - After alternator energizes, voltage will increase several tenths. Amps will increase gradually, then quickly, to medium to high amps.
  - Finally, volts will increase to setpoint and amps will decrease.

The time it takes to reach optimum voltage and amperage will vary with engine speed, load, and ambient temperature.
- **High-cycle Maintenance-free Battery**

These batteries respond better than standard maintenance-free. Charge acceptance of these batteries may display characteristics similar to maintenance batteries.
- **AGM (Absorbed Glass Mat) Maintenance-free Battery**

These dry-cell batteries respond better than standard maintenance-free. If battery state of charge drops to 75% or less, batteries should be recharged to 95% or higher separately from the engine's 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.

## Battery Charge Volt and Amp Values

Volt and amp levels fluctuate depending on the battery state of charge. If batteries are in a state of discharge—as after extended cranking time to start the engine—system volts will measure lower than the regulator setpoint after the engine is restarted and system amps will measure higher. This is a normal condition for the charging system; the greater the battery discharge level, the lower the system volts and the higher the system amps. The volt and amp readings will change as batteries recover and become fully charged: system volts will increase to regulator setpoint and system amps will decrease to low level (depending on other loads).

- **Low Amps:** Minimum or lowest charging system amp value required to maintain battery state of charge, obtained when testing the charging system with a fully charged battery and no other loads applied. This value will vary with battery type.
- **Medium Amps:** System amps value which can cause the battery temperature to rise above adequate charging temperature within 4-8 hours of charge time. To prevent battery damage, the charge amps should be reduced when battery temperature rises. Check battery manufacturer's recommendations for proper charge amp rates.
- **High Amps:** System amps value which can cause the battery temperature to rise above adequate charging temperature within 2-3 hours of charge time. To prevent battery damage, the charge amps should be reduced when battery temperature rises. Check battery manufacturer's recommendations for proper charge amp rates.
- **Battery Voltage:** Steady-state voltage value as measured with battery in open circuit with no battery load. This value relates to battery state of charge.
- **Charge Voltage:** Voltage value obtained when the charging system is operating. This value will be higher than battery voltage and must never exceed the regulator voltage setpoint.
- **B+ Voltage:** Voltage value obtained when measuring voltage at battery positive terminal or alternator B+ terminal.
- **Surface Charge:** Higher than normal battery voltage occurring when the battery is disconnected from battery charger. The surface charge must be removed to determine true battery voltage and state of charge.
- **Significant Magnetism:** Change in strength or intensity of a magnetic field present in alternator rotor shaft when the field coil is energized. The magnetic field strength when the field coil is energized should feel stronger than when the field is not energized.
- **Voltage Droop or Sag:** Normal condition occurring when the load demand on alternator is greater than rated alternator output at given rotor shaft RPM.



## CEN NI607 and NI611

### Alternator Description and Operation

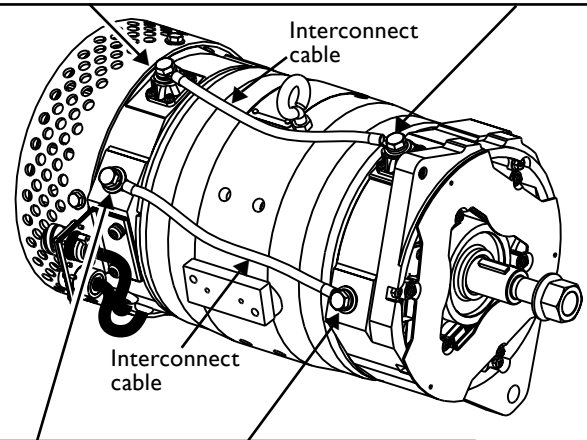
**N1607** 500 A 28 V and **N1611** 570 A 28 V alternators are internally rectified. All windings and current-transmitting components are non-moving, so there are no brushes or slip rings to wear out. Energize switch activates regulator. Field coil is then energized. Alternator output current is self-limiting and will not exceed rated capacity of alternator.

**N3215B** remote-mounted regulator used with these units:

- regulates alternator voltage so that neither Battery A signal nor Battery B signal exceeds 30.0 volts.
- is negative temperature compensated according to switch-selected vehicle battery type. Switch is factory-set to position 2. Customer selects position per application
  - Position 1 for 6TAGM
  - Position 2 for 6TMF

#### B+ connections on alternator

Both positive cables must be connected together at alternator or isolator input when alternator is installed in vehicle and during operation. Interconnect cable is part of vehicle cabling.



#### B- connections on alternator

Both ground cables must be connected to vehicle's common ground. An interconnect cable is required as shown if a single cable to vehicle common ground is used.

Figure 1 — NI607 and NI611 Alternator

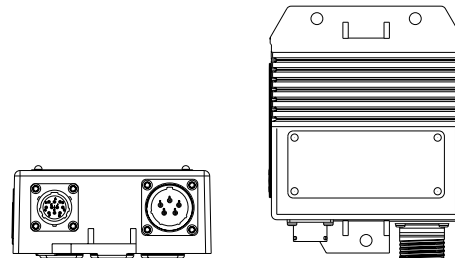


Figure 2 — N3215B Regulator Connections

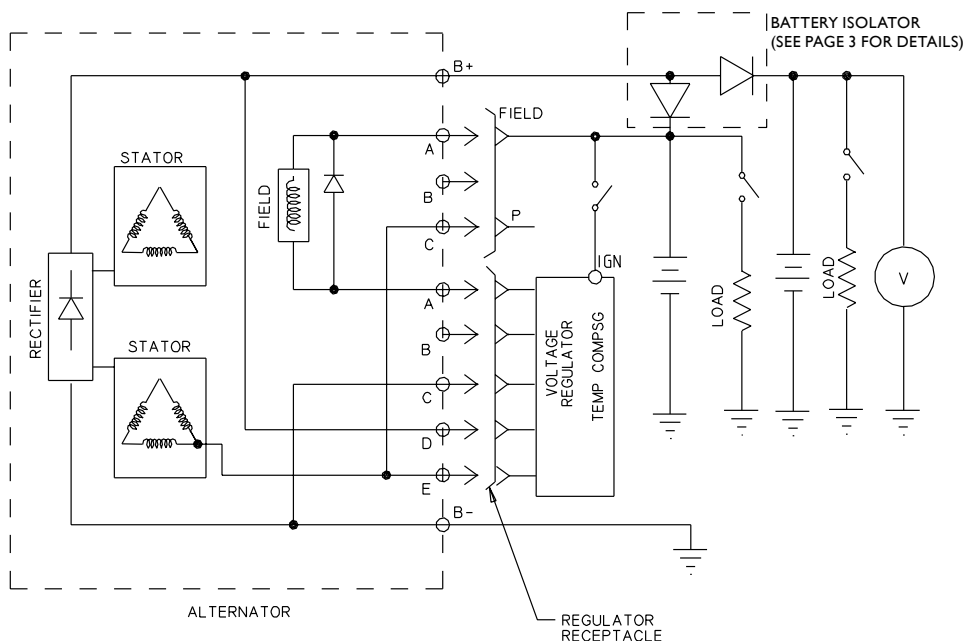


Figure 3 — NI607 and NI611 Alternators with Regulator



### N2013 Battery Isolator Description and Operation

N2013 battery isolator used with this charging system:

- allows alternator to charge two battery banks at the same time.
- allows one battery bank to discharge without draining the other.
- is rated for 14 V or 28 V DC nominal. 600 A max. current.
- operates optimally between -40°C to 65°C (-40°F to 149°F) ambient temperature.
- includes voltage ripple filter connected to negative ground.

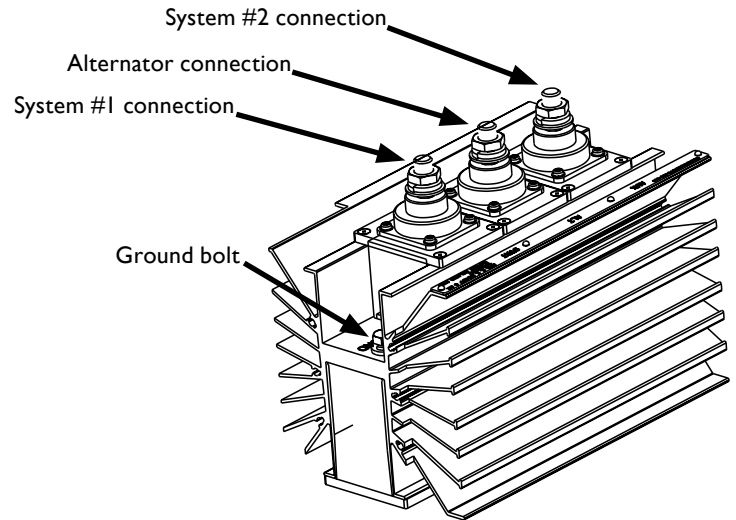


Figure 4 – N2013 Battery Isolator

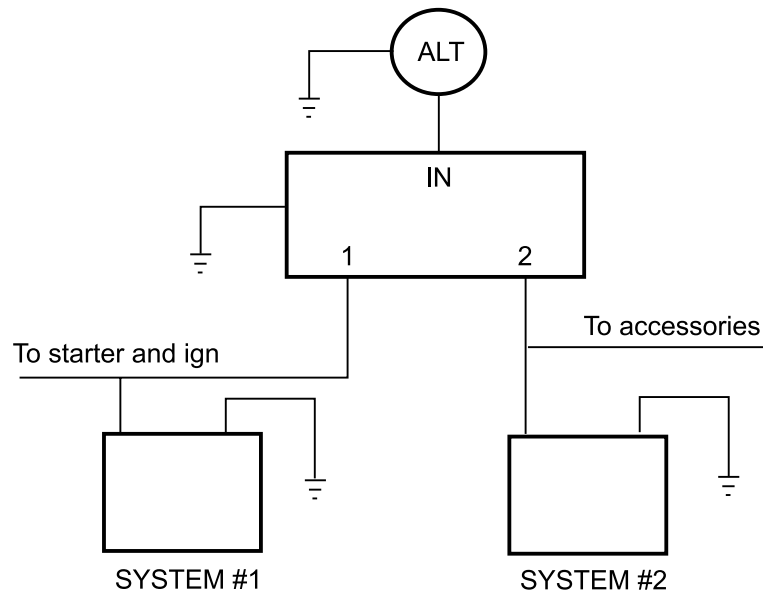


Figure 5 - Generic Wiring Schematic for Reference Only—See Vehicle Manufacturer Specifications

## Section B: Basic Troubleshooting



### Tools and Equipment for Job

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

### Identification Record

List the following for proper troubleshooting:

- Alternator model number \_\_\_\_\_
- Regulator model number \_\_\_\_\_
- Setpoint listed on regulator \_\_\_\_\_
- Battery isolator model number \_\_\_\_\_

### Preliminary Check-out

Check symptoms in Table 1 and correct if necessary.

TABLE 1 – System Conditions	
SYMPTOM	ACTION
Low Voltage Output	Check: loose drive belt; low battery state of charge. Check: current load on system is greater than alternator can produce. Check: defective wiring or poor ground path; low regulator setpoint. Check: defective alternator and/or regulator.
High Voltage Output	Check: wrong regulator. Check: high regulator setpoint. Check: defective regulator.
No Voltage Output	Check: alternator. Check: presence of energize signal. Check: battery voltage at alternator output terminal.

### Basic Troubleshooting

- Inspect charging system components**  
Check connections at ground cables, positive cables, and regulator harness. Repair or replace any damaged component before troubleshooting.
- Inspect battery isolator connections**  
Connections must be attached properly and clean and tight. See Figure 4, page 3.
- Inspect connections of vehicle batteries**  
Connections must be clean and tight.
- Determine battery type, voltage and state of charge**  
Batteries in each bank must be all the same type for system operation. If batteries are discharged, recharge or replace batteries as necessary. Electrical system cannot be properly tested unless batteries are charged 95% or higher. See page 1 for details.
- Connect meters to alternator**  
Connect red lead of DMM to alternator 28 V B+ terminal and black lead to alternator B- terminal. Clamp inductive ammeter on 28 V B+ cable.
- Operate vehicle**  
Observe charge voltage.
 

**CAUTION**

If charge voltage is above 32 volts, immediately shut down system. Electrical system damage may occur if charging system is allowed to operate at excessive voltage. Go to Table 1 at left.

If voltage is at or below regulator setpoint, let charging system operate for several minutes to normalize operating temperature.
- Observe charge volts and amps in each circuit**  
Charge voltage should increase and charge amps should decrease. If charge voltage does not increase within ten minutes, continue to next step.
- Batteries** are considered fully charged if charge voltage is at regulator setpoint and charge amps remain at lowest value for 10 minutes.
- If charging system** is not performing properly, go to page 5.



## Section C: Advanced Troubleshooting

### NOTICE

Perform on-vehicle troubleshooting before attempting on-bench tests or static tests.

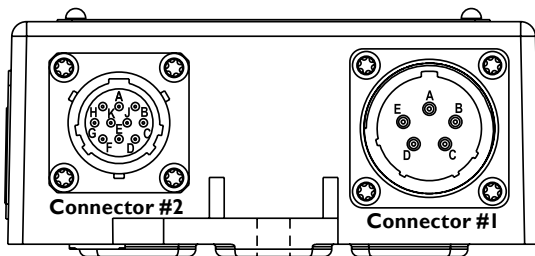
### Tools and Equipment for Testing

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

**TABLE 2 – N3215B Regulator/Alternator Lights on Vehicle**

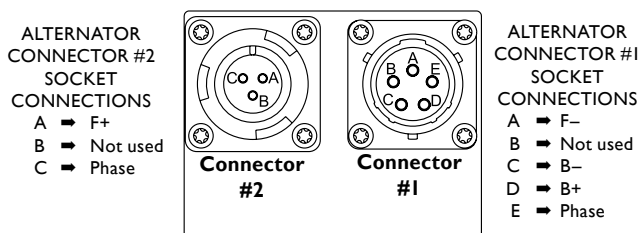
REG.	ALT.	STATUS
Off	Off	System is OK.
On*	Off	Go to Test Procedure 1 on page 5.
Off	On	Go to Test Procedure 2 on page 5.
On*	On	Go to Test Procedure 2 on page 5.

\* If alternator light comes on within 30 seconds of regulator light coming on, regulator has registered OVCO. If alternator light does not come on within 30 seconds, go to Test Procedure 1.



<p><b>REGULATOR CONNECTOR #2</b> PIN CONNECTIONS</p> <p>A ➔ Battery A +28V Sense B ➔ Unused C ➔ Temperature Sense + D ➔ Temperature Sense – E ➔ PGM } Do F ➔ PGM } Not G ➔ PGM } Use H ➔ Battery B +28V Sense J ➔ Unused K ➔ Unused</p>	<p><b>REGULATOR CONNECTOR #1</b> PIN CONNECTIONS</p> <p>A ➔ F– B ➔ Energize C ➔ B– D ➔ B+ E ➔ Regulator OVCO Status</p>
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**Figure 6 — Regulator Connectors**



**Figure 7 — Alternator Connectors (ADE)**

### TEST PROCEDURE 1

The following tests will determine whether regulator and cabling is functioning. If any cabling test fails, fix cabling, otherwise, regulator is defective.

See Figures 6 and 7.

1. First check to make sure all cabling between vehicle and regulator is tight.
2. With engine off, at 10-pin connector on regulator make sure there is battery voltage between pin A and vehicle chassis ground, then pin H and vehicle chassis ground. Then check for 10K ohms  $\pm$  4K ohms between pins C & D.
3. With engine off, check for continuity between pin A on 5-pin connector on regulator and pin A on 5-pin connector on alternator.
4. With engine running, check for battery voltage at pin B on 5-pin connector at regulator.
5. With engine off, check for continuity between pin C on 5-pin connector at regulator and ground. Then check for continuity between pin D and B+ stud on alternator.
6. With engine off, check for continuity between pin E on 5-pin connector on regulator and the pin that drives the instrument panel regulator warning light on vehicle.

### TEST PROCEDURE 2

The following tests will determine whether alternator is functioning.

During these tests, engine **MUST BE** running.

See Figure 7 and wiring diagram on page 2.

1. Disconnect harness at Connector #2 before starting engine. Then, start engine. In harness plug, test for battery voltage at socket A. If battery voltage does not exist, vehicle wiring must be checked. If battery voltage exists, go to Step 2.
2. All of the following tests must prove to be good:
  - a. Are there less than 2 ohms between socket A in connector #2 and pin A in connector #1?
  - b. Does continuity exist between pin C in connector #1 and alternator ground?
  - c. Using diode tester, are there 1-2 V between pins C and D in connector #1?
  - d. Does continuity exist between pin D and B+ terminal on alternator?

If ALL tests are good, go to Step 3.

If ONE test is bad, alternator is defective.

3. With engine off: Connect one jumper between socket A in connector #2 and one positive terminal on battery pack or isolator. Connect one end of second jumper to pin A in connector #1. Momentarily touch the other end of the jumper to ground. Spark will occur. Touch steel tool to alternator shaft at drive end to detect significant magnetism. If shaft is magnetized, regulator is defective. If shaft is not magnetized, alternator is defective.



Chart 1 - No Power to System #1 or #2 with Engine Running

**Before Troubleshooting, Check Batteries for Proper Charge Voltage. See Page 1.**

Disconnect battery master switches.

Check for 0.1 V diode voltage drop between System 1 terminal on isolator and alternator terminal on isolator. Then check for 0.1 V diode voltage drop between System 2 terminal on isolator and alternator terminal on isolator.

Does the voltage drop exist at each set of tests?

Yes

No

Go to page 4 to troubleshoot alternator and regulator.

Battery isolator is defective.

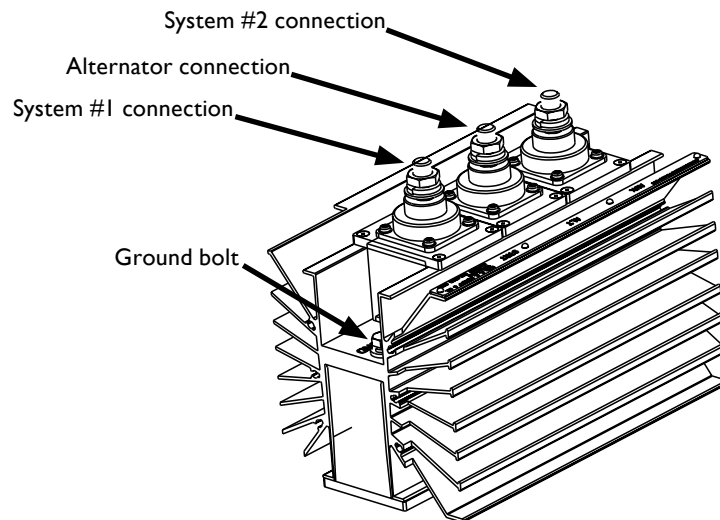


Figure 8 - N2013 Battery Isolator

If you have questions about your alternator or any of these test procedures, or if you need to locate a Factory Authorized Service Dealer, 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)