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.

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

Table of Contents

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 N1245 Alternator Description and Operation

N1245 28 V (260 A) alternator is 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.

When controlled by the **N3043** regulator, this alternator becomes self-energizing through internal diode trios. Residual magnetic field induces small voltage in stator and energizes field coil. Field coil continues receiving incremental voltage until full voltage is achieved. AC is rectified into DC output through diodes. Regulator controls voltage output. N3043 regulator has a D+ terminal to provide signal to vehicle electrical system, confirming alternator operation.

When controlled by the **N3044 or N3261** regulator, after engine is running, regulator receives energize signal through IGN terminal. Regulator monitors alternator rotation and provides field current only when it detects alternator shaft rotating at or above idle speed. After regulator detects alternator rotation, it gradually applies field current, preventing an abrupt mechanical load on accessory drive system. The soft start may take up to 20 seconds.These regulators are flat temperature compensated. These regulators have:

- P terminal that can provide optional AC voltage tap.
- D+ terminal to provide optional signal to vehicle electrical system, confirming alternator operation.
- Tricolored LED on N3261 only. See page 6.

CEN N1248-3 Alternator Description and Operation

N1248-3 28 V (310 A) alternator is 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.

When controlled by the **N3043** regulator, this alternator becomes self-energizing through internal diode trios. Residual magnetic field induces small voltage in stator and energizes field coil. Field coil continues receiving incremental voltage until full voltage is achieved. AC is rectified into DC output through diodes. Regulator controls voltage output. N3043 regulator has a D+ terminal to provide signal to vehicle electrical system, confirming alternator operation.

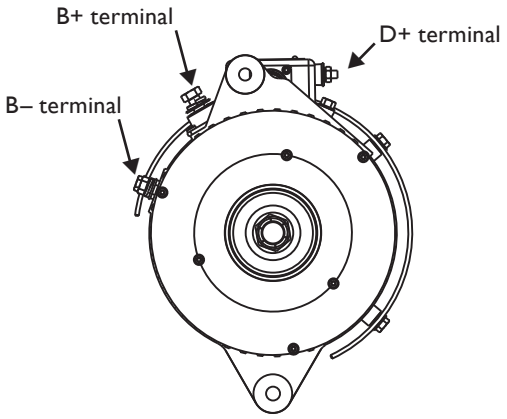


Figure 1 — N1245/N1248-3 Alternator Terminals (N3043 Regulator Attached to Alternator)

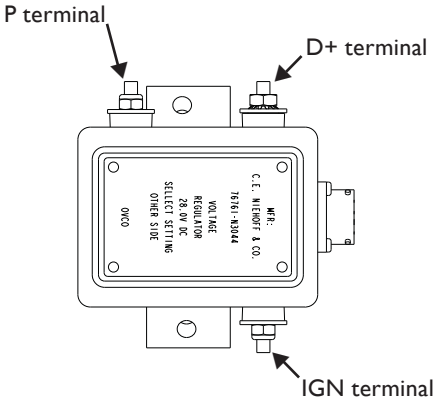


Figure 2 — N3044 Regulator Terminals

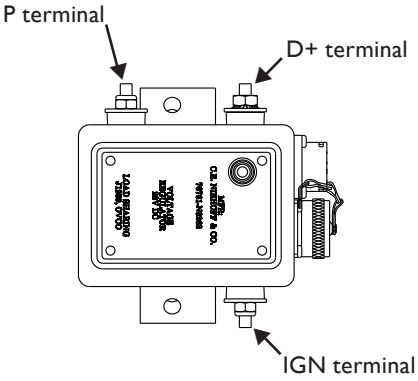


Figure 3 — N3261 Regulator Terminals

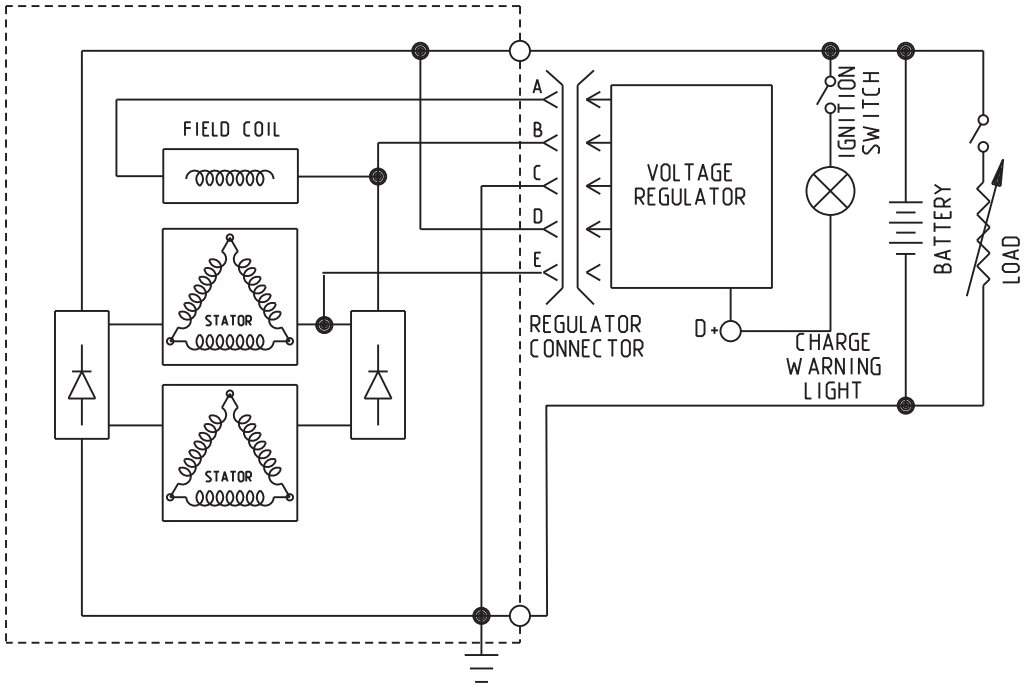


Figure 4 — N1245/N1248-3 Alternator with N3043 Regulator Wiring Diagram

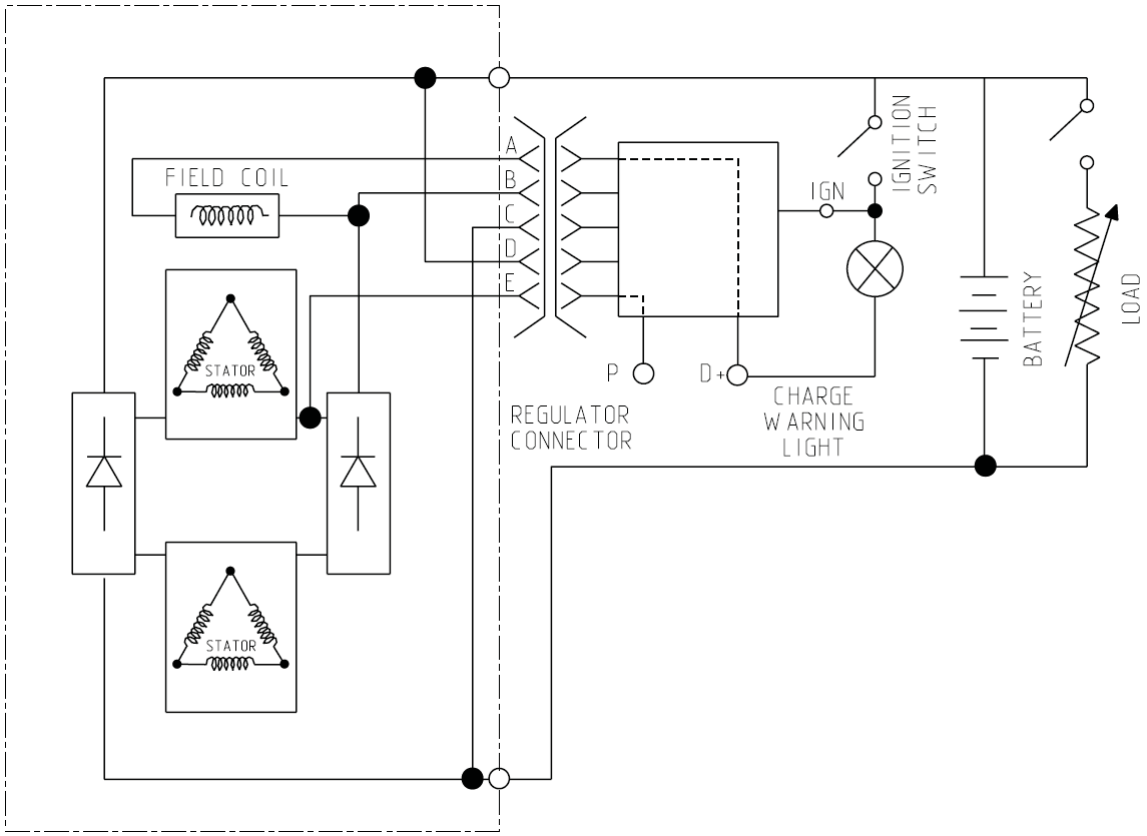


Figure 5 — N1245 Alternator with N3044 or N3261 Regulator Wiring Diagram

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 _____

Preliminary Check-out

Check symptoms in Table 3 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 or regulator. Check: wrong regulator.
High Voltage Output	Check: high regulator setpoint. Check: defective regulator. Check: alternator.
No Voltage Output	Check: broken drive belt. Check: presence of energize signal to IGN terminal on N3044 or N3261 regulator. Check: battery voltage at alternator output terminal. Check: defective alternator and/or regulator. Check: lost residual magnetism in alternator with N3043 regulator. Go to: Chart 2, page 7.

Basic Troubleshooting

1. **Inspect charging system components for damage**
   Check connections at B– cables, B+ cables, B+ interconnect cable, B– interconnect cable, and alternator-to-regulator harness. Repair or replace any damaged component before troubleshooting.
2. **Inspect all vehicle battery connections**
   Connections must be clean and tight.
3. **Determine battery voltage and state of charge**
   If batteries are discharged, recharge or replace batteries as necessary. Electrical system cannot be properly tested unless batteries are charged 95% or higher. In addition, open circuit voltages must be within ± 0.2 V.
4. **Connect meters to alternator**
   Connect red lead of DMM to alternator anti-drive end B+ terminal and black lead to alternator anti-drive end B– terminal. Clamp inductive ammeter on anti-drive end B+ cable.
5. **Operate vehicle**
   Observe charge voltage at batteries with engine running (nom. 27-28 V).

   CAUTION

   If charge voltage is above 32 V, immediately shut down system. Electrical system damage may occur if charging system is allowed to operate at excessive voltage. Go to Table 2.

   If voltage is at or below regulator setpoint, let charging system operate for several minutes to normalize operating temperature.
6. **Observe charge volts and amps**
   Charge voltage should increase and charge amps should decrease. If charge voltage does not increase within ten minutes, continue to next step.
7. **Batteries** are considered fully charged if charge voltage is at regulator setpoint and charge amps remain at lowest value for 10 minutes.
9. **If charging system** is not performing properly, go to:
   - N3043—Chart 1, page 5
   - N3044 or N3261—Chart 2, page 7

Chart 1 – No Alternator Output – **N3043 Regulator**

CAUTION When performing the following test, do not allow jumper to contact B+ terminal more than a few seconds. Internal fuse may blow. Wait 20 minutes before repeating test to allow fuse to reset.

With key on, engine off: Momentarily (1 sec.) jumper D+ terminal on regulator to B+ terminal on alternator. Touch shaft with steel tool to detect significant magnetism. Is shaft magnetized?

- Yes
- No

Remove jumper from D+ to B+.

CAUTION When performing the following test, ensure that the probes do not touch other pins, as an arc may damage the pins and wiring in the harness.

With key off, engine off: Unplug alternator-to-regulator harness. Connect DMM across pin D and pin C in harness plug. Does battery voltage exist?

- Yes
- No → Alternator is defective.

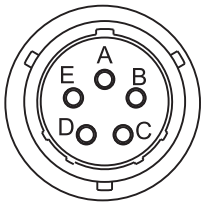
Set DMM to diode test. Connect black lead of DMM to pin B in harness plug. Connect red lead to B-terminal or alternator. DMM should read voltage drop. Reverse leads. DMM should read OL.

- Yes
- No → Alternator is defective.

CAUTION When performing the following test, ensure that the jumpers do not touch other pins, as an arc may damage the pins and wiring in the harness. Always connect jumper wires away from pins or not at pins. Spark may erode pin.

With key on, engine off: Install a jumper from B+ terminal on alternator to pin B in harness plug. Momentarily (1 sec.) jumper pin A to B– terminal on alternator. Touch shaft with steel tool to detect significant magnetism. Is shaft magnetized?

- Yes → Regulator is defective.
- No → Alternator is defective.



CONNECTIONS	
A	F–
B	F+/D+
C	B–
D	B+
E	Phase

Figure 6 – Alternator-to-Regulator Harness Plug

N3044 and N3261 Regulators

DESCRIPTION AND OPERATION

N3044 and **N3261** regulators are mounted directly to the outside of the alternator.

Main diagnostic feature of **N3261** regulator consists of a tricolored (green, amber, red) LED located on the top of the regulator. The LED works like a voltmeter, measuring charging voltage. See Table 2 for diagnostic features and LED explanations.

N3044 and **N3261** regulators have OVCO (overvoltage cutout) and will trip at vehicle electrical system voltage above 32 volts that exists longer than 3 seconds. OVCO feature detects high voltage and reacts by signaling relay in F+ alternator circuit to open. This turns off alternator (LED on N3261 is solid RED). OVCO circuit is reset when engine is restarted. Regulator then regains control of alternator output voltage.

Troubleshooting

Shut down vehicle and restart engine. If alternator functions normally after restart, a "no output condition" was normal response of voltage regulator to "high voltage" condition. Inspect condition of electrical system, including loose battery cables, both positive and negative. If battery disconnects from system, it could cause "high voltage" condition in electrical system, causing OVCO circuit to trip.

If you have reset alternator once, and electrical system returns to normal charge voltage condition, there may have been a one time, high voltage spike, causing OVCO circuit to trip.

If OVCO circuit repeats cutout a second time in short succession and shuts off alternator relay circuit, try third restart. If OVCO circuit repeats cutout, go to Chart 3, page 8.

TABLE 2 – N3261 Regulator Diagnostics

LED COLOR		STATUS	ACTION
GREEN	Flashing	Alternator and regulator operating normally.	No action required.
AMBER	Flashing	System voltage is lower than setpoint—electrical load exceeds alternator rating at present rotor speed.	When loads decrease or speed increases, LED should be flashing GREEN. If not, check drive belt and charging system connections.
RED	Flashing	System voltage higher than setpoint.	If flashing more than 3 seconds, OVCO will trip, disabling charging system. LED will flash RED.
	Solid	OVCO tripped.	Overvoltage condition. System diagnosis required. Go to Chart 3, page 8.
CLEAR	LED off	Energize circuit fault.	Check for system voltage at IGN terminal on regulator. If OK, replace regulator. If not OK, check vehicle wiring and ignition circuit.

Chart 2 – No Alternator Output – **N3044 or N3261 Regulator**

Shut down vehicle and restart engine. Does alternator function normally after restart?

- Yes → Regulator responded to overvoltage condition. Go to Chart 3 on page 8 to troubleshoot OVCO.
- No →

Shut off engine. With key off, engine off: Test for battery voltage at alternator 28 V B+ terminal. Does battery voltage exist?

- Yes →
- No → Repair vehicle battery circuit wiring as necessary. Continue test.

With key on, engine running: Test for battery voltage between IGN terminal on regulator and alternator B– terminal. Does 28 V battery voltage exist?

- Yes →
- No → Repair vehicle ignition circuit wiring as necessary. Continue test.

With key off, engine off: Remove alternator-to-regulator harness from regulator. Test for battery voltage across sockets D and C in harness plug. Does 28 V battery voltage exist?

- Yes →
- No → Alternator is defective.

With DMM, check resistance across field coil. Connect red lead of DMM to socket A in alternator-to-regulator harness plug. Connect black lead to socket B in plug. Does meter show 1.5 ± 0.2 ohms?

- Yes →
- No → Alternator is defective.

Install a jumper wire from socket B in alternator-to-regulator harness plug to B+ terminal on alternator. Momentarily (1 sec.) jumper socket A to B– terminal on alternator. Spark will occur. Touch steel tool to shaft to detect significant magnetism. Is shaft magnetized?

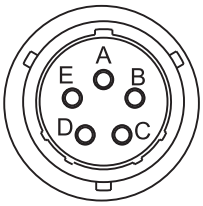
- Yes →
- No → Alternator is defective.

Test phase signal going into regulator (AC). Set meter to diode tester:

Connect red lead of DMM to socket C of alternator-to-regulator harness plug and black lead to socket E of plug. Meter should show voltage drop value.

Then reverse meter lead connections. Meter should show OL (blocking).

- Yes → Regulator is defective.
- No → Alternator is defective.



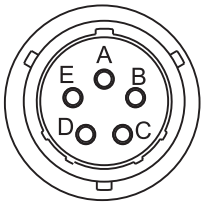
CONNECTIONS	
A	F–
B	F+/D+
C	B–
D	B+
E	Phase

Figure 7 – Alternator-to-Regulator Harness Plug

Chart 3 – No Alternator Output – Test OVCO Circuit – **N3044 or N3261 Regulator**

Unplug alternator-to-regulator harness from regulator. Connect red lead from DMM to socket A in plug. Connect black lead to socket B in plug. Does resistance read 1.5 ± 0.2 ohms?

- No → Alternator is defective.
- Yes → With red lead from DMM connected to socket A in plug, connect black lead to B– terminal. Does resistance read OL (out of limits)?
  - No → Alternator is defective.
  - Yes → Replace existing regulator with known good regulator. Run engine. Does OVCO trip?
    - Yes → Alternator is defective.
    - No → Original regulator is defective.



CONNECTIONS	
A	F–
B	F+/D+
C	B–
D	B+
E	Phase

Figure 8 – Alternator-to-Regulator Harness Plug

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*