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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.



CEN NI506-I Dual Voltage Alternator Description and Operation

N1506-1 100 A (28 / 14 V) dual voltage 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 (commonly an oil pressure switch) activates regulator. Field coil is then energized. Upper voltage (28 V) is rectified with standard diodes. Lower voltage (14V) circuit output current is controlled by SCRs in the drive end housing. Alternator output current is self-limiting and will not exceed rated capacity of alternator.

N3030 regulator used with these units maintains alternator output voltage at regulated settings as vehicle electrical loads are switched on and off.

F- TERMINAL USED ON SOME VEHICLES

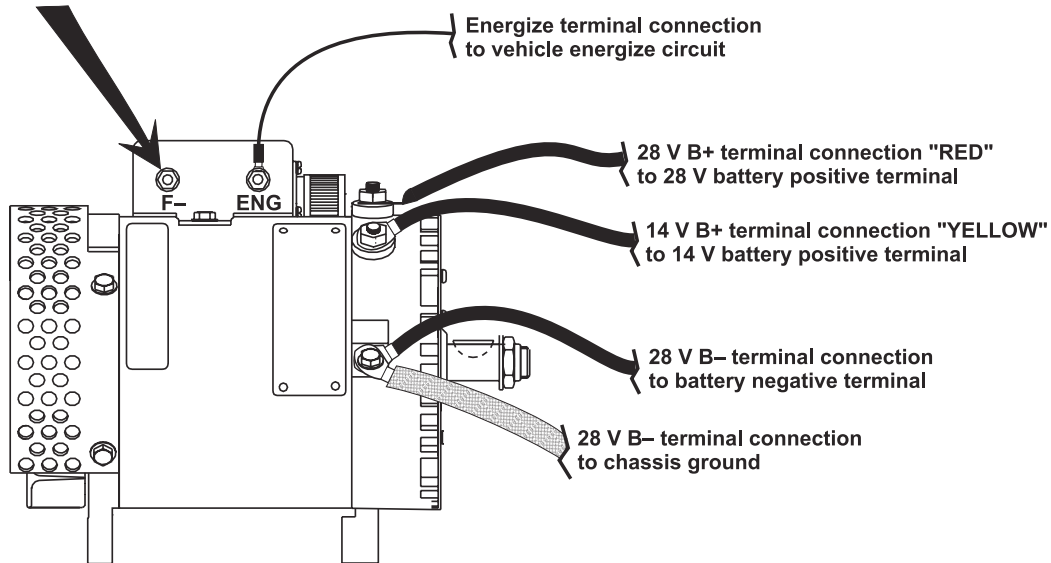


Figure 1 — NI506-I Alternator and N3030 Regulator Terminals

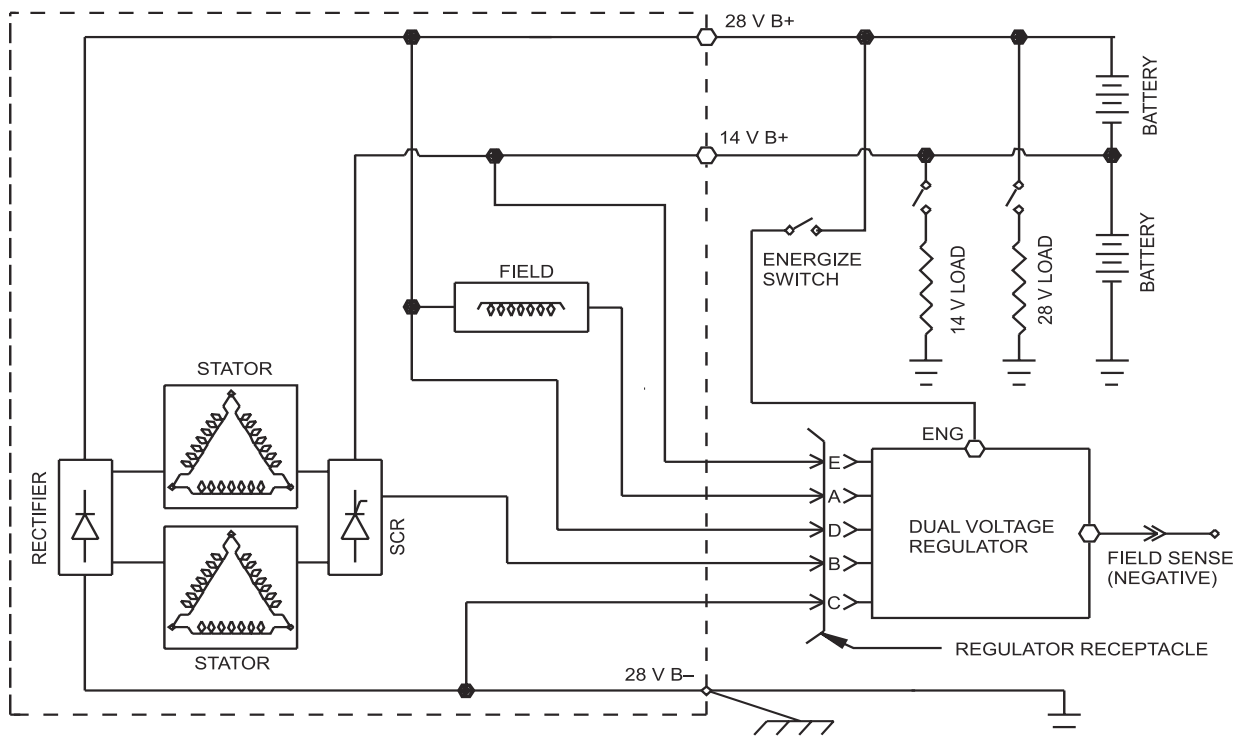


Figure 2 — NI506-I Alternator with Regulator



A. Tools and Equipment for Job

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

B. Identification Record

List the following for proper troubleshooting:

- Alternator model number _____
- Regulator model number _____
- Setpoint listed on regulator

C. 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. Check: alternator.
No 28 V Output	Check: presence of energize signal. Check: battery voltage at alternator output terminal. Check: defective alternator and/or regulator. Go to Chart 1, page 4.
No 14 V Output	Go to Chart 2, page 5.

D. Basic Troubleshooting

CAUTION

Before troubleshooting, verify correct wiring of alternator to vehicle. See Figure 1 for correct connections to alternator. Failure to correctly wire alternator will damage components or vehicle.

1. **Inspect charging system components**
Check connections at ground cables, positive cables, and regulator harness. Repair or replace any damaged component before troubleshooting.
2. **Inspect connections of vehicle batteries**
Connections must be clean and tight.
3. **Determine battery type, voltage and state of charge**
Batteries 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.
4. **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 28V B+ cable.
5. **Operate vehicle**
Observe charge voltage.

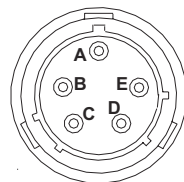
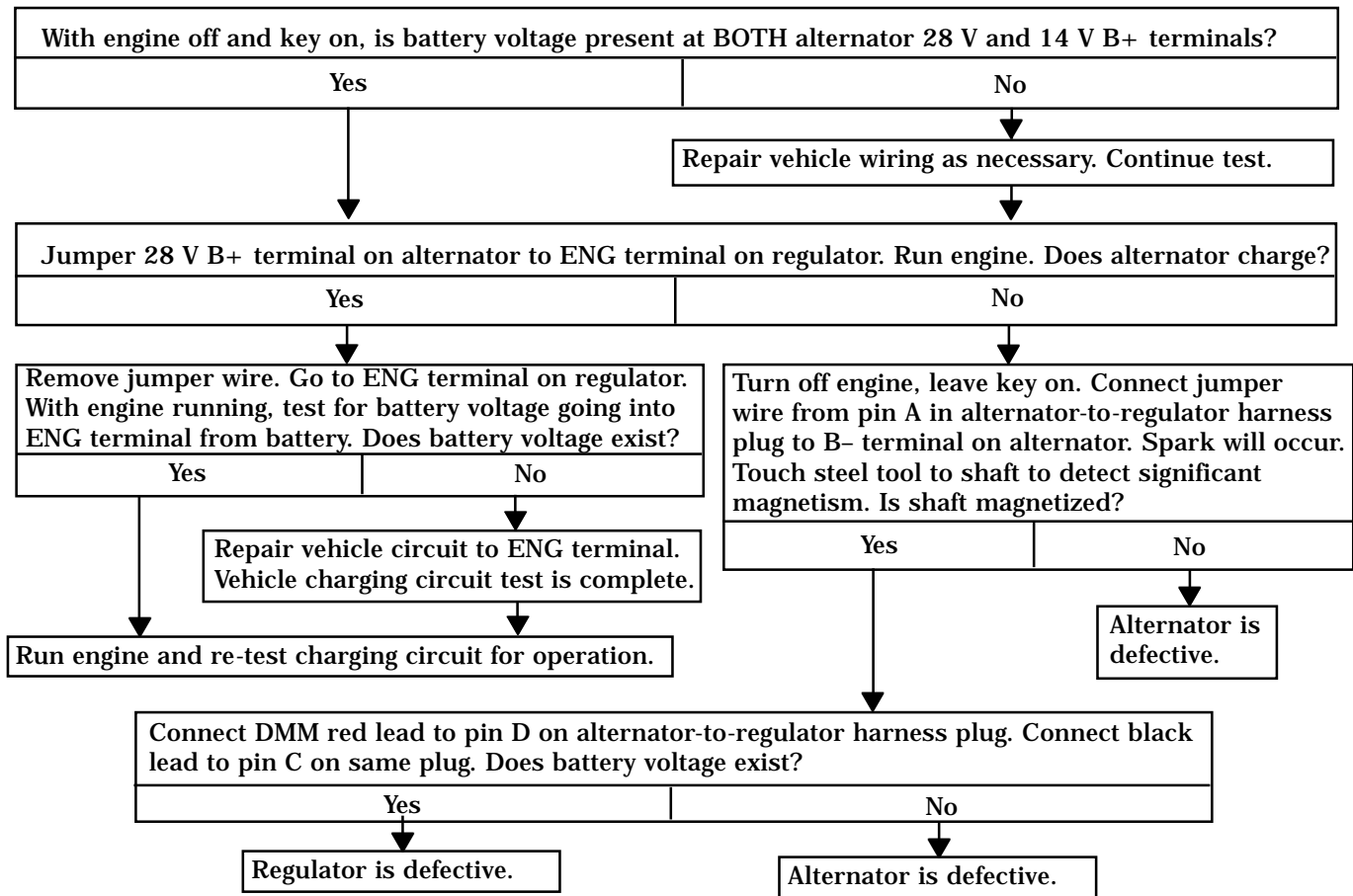
CAUTION

If charge voltage is above 33 volts for 28 V system or 16 V for 14 V system, 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.
6. **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.
7. **Batteries** are considered fully charged if charge voltage is at regulator setpoint and charge amps remain at lowest value for 10 minutes.
8. **If charging system** is not performing properly, go to Chart 1, page 4.



Chart 1 – No 28V Alternator Output – Test Charging Circuit



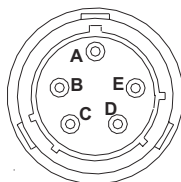
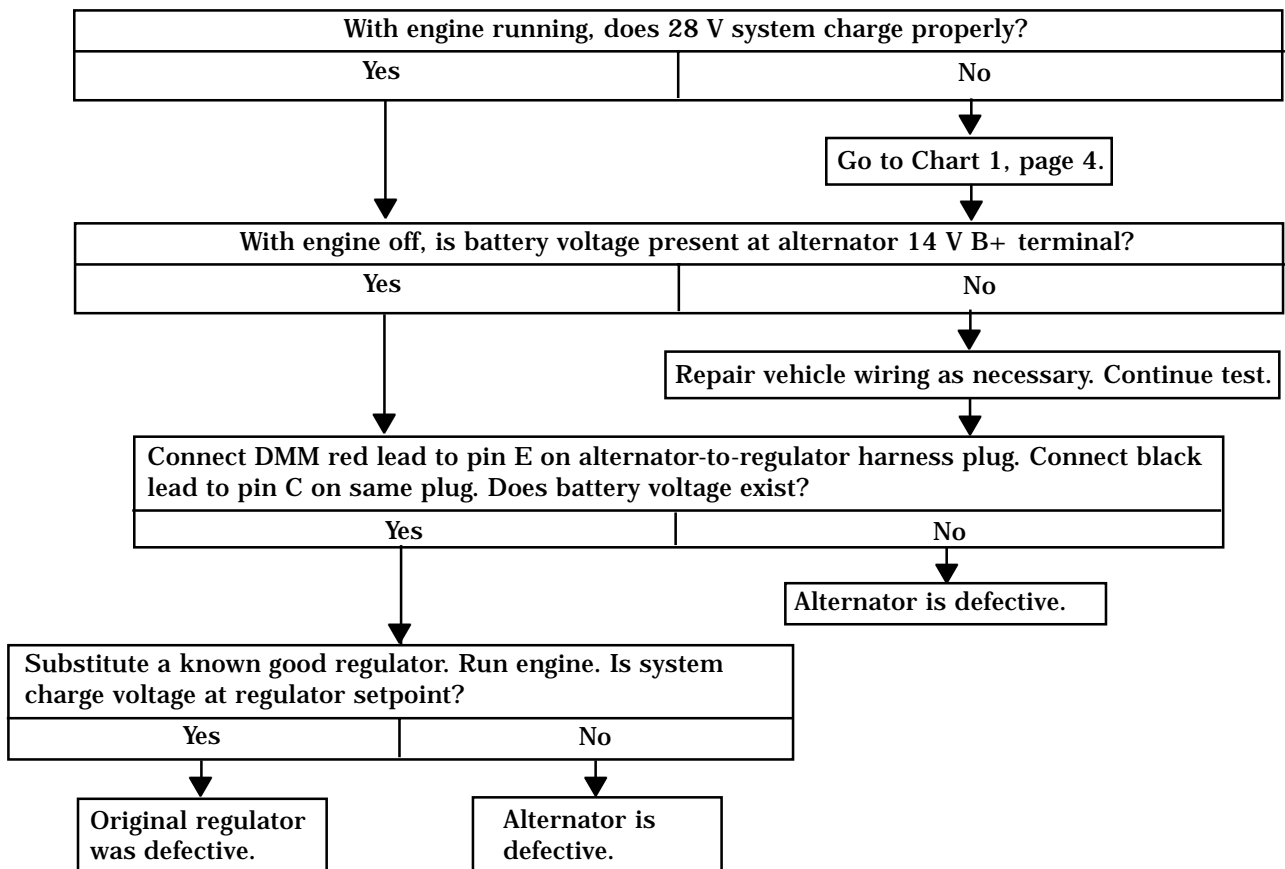
- PIN CONNECTIONS**
- Pin A F-
 - Pin B SCR Gate
 - Pin C B-
 - Pin D 28V B+
 - Pin E 14V B+

Figure 3 – Alternator-to-Regulator Harness Plug



Section 3: Advanced Troubleshooting (cont.)

Chart 2 – No 14 V Alternator Output – Test Circuit



PIN CONNECTIONS
Pin A F-
Pin B SCR Gate
Pin C B-
Pin D 28 V B+
Pin E 14V B+

Figure 4 – 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 Distributor, please contact us at:
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