C.E. Niehoff & Co.

C715/C716 Alternators Troubleshooting Guide

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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 C715 and C716 Alternators Description and Operation

The **C715** alternator (14 V, 360 A) and **C716** alternator (14 V, 400 A) are internally rectified. All windings and current-transmitting components are non-moving, so there are no brushes or slip rings to wear out. This unit is externally energized through either an ignition switch or an energize switch (commonly an oil pressure switch), which activates regulator. Field coil is then energized. Regulator maintains alternator output voltage at regulated setting as vehicle electrical loads are switched on and off. Alternator output current is self-limiting and will not exceed rated capacity of alternator.

A2-128 regulator used with all units has R terminal for optional AC voltage tap. A 15.5 V regulator set-point is available for battery isolator applications.

Electromagnetic interference (EMI) is suppressed with internal filters to acceptable levels defined by the Society of Automotive Engineers (SAE) specification J1113/41. A2-128 regulator will not reduce EMI from sources such as antennas, poor cable routing practice, or other electronic devices that cause EMI. If EMI continues, consult an electromagnetic compliance (EMC) specialist to determine EMI source.

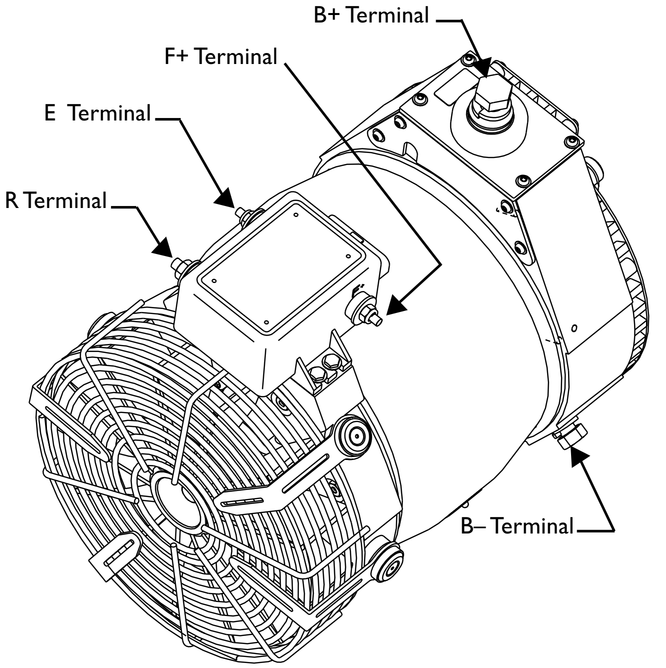


Figure 1 — C715/C716 Alternator with A2-128 Regulator

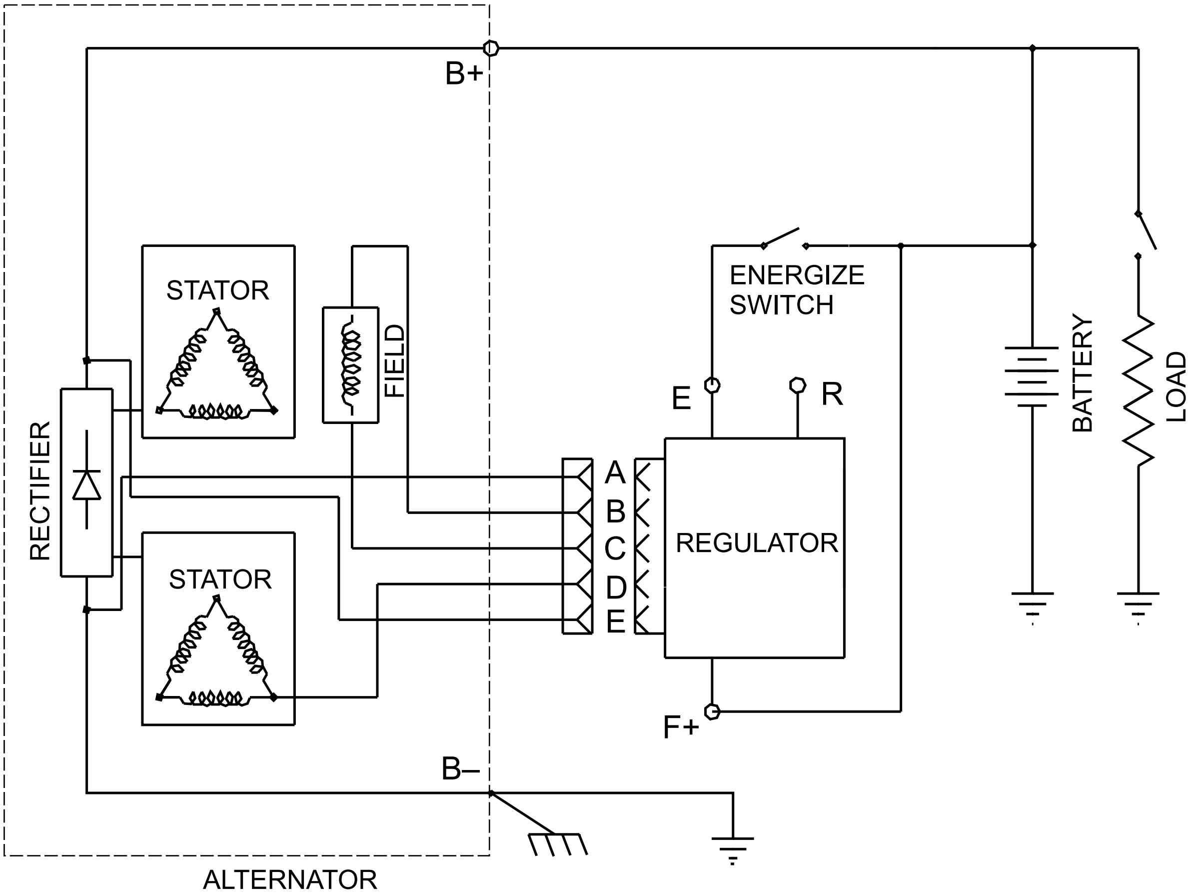


Figure 2 — C715/C716 Wiring Diagram

A. Tools and Equipment for Job

- Digital Multimeter (DMM)
- Ammeter (digital, inductive)
- CEN Regulator Bypass Adapter A10-129
- Jumper wire
- 12 V test light

B. Identification Record

Complete the following for proper troubleshooting:

☐ Alternator model number ____________________

☐ Regulator model number ______________________

☐ Setpoints listed on regulator _________________

C. Preliminary Check-out

Check condition of items in Table 1 and correct if necessary.

TABLE I – 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 Voltage Output	Check: broken drive belt. Check: battery voltage at alternator output terminal. Check: defective alternator and/or regulator.

D. Basic Troubleshooting

1. **Inspect charging system components for damage**
   Check connections at B– cable, B+ cable, and regulator harness. Repair or replace any damaged component before troubleshooting.

2. **Inspect 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.

4. **Determine if battery isolator is used in charging circuit**
   Check vehicle wiring diagram. If so, you must jumper out isolator before troubleshooting. See Chart 1 on page 4 for details.

5. **Connect meters to alternator**
   Connect red lead of DMM to alternator B+ terminal and black lead to alternator B– terminal. Clamp inductive ammeter on B+ cable.

6. **Operate vehicle**
   Observe charge voltage.

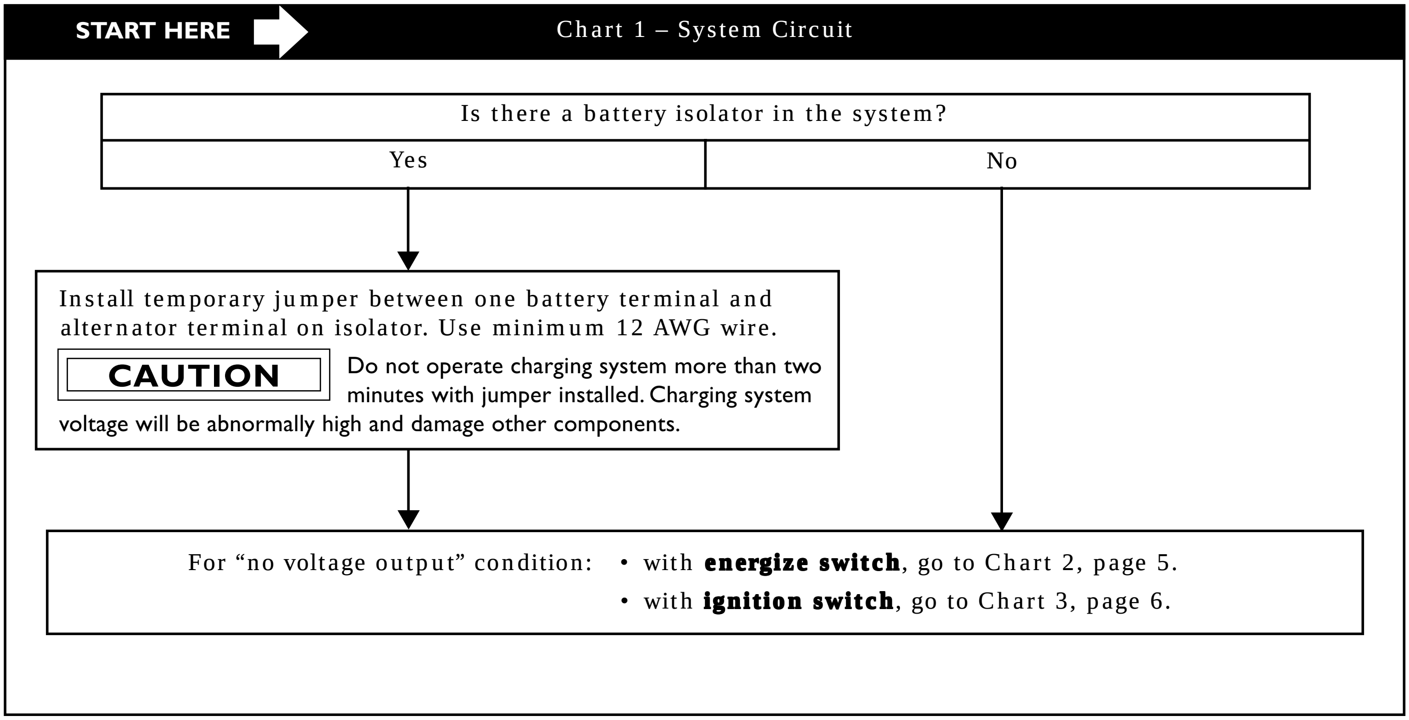
   CAUTION If charge voltage is above 16.5 volts, immediately shut down system. Electrical system damage may occur if charging system is allowed to operate at high voltage. Go to Table I at left.

   If voltage is at or below regulator setpoint, let charging system operate for several minutes to normalize operating temperature.

7. **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.

8. **Battery** is 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 Chart 1, page 4.



Is there a battery isolator in the system?

Install temporary jumper between one battery terminal and alternator terminal on isolator. Use minimum 12 AWG wire.

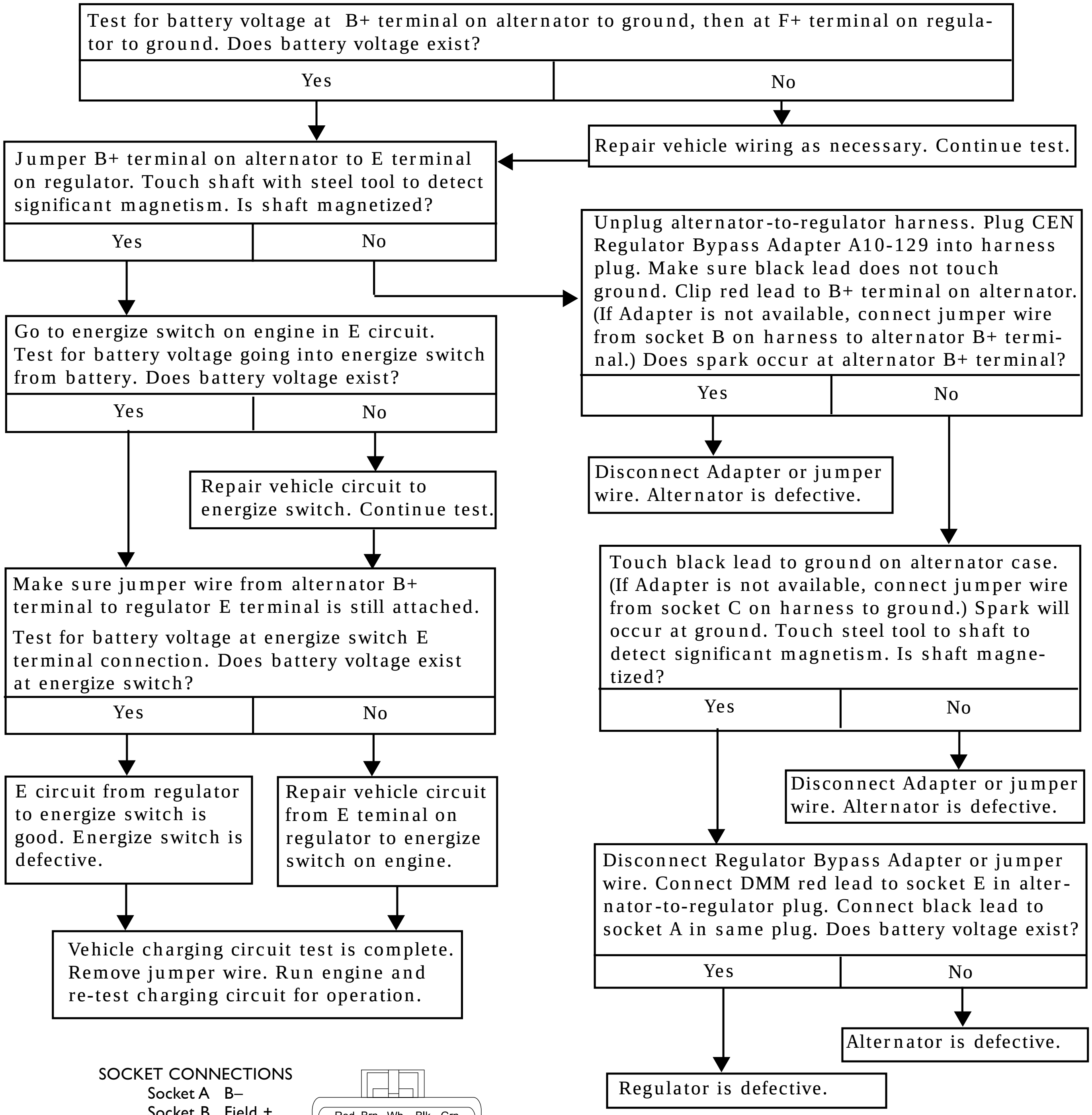
CAUTION Do not operate charging system more than two minutes with jumper installed. Charging system voltage will be abnormally high and damage other components.

For "no voltage output" condition:

- with **energize switch**, go to Chart 2, page 5.
- with **ignition switch**, go to Chart 3, page 6.

Chart 2 – No Alternator Output – **Energize Switch** – Test Charging Circuit

STATIC TEST – ENGINE OFF, BATTERY SWITCH ON, KEY ON



Test for battery voltage at B+ terminal on alternator to ground, then at F+ terminal on regulator to ground. Does battery voltage exist?

Yes / No

Repair vehicle wiring as necessary. Continue test.

Jumper B+ terminal on alternator to E terminal on regulator. Touch shaft with steel tool to detect significant magnetism. Is shaft magnetized?

Yes / No

Go to energize switch on engine in E circuit. Test for battery voltage going into energize switch from battery. Does battery voltage exist?

Yes / No

Repair vehicle circuit to energize switch. Continue test.

Make sure jumper wire from alternator B+ terminal to regulator E terminal is still attached.

Test for battery voltage at energize switch E terminal connection. Does battery voltage exist at energize switch?

Yes / No

E circuit from regulator to energize switch is good. Energize switch is defective.

Repair vehicle circuit from E teminal on regulator to energize switch on engine.

Vehicle charging circuit test is complete. Remove jumper wire. Run engine and re-test charging circuit for operation.

Unplug alternator-to-regulator harness. Plug CEN Regulator Bypass Adapter A10-129 into harness plug. Make sure black lead does not touch ground. Clip red lead to B+ terminal on alternator. (If Adapter is not available, connect jumper wire from socket B on harness to alternator B+ terminal.) Does spark occur at alternator B+ terminal?

Yes / No

Disconnect Adapter or jumper wire. Alternator is defective.

Touch black lead to ground on alternator case. (If Adapter is not available, connect jumper wire from socket C on harness to ground.) Spark will occur at ground. Touch steel tool to shaft to detect significant magnetism. Is shaft magnetized?

Yes / No

Disconnect Adapter or jumper wire. Alternator is defective.

Disconnect Regulator Bypass Adapter or jumper wire. Connect DMM red lead to socket E in alternator-to-regulator plug. Connect black lead to socket A in same plug. Does battery voltage exist?

Yes / No

Alternator is defective.

Regulator is defective.

SOCKET CONNECTIONS

Socket A	B–
Socket B	Field +
Socket C	Field –
Socket D	Phase (R)
Socket E	B+

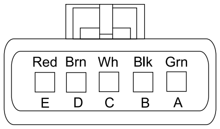
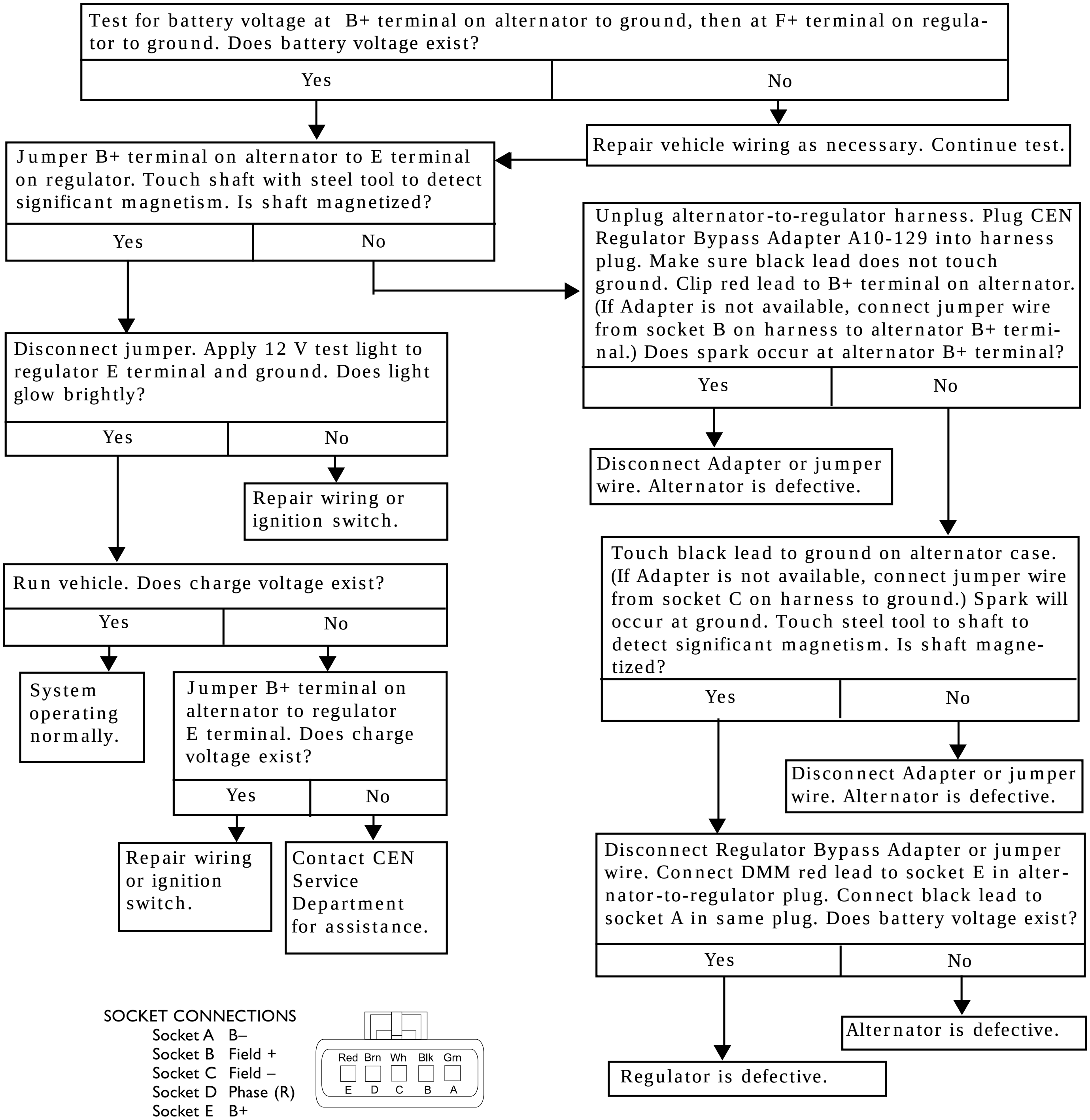


Figure 3 – Alternator-to-Regulator Harness Plug

Chart 3 – No Alternator Output – **Ignition Switch** – Test Charging Circuit

STATIC TEST – ENGINE OFF, BATTERY SWITCH ON, KEY ON



Test for battery voltage at B+ terminal on alternator to ground, then at F+ terminal on regulator to ground. Does battery voltage exist?

Yes

No

Repair vehicle wiring as necessary. Continue test.

Jumper B+ terminal on alternator to E terminal on regulator. Touch shaft with steel tool to detect significant magnetism. Is shaft magnetized?

Yes

No

Unplug alternator-to-regulator harness. Plug CEN Regulator Bypass Adapter A10-129 into harness plug. Make sure black lead does not touch ground. Clip red lead to B+ terminal on alternator. (If Adapter is not available, connect jumper wire from socket B on harness to alternator B+ terminal.) Does spark occur at alternator B+ terminal?

Yes

No

Disconnect jumper. Apply 12 V test light to regulator E terminal and ground. Does light glow brightly?

Yes

No

Disconnect Adapter or jumper wire. Alternator is defective.

Repair wiring or ignition switch.

Touch black lead to ground on alternator case. (If Adapter is not available, connect jumper wire from socket C on harness to ground.) Spark will occur at ground. Touch steel tool to shaft to detect significant magnetism. Is shaft magnetized?

Yes

No

Run vehicle. Does charge voltage exist?

Yes

No

System operating normally.

Jumper B+ terminal on alternator to regulator E terminal. Does charge voltage exist?

Yes

No

Disconnect Adapter or jumper wire. Alternator is defective.

Repair wiring or ignition switch.

Contact CEN Service Department for assistance.

Disconnect Regulator Bypass Adapter or jumper wire. Connect DMM red lead to socket E in alternator-to-regulator plug. Connect black lead to socket A in same plug. Does battery voltage exist?

Yes

No

Alternator is defective.

Regulator is defective.

SOCKET CONNECTIONS

Socket A	B–
Socket B	Field +
Socket C	Field –
Socket D	Phase (R)
Socket E	B+

Figure 4 – Alternator-to-Regulator Harness Plug