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Hazard Definitions

CAUTION *Indicates presence of hazards that will or can cause minor personal injury or damage to equipment.*

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

Required Tools and Equipment

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

Battery Conditions

NOTICE Battery conditions may be observed during cold-start voltage tests until temperatures of electrical system components stabilize.

Maintenance/Low Maintenance Battery

- Immediately after engine starts, system volts are lower than regulator setpoint and amp output is medium.
- 3–5 minutes into charge cycle, system voltage increase and 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 as maintenance battery but slightly longer recharge time.

Maintenance-free Battery

- Immediately after engine starts, system volts are lower than regulator setpoint and charging amps are low.
- Volts and amps remain low when charge cycle begins.
- After alternator energizes, voltage increases by several tenths. Amps increase to medium-to-high levels.
- Volts will increase to setpoint and amps will decrease. Time required to reach optimum voltage and amps 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 batteries. If battery state of charge drops to 75% or less, recharge batteries to 95% or higher separately from engine charging system to avoid damaging charging system components and provide best overall performance. Charge acceptance may display characteristics similar to maintenance batteries.

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).
- Zero meter scale or identify meter burden by touching meter leads together. Meter burden must be subtracted from final reading obtained.
- Be sure meter leads touch power 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.
- Use CEN tools designed especially for troubleshooting CEN alternators when available.

Resistance (ohms) testing:

- Set meter to proper scale.
- Zero the meter scale or identify meter burden by touching meter leads together. Meter burden must be subtracted from final reading obtained.
- Be sure meter leads touch power source area only. Do not allow fingers or body parts to touch meter leads or power source during reading.
- Take reading when power source is at 70° F/21° C. Readings taken at higher temperatures will increase reading. Conversely, readings taken at lower temperatures will decrease reading.
- Test directly at power source. Testing through extended harnesses or cable extensions may increase reading.

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 is not limited to inadequate cable gage or faulty connections.
- Voltage drop measurements must be taken with all electrical loads or source operating.

Dynamic/Live testing: Definition: Connecting power and ground to a 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 C636 Alternator
Description and Operation**

The CEN C636 42 V 370 A alternator is internally rectified. All windings and current-conducting components are non-moving, so there are no brushes or slip rings to wear out. Voltage regulator is activated when it receives an ignition/energize signal from vehicle usually via oil pressure switch or multiplex system. The regulator monitors alternator shaft rotation and provides field current only when it detects the alternator shaft rotating at a suitable speed. After the regulator detects shaft rotation, it gradually applies field current, preventing an abrupt mechanical load on accessory drive system. Soft start may take up to 20 seconds after rotation and energize signals are sensed.

Refer to Figure 1 for alternator terminal locations.

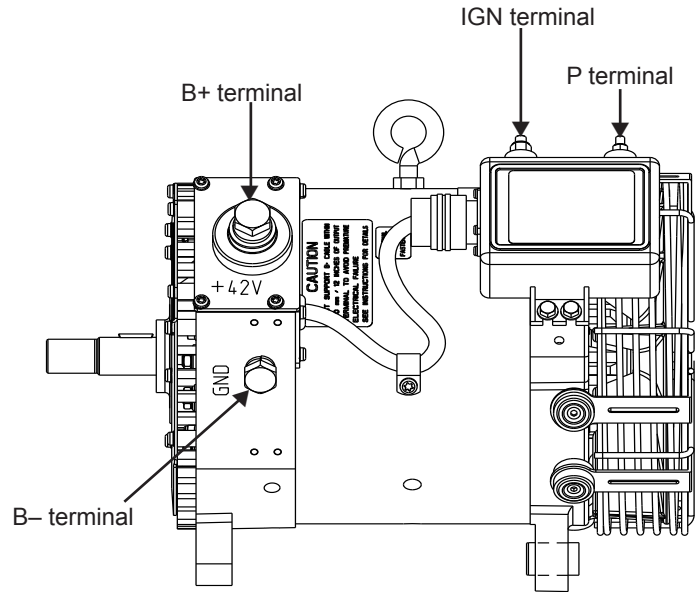


Figure 1 — C636 Alternator and A2-384 Regulator Terminals

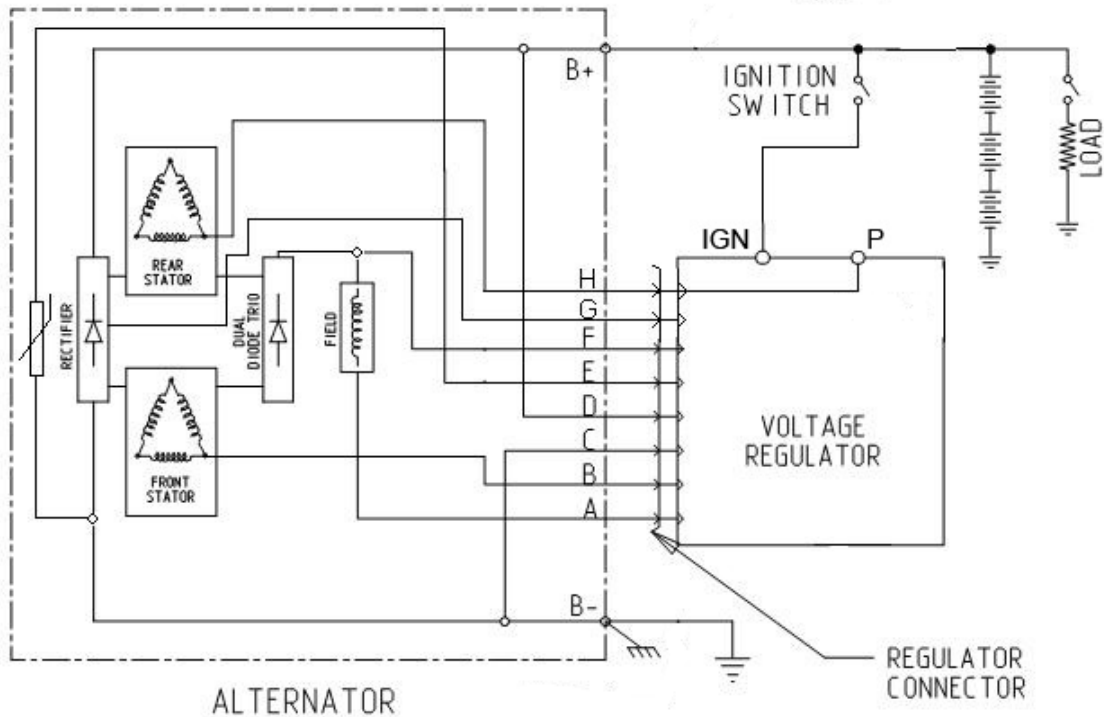


Figure 2 — C636 Wiring Diagram



Section A: Description and Operation (cont)

A2-384 regulator used with these units also:

- provides overvoltage cutout (OVCO). Regulator will trip OVCO when system voltage rises above 46 volts for longer than 3 seconds. OVCO feature detects high voltage and reacts by opening alternator field circuit and turning off alternator. Removing and reapplying energize signal at IGN terminal will reset OVCO circuit.
- limits output power to 10kW throughout RPM range. See Figure 4 for output curves.

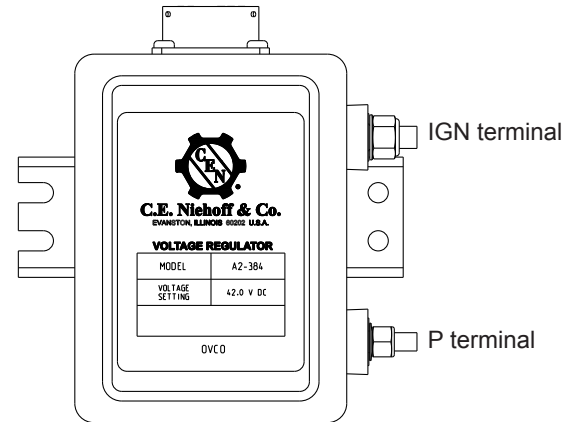


Figure 3 — A2-384 Regulator

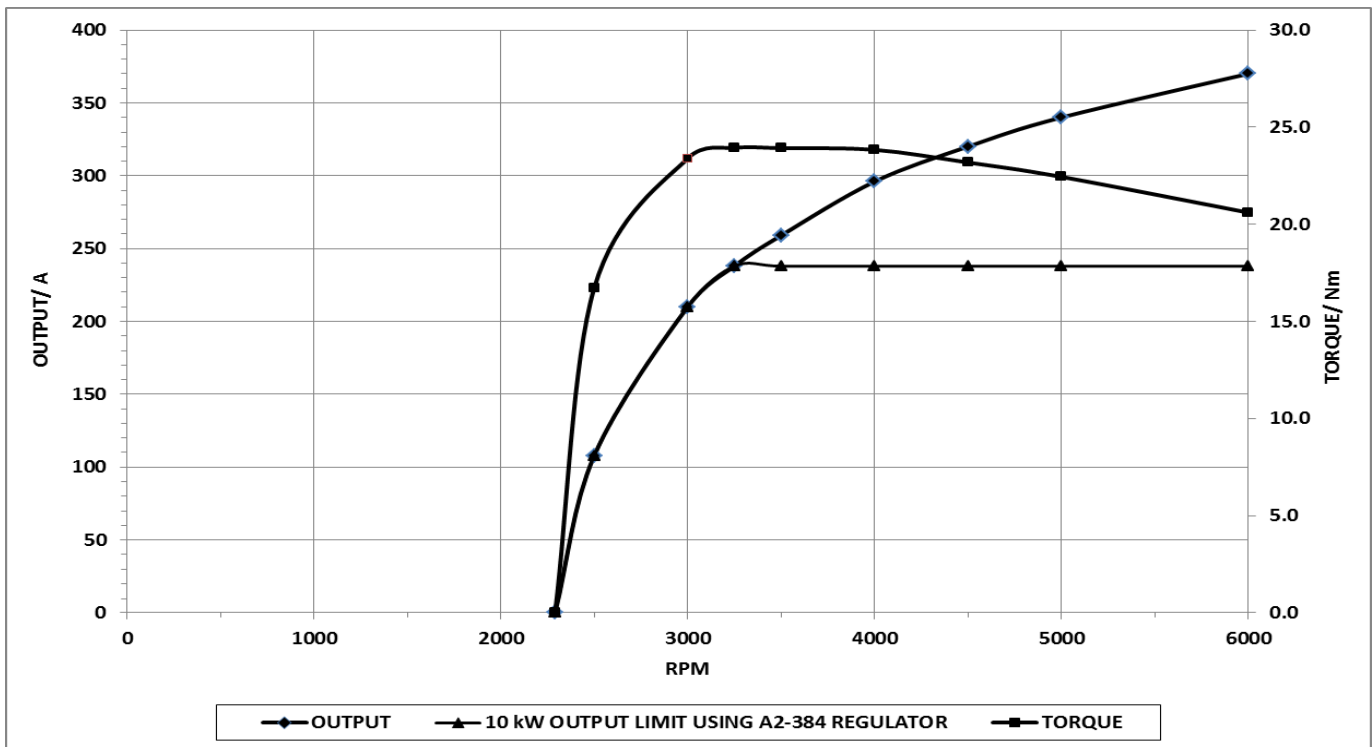


Figure 4 — 10kW Output Limiting Curve with A2-384 Regulator



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 3 below and correct if necessary.

CONDITION:	CHECK FOR:
Low Voltage Output	Low battery state of charge. Load on system exceeds rated output of alternator. Faulty wiring or poor ground path. Faulty alternator or regulator. Wrong regulator installed. Wrong pulley installed. Power-limiting feature activated (see page 6, chart 3).
High Voltage Output	Faulty regulator. Faulty alternator.
No Voltage Output	No energize signal at IGN terminal on regulator. Faulty alternator B+ terminal connection. Faulty alternator or regulator.

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. 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.
4. Connect meters to alternator:
 - Connect DMM red lead to alternator B+ terminal.
 - Connect DMM black lead to alternator B– terminal.
 - Clamp inductive ammeter onto B+ cable.
5. 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 setpoint and charge amps remain at lowest value for 10 minutes.

If voltage is at or below regulator setpoint, 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 46 V, shut down system immediately. Damage to electrical system may occur if charging system is allowed to operate above 16 V for more than 3 seconds.*

Check for OVCO Condition

- 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 vehicle electrical system, including loose battery cables. 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 field circuit, try a third restart. If OVCO circuit repeats cutout, follow troubleshooting procedures in charts 1 and 2 on pages 5 and 6.

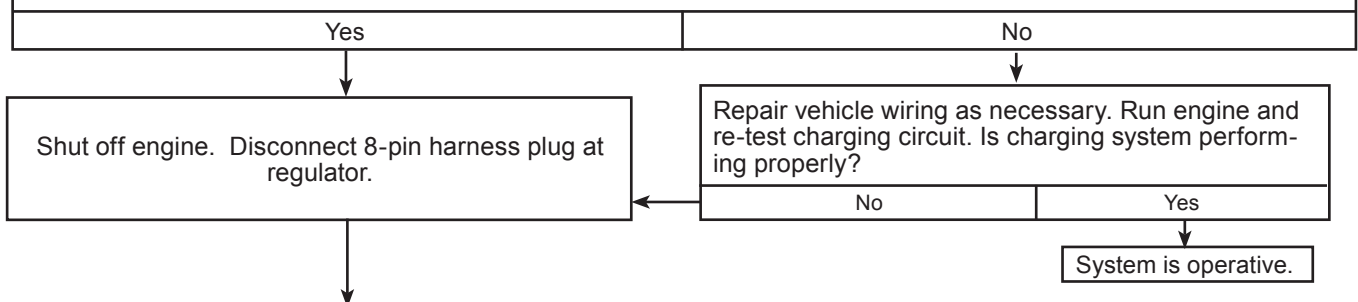


Chart 1: No Alternator Output – Test Charging Circuit

- 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 FUSES BEFORE TROUBLESHOOTING.
- BEFORE STARTING DIAGNOSTIC SEQUENCE, VERIFY THE FOLLOWING AND REPAIR/REPLACE IF NOT TO SPEC:
 - BATTERIES FOR STATE-OF-CHARGE (37.5-42.0 V), CONDITION, AND SECURE CONNECTIONS .
 - MASTER BATTERY SWITCH FOR FUNCTION.

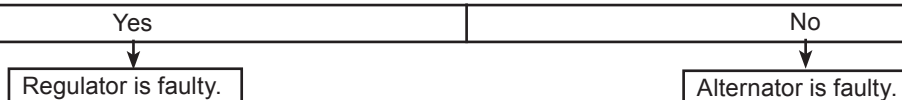
CAUTION MAKE SURE METER PROBES DO NOT TOUCH OTHER PINS AND CAUSE AN ARC THAT MAY DAMAGE PINS AND HARNESS WIRING.

MASTER BATTERY SWITCH ON, KEY ON, ENGINE ON: Test for battery voltage at B+ terminal on alternator to ground, then at IGN terminal on regulator to ground. Does battery voltage exist at both locations?



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

1. Battery voltage test: Connect DMM red lead to pin D. Connect DMM black lead to pin C. Battery voltage should exist.
2. Field coil resistance test: Set DMM on Ohms test. Field resistance between pins F and A should measure nominal 5.8 ± 0.5 ohms.
3. Set DMM to Ohms. Measure resistance between pin A and B-. Meter should read OL. Repeat test with pin F and B-. Meter should read OL.
4. Phase supply test: Set DMM to diode test. Connect DMM black lead to pin B. Connect red lead to alternator B+ terminal. DMM should read blocking in this direction. Then reverse leads. DMM should read flow in this direction. Repeat for pin B and B- terminal. Tests should read flow in one direction and blocking in the other direction.
5. Connect DMM black lead to pin H. Connect DMM red lead to alternator B+ terminal. DMM should read blocking in this direction. Reverse DMM leads. DMM should read flow in this direction. Repeat for pin H and B- terminal. Tests should read flow in one direction and blocking in the other direction.



- A = F-
- B = AC 1
- C = B-
- D = B+
- E = Temp
- F = F+/D+
- G = Kelvin+
- H = AC 2



Figure 5: Alternator-to-Regulator Harness Plug Pins

Section C: Advanced Troubleshooting (CONT'D)



Chart 2: Test OVCO Circuit

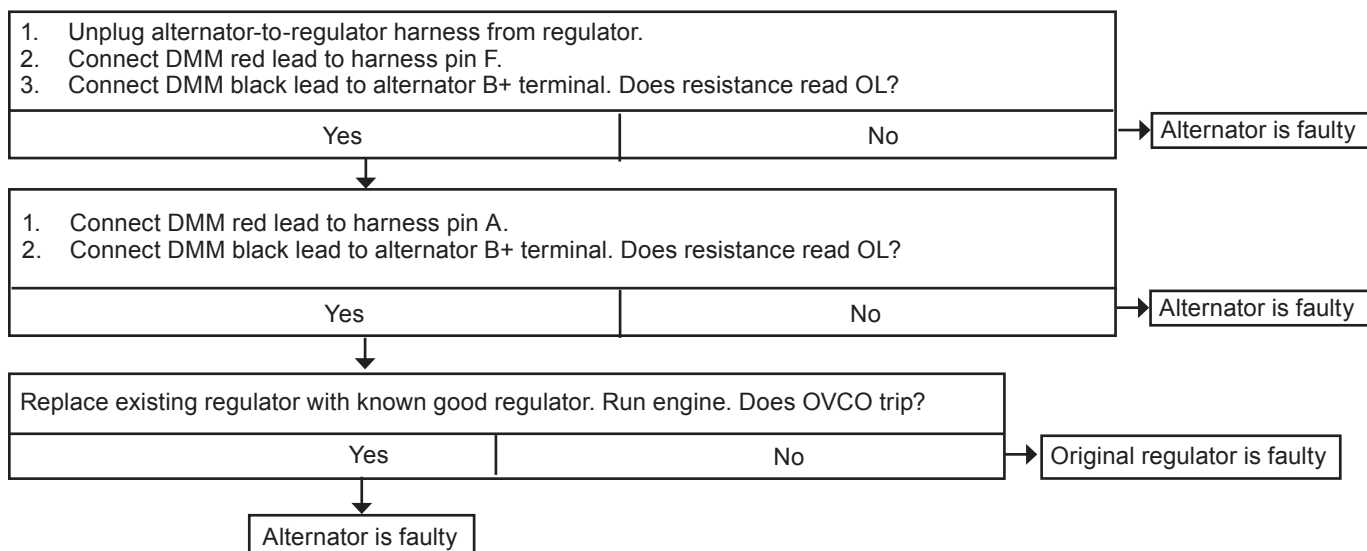
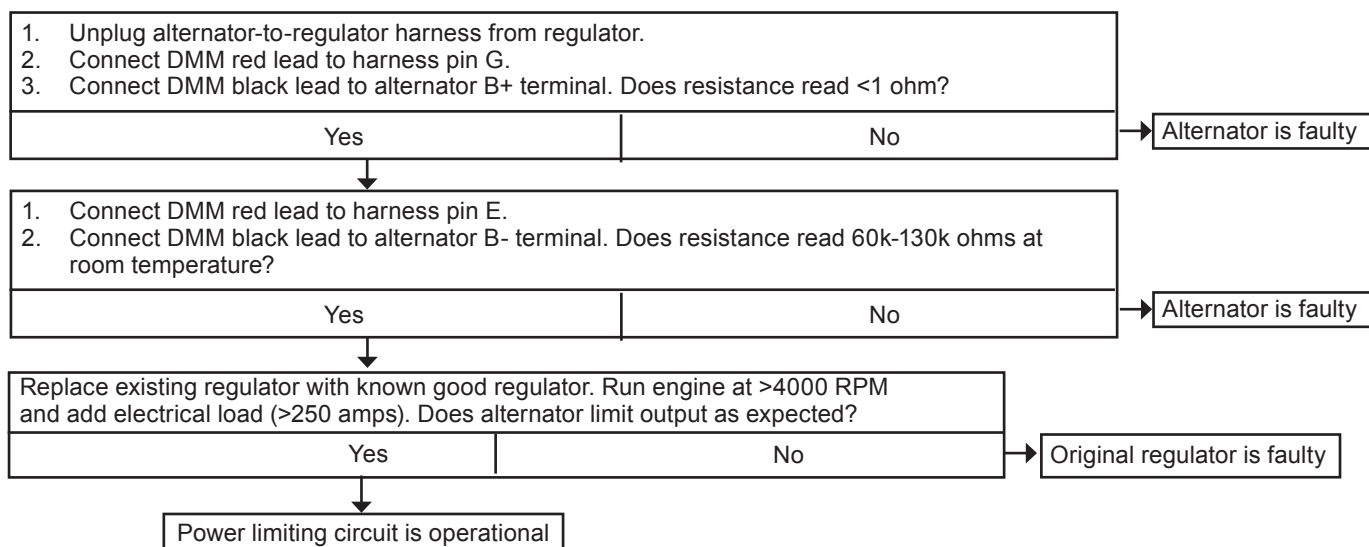


Chart 3: Test Power Limiting Circuit



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:
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 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