



WARNING

Before troubleshooting any CEN products, the service technician should:

- read, understand, and agree to follow all information contained in this troubleshooting guide.
- understand the operational characteristics of the electrical charging system components to be tested.
- be proficient at the use of tools and test equipment used in troubleshooting CEN products.

Hazard Definitions

These terms are used to bring attention to presence of hazards of various risk levels or to important information concerning product life.

WARNING

Indicates presence of hazard(s) that can cause severe personal injury, death, or substantial property damage if ignored.

CAUTION

Indicates presence of hazards that will or can cause minor personal injury or property damage.

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Tools and Equipment

- Digital Multimeter (DMM)
- Ammeter (digital, inductive)
- Jumper wires
- CEN 6-pin Metri-Pack Inline Harness Test Tool A10-114

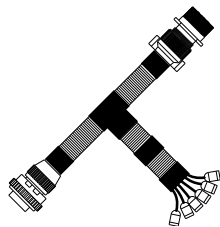


Figure 1—CEN 6-pin Metri-Pack Inline Harness Test Tool A10-114

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. See page 1 for more information.

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 the meter leads touch source area only. Prevent altering the reading by not allowing fingers or body parts to touch meter leads or source during 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.

Voltage drop testing:

- Measure voltage between B+ on alternator or source and B- (ground) on alternator or source. Record obtained reading. Move to batteries or other source and measure again between B+ and B- terminals on battery or other source. Difference between the two readings represents voltage lost within the circuit due to but 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.

1. Be sure to connect jumper leads directly and securely to source contacts of the component being tested.
2. Be sure to make any connection to power and ground at the 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 C659 Alternator with A2-146 Regulator

C659 (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.

This alternator becomes self-energized 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 then rectified into DC output through diodes in drive end housing and supplied to the battery from the alternator B+ terminal. See Figure 4 on page 3. Alternator output current is self-limiting and will not exceed rated capacity of alternator. Regulator maintains alternator output voltage at pre-determined regulated setting (see Table 1 below for setpoints) as vehicle electrical loads are switched on and off. Regulator maintains alternator output voltage at pre-determined regulated setting (see below for setpoints) as vehicle electrical loads are switched on and off.

A2-146 regulator has:

- P terminal that can provide optional AC voltage tap. P terminal signal frequency (Hz) x 10 = alternator shaft rpm.
- D+ terminal that can provide DC voltage signal to vehicle electrical system, confirming alternator operation.

Regulator fixed (flat temperature compensation) setpoints shown in Table 1 are selected based on battery type and are temperature- or climate-dependent. Battery type selection and battery maintenance/function are the sole responsibilities of the customer.

Table 1— Voltage Setpoint Switch Position		
Voltage Setpoints (± 0.2 V)		Battery Type*
Position 1	27.5 V	Maintenance
Position 2	28.0 V	Maintenance
Position 3	28.5 V	Maintenance-free
Position 4	29.0 V	Maintenance-free

* Setpoint can depend on temperature or climate condition, as well as battery type. If boiling or excessive gassing occurs with higher voltage setpoint, change to next lower voltage setpoint.

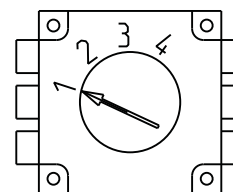


Figure 2—Voltage Setpoints

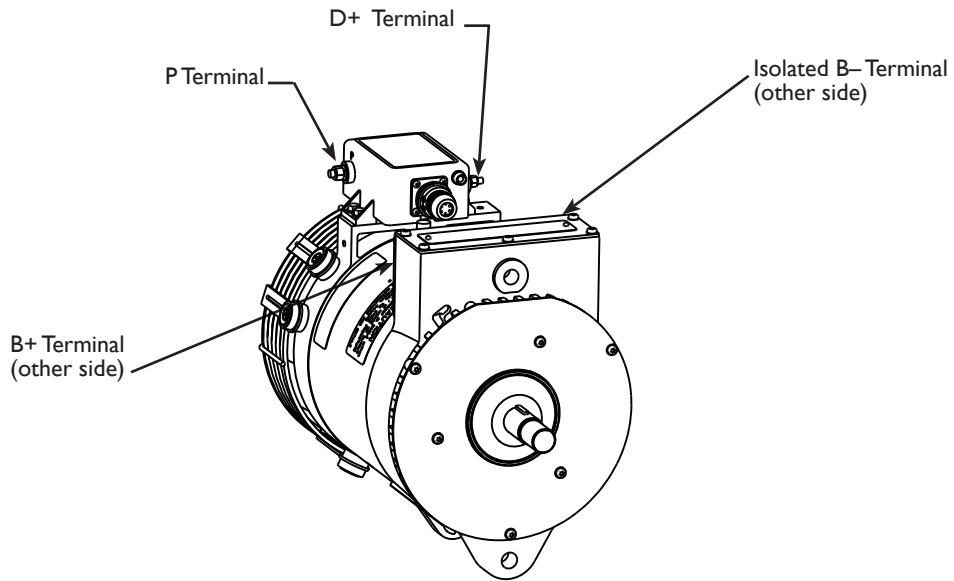


Figure 3—Alternator with A2-146 Regulator

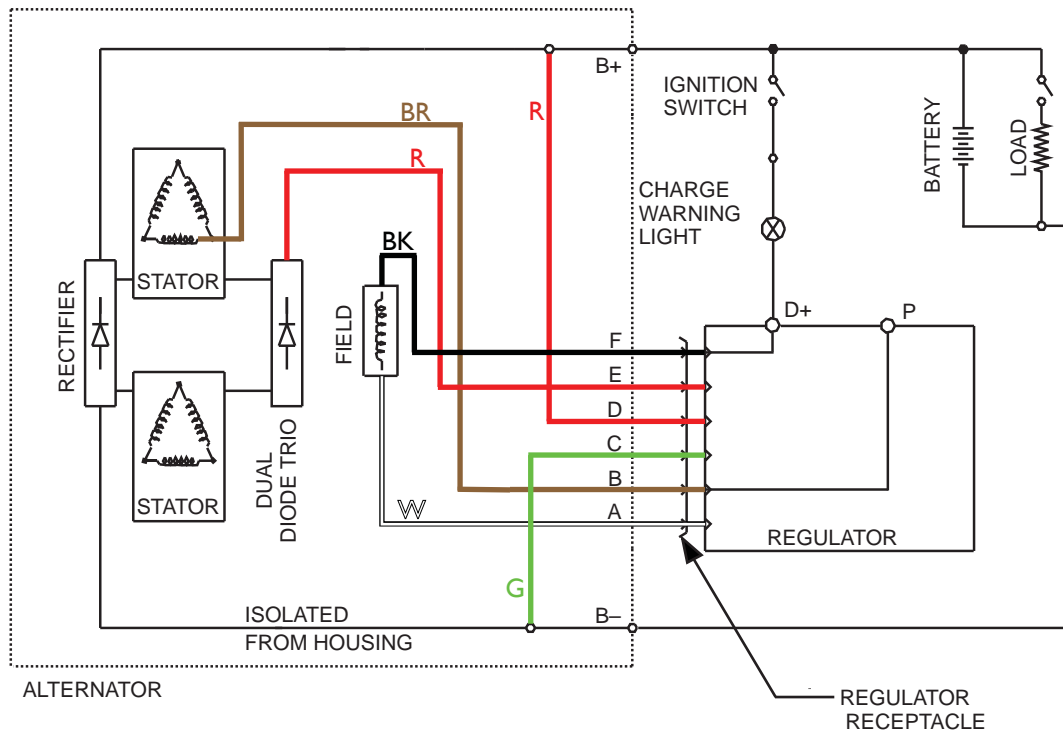


Figure 4—Alternator Schematic Diagram



No Alternator Output – Test Charging Circuit

Before starting diagnostic sequence, verify the following and repair/replace if not to spec:
 —batteries for state-of-charge (24.5-25.5 V), condition, and secure connections
 —master battery switch for function

MASTER BATTERY SWITCH ON, KEY ON, ENGINE ON: Test for battery voltage across B+ terminal on alternator and isolated B- terminal on alternator. Does battery voltage exist?



Repair vehicle wiring as necessary. Run engine and re-test charging circuit. Is charging system performing properly?



System is operative.

SOCKET CONNECTIONS

- Socket A F-
- Socket B Phase
- Socket C B-
- Socket D B+
- Socket E D+
- Socket F F+

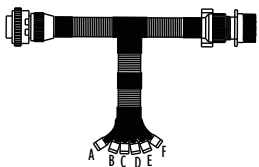
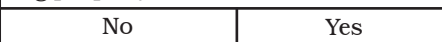


Figure 5 – CEN 6-pin A10-114 Inline Harness Tool Socket Connections

MASTER BATTERY SWITCH ON, KEY OFF, ENGINE OFF: Self-energized alternator may have lost magnetism. 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?



Residual magnetism has been restored. Remove jumper from D+ to B+. Run engine and re-test charging circuit. Is charging system performing properly?



System is operative.

Remove jumper from D+ to B+.

Install a jumper from B+ terminal on alternator to pin F 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?



Regulator is defective.

Alternator is defective.

MASTER BATTERY SWITCH OFF, KEY OFF, ENGINE OFF: Disconnect 6-pin alternator-to-regulator harness plug at regulator and connect CEN A10-114 inline test tool to harness plug end only. Make sure connections are secure.

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

1. Battery voltage test: Connect DMM red lead to socket D in test tool. Connect DMM black lead to socket C in test tool. Battery voltage should exist.
2. Field coil resistance test: Set DMM to ohms test. Field resistance between sockets F and A in test tool should measure nominal $1.0-1.5 \pm 0.2$ ohms. Field coil is defective if reading is less than 0.5 ohms or greater than 3 ohms.
3. Significant magnetism test:
 - a. Securely connect one jumper wire between socket F in test tool and B+ terminal on alternator.
 - b. Insert one end of **second** jumper wire in socket A in test tool. Momentarily (1 sec.) touch other end of **second** jumper wire to alternator B- terminal. Spark will occur at B- terminal. Touch steel tool to shaft to detect significant magnetism.
 - c. Remove both jumper wires.
4. Turn off master battery switch. Disconnect B+ battery cable on alternator. Set DMM to diode test. Connect black lead on DMM to socket E in test tool and red lead to B+ terminal on alternator. DMM should read OL. Reverse leads. DMM should read OL again. Reconnect B+ battery cable to alternator. Turn on master battery switch.
5. Phase taps test: Set DMM to diode test. Connect DMM black lead to socket B in test tool. 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 socket B and B- terminal. Tests should read flow in one direction and blocking in the other direction.



Regulator is defective.

Alternator is defective.

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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