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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.

Section 1: Wiring Diagram



CEN C520 Alternator Description and Operation

C520 14 V 300 A 3-phase alternator is internally rectified. All windings and current-conducting components are non-moving, so there are no brushes or slip rings to wear out.

After engine is running, regulator receives energize signal. 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.

A2-215 regulator used with some of these units is flat temperature compensated. A 15.5 V regulator setpoint is available for battery isolator applications.

A2-326 regulator used with some of these units includes measurement of battery current, voltage, and temperature for adjustment of regulator setpoint.

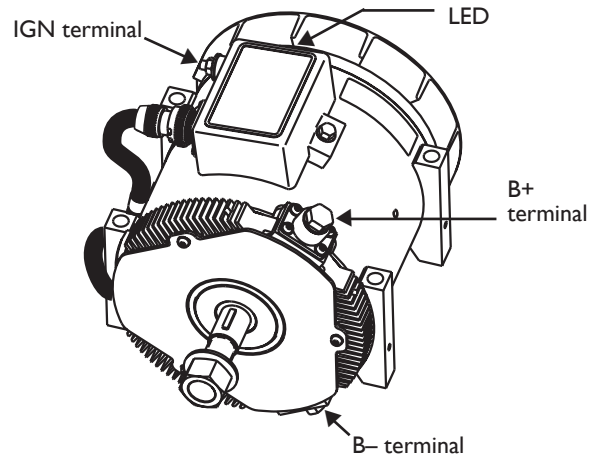


Figure 1 — C520 Alternator/A2-215 Regulator Features

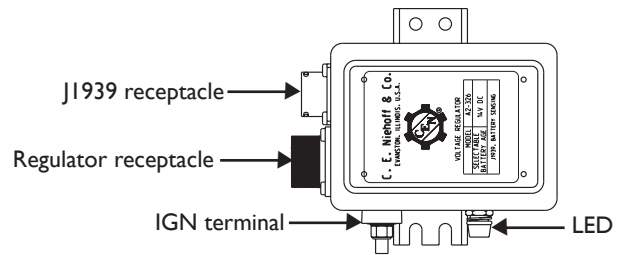


Figure 2 — A2-326 Remote-Mounted Regulator Features

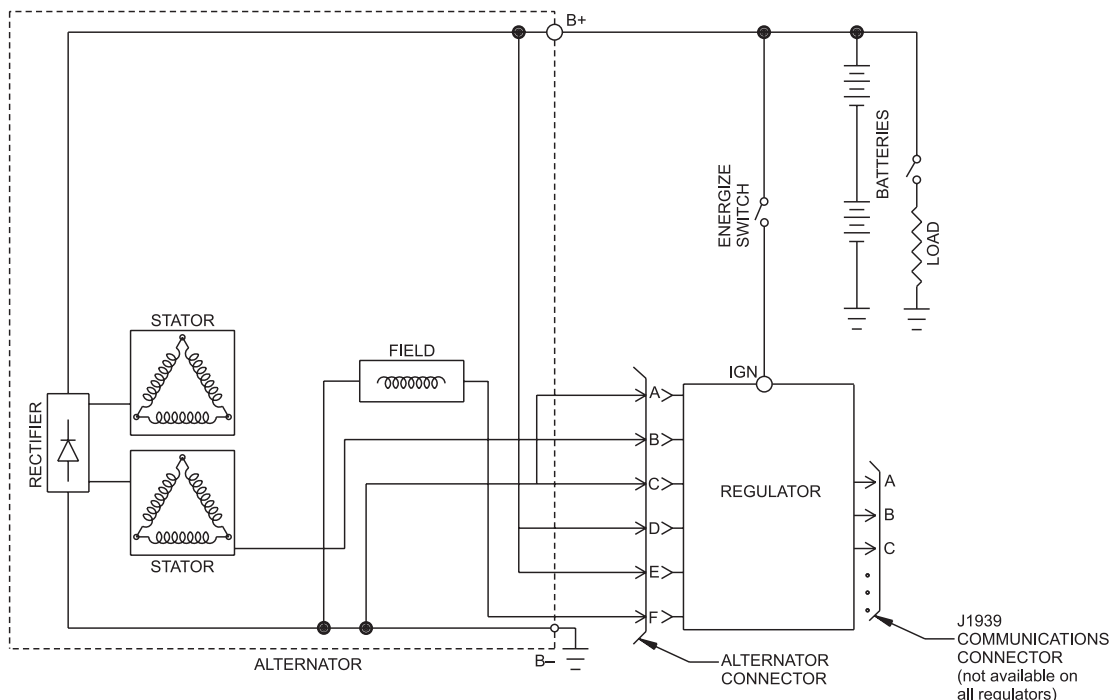


Figure 3 — C520 Alternator with Regulator



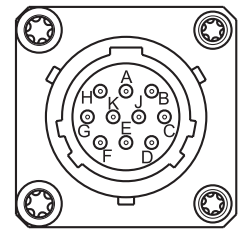
**CAN/J1939 Interface
DESCRIPTION AND OPERATION**

The CEN A2-326 digital regulator is compatible with SAE J1939 communications standard for vehicle networking.

CEN uses MIL-STD connector MS3112E12-10P to interface between the A2-326 and the vehicle J1939 databus. Mating connector is MS3116E12-10S or equivalent. If J1939 connection is not used, the 10-pin connector must be covered with connector cover MS3181-12CA or equivalent. Message content is shown in Table 2.

**TABLE 1 – J1939 Connector
Circuit Identification**

Pin	Identification
A	CANH
B	CANL
C	CAN SHIELD
D	Battery
E	Mfr use only
F	Mfr use only
G	Mfr use only
H	Temperature sensor
J	Voltage sensor
K	Current sensor



**Figure 4 – J1939
Connector Pins**

TABLE 2 – A2-326 Regulator/J1939 Readout Diagnostics (see Table 3)

Regulator Readout	Expected Reading	Action—If Expected Reading Not Present
Alternator Output Voltage 28 V System	13–15 V	See Chart 1, page 6.
Alternator Speed	1200 to 8000 RPM	Check drive belt and charging system connections.
Regulator Temperature	Less than 257 F/125°C	Decrease load on alternator.
Alternator Output	0–100%	Varies with load.
Charging System Hours	>0 hours	Check drive belt and charging system connections.

TABLE 3 – Message Data

PGN Name	PGN	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
ALT RPM	0xFED5	ALT RPM							
ALT VOLT	0xFE7	VOLT SETPOINT		ALT VOLT		REG IGN VOLT		BATT VOLT	
ALT TEMP	0xFE7				REG TEMP	BATT TEMP			
PROPRIETARY #1	0xFFC8	BATT CURRENT	SHUTDOWN COUNT	BATT AGE	HOUR METER		MINUTES (0-59)	ALT LOAD	
PROPRIETARY #2	0xFFC9	Proprietary Content: For Manufacturer Test Only							



A. Tools and Equipment for Job

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

If no tools are available, monitor LED code.

B. Identification Record

List the following for proper troubleshooting:

- Alternator model number _____
- Regulator model number _____

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. Check: defective alternator and/or regulator.
High Voltage Output	Check: defective regulator. Check: alternator.
No Voltage Output	Check: presence of energize signal to IGN terminal on regulator. Check: battery voltage at alternator output terminal. Check: defective alternator and/or regulator.

C. Basic Troubleshooting

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 B+ terminal and black lead to alternator B- terminal. Clamp inductive ammeter on B+ cable.

5. Operate vehicle

Observe charge voltage.

CAUTION

If charge voltage is above 33 volts, immediately shut down system. Electrical system damage may occur if charging system is allowed to operate at excessive voltage. Go to Table 4 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

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 6.



A2-215 and A2-326 Regulators DESCRIPTION AND OPERATION

A2-215 regulator is attached directly to the outside of the alternator. **A2-326** regulator is remotely mounted from extended wiring harnesses.

Main diagnostic feature of **A2-215** regulator is green lens LED. The LED indicates field coil performance. See Table 5 for diagnostic features and LED explanations.

Main diagnostic feature of **A2-326** regulator consists of a tricolored (green, amber, red) LED located on the side of the regulator. The LED works like a voltmeter, measuring charging voltage. See Table 6 for diagnostic features and LED explanations.

TROUBLESHOOTING A2-326 REGULATOR

Shut down vehicle and restart engine. If alternator functions normally after restart, a “no output condition” was normal response of voltage regulator to overvoltage condition. Inspect condition of electrical system.

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

If OVCO circuit repeats cutout a second time in short succession and shuts off alternator F+ circuit, try third restart. If OVCO circuit repeats cutout a third time, check color of LED while engine is running.

TABLE 5 – A2-215 Regulator Diagnostics

LED CONDITION		STATUS	ACTION
GREEN	On steady	Field on full.	No action required.
GREEN	Flashing	Speed of LED flashing determines alternator output.	Check drive belt, moderate RPM if necessary.
CLEAR	LED off	Field off.	Check condition of field circuit.

TABLE 6 – A2-326 Regulator Diagnostics

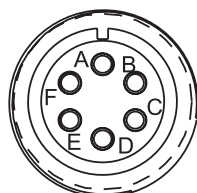
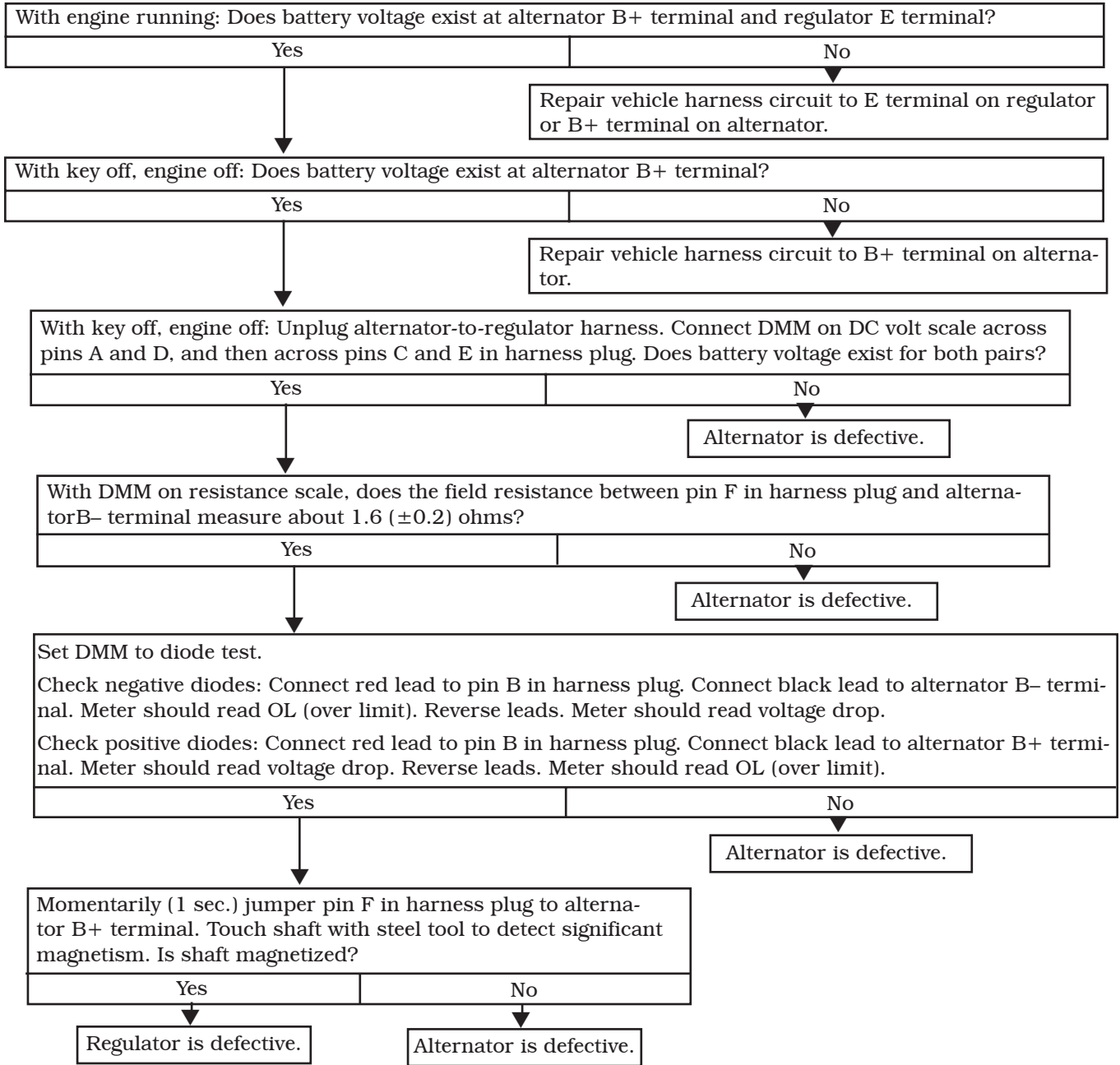
LED COLOR		STATUS	ACTION
GREEN	Flashing*	Alternator and regulator operating normally.	No action required.
AMBER	Flashing *	Energize signal present, alternator not rotating or alternator speed too low for cut-in.	Check drive belt, increase RPM.
		If alternator is rotating: System voltage lower than setpoint – electrical load exceeds alternator rating at present rotor speed.	When loads decrease or speed increases, LED should flash GREEN. If not, check drive belt and charging system connections.
RED	Flashing*	System voltage higher than setpoint.	May occur during normal load switching.
	Steady	OVCO tripped.	Overvoltage condition. Attempt reset. System diagnosis required.
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.

* Flashing occurs twice per second.



Chart 1 – No Alternator Output – **Quick Diagnostic**

Remote-mounted regulator applications: Check condition of fuse in wiring harness before troubleshooting.



- PIN CONNECTIONS**
- Pin A GND/B-
 - Pin B AC
 - Pin C GND/B-
 - Pin D B+
 - Pin E B+
 - Pin F F+

Figure 5 – 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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TEL: 800.643.4633 USA and Canada • TEL: 847.866.6030 outside USA and Canada • FAX: 847.492.1242
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