Hazard Definitions

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

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

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

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Battery Conditions

NOTICE — Until temperatures of electrical system components stabilize, these conditions may be observed during cold-start voltage tests.

- **Maintenance/Low Maintenance Battery**
  - — Immediately after engine starts, system volts are lower than regulator setpoint, amps are medium.
  - — 3–5 minutes into charge cycle, system volts increase, 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 with slightly longer recharge times.
- **Maintenance-free Battery**
  - — Immediately after engine starts, system volts are lower than regulator setpoint, low charging amps.
  - — Once charge cycle begins, low volts and low amps are still present.
  - — After alternator energizes, voltage will increase several tenths. Amps will increase gradually, then quickly, to medium to high amps.
  - — Finally, volts will increase to setpoint and amps will decrease.

  The time it takes to reach optimum voltage and amperage 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. If battery state of charge drops to 75% or less, batteries should be recharged to 95% or higher separately from the engine's 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.

Battery Charge Volt and Amp Values

Volt and amp levels fluctuate depending on the battery state of charge. If batteries are in a state of discharge—as after extended cranking time to start the engine—system volts will measure lower than the regulator setpoint after the engine is restarted and system amps will measure higher. This is a normal condition for the charging system; the greater the battery discharge level, the lower the system volts and the higher the system amps. The volt and amp readings will change as batteries recover and become fully charged: system volts will increase to regulator setpoint and system amps will decrease to low level (depending on other loads).

- **Low Amps:** Minimum or lowest charging system amp value required to maintain battery state of charge, obtained when testing the charging system with a fully charged battery and no other loads applied. This value will vary with battery type.
- **Medium Amps:** System amps value which can cause the battery temperature to rise above adequate charging temperature within 4-8 hours of charge time. To prevent battery damage, the charge amps should be reduced when battery temperature rises. Check battery manufacturer's recommendations for proper charge amp rates.
- **High Amps:** System amps value which can cause the battery temperature to rise above adequate charging temperature within 2-3 hours of charge time. To prevent battery damage, the charge amps should be reduced when battery temperature rises. Check battery manufacturer's recommendations for proper charge amp rates.
- **Battery Voltage:** Steady-state voltage value as measured with battery in open circuit with no battery load. This value relates to battery state of charge.
- **Charge Voltage:** Voltage value obtained when the charging system is operating. This value will be higher than battery voltage and must never exceed the regulator voltage setpoint.
- **B+ Voltage:** Voltage value obtained when measuring voltage at battery positive terminal or alternator B+ terminal.
- **Surface Charge:** Higher than normal battery voltage occurring when the battery is disconnected from battery charger. The surface charge must be removed to determine true battery voltage and state of charge.
- **Significant Magnetism:** Change in strength or intensity of a magnetic field present in alternator rotor shaft when the field coil is energized. The magnetic field strength when the field coil is energized should feel stronger than when the field is not energized.
- **Voltage Droop or Sag:** Normal condition occurring when the load demand on alternator is greater than rated alternator output at given rotor shaft RPM.

CEN C630/C619/N1222/N1223/A1-607/A1-608 Alternators Description and Operation

The **C630** alternator (14 V, 350 A), **C619** alternator (14 V, 340 A), **N1222/A1-608** alternators (14 V, 290 A) and **N1223/A1-607** alternators (14 V, 250 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.

A2-121 regulator used with all units has a 15.5 V regulator setpoint 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. A2-121 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.

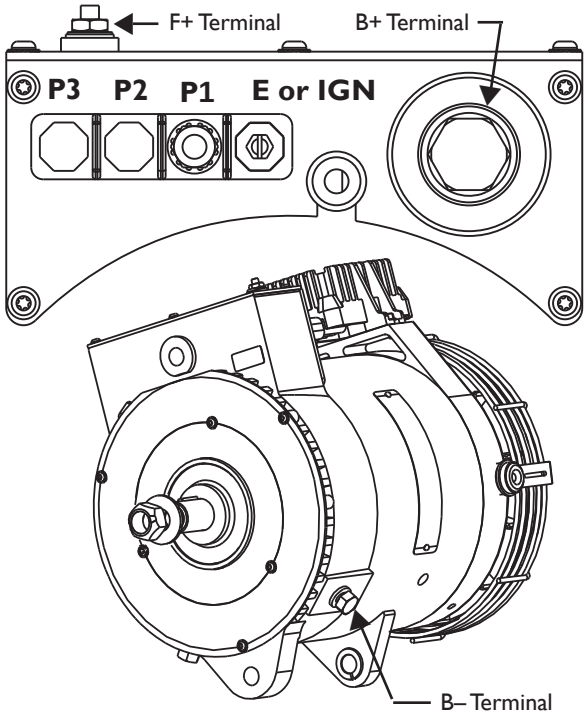

Figure 1 — Alternator with A2-121 Regulator

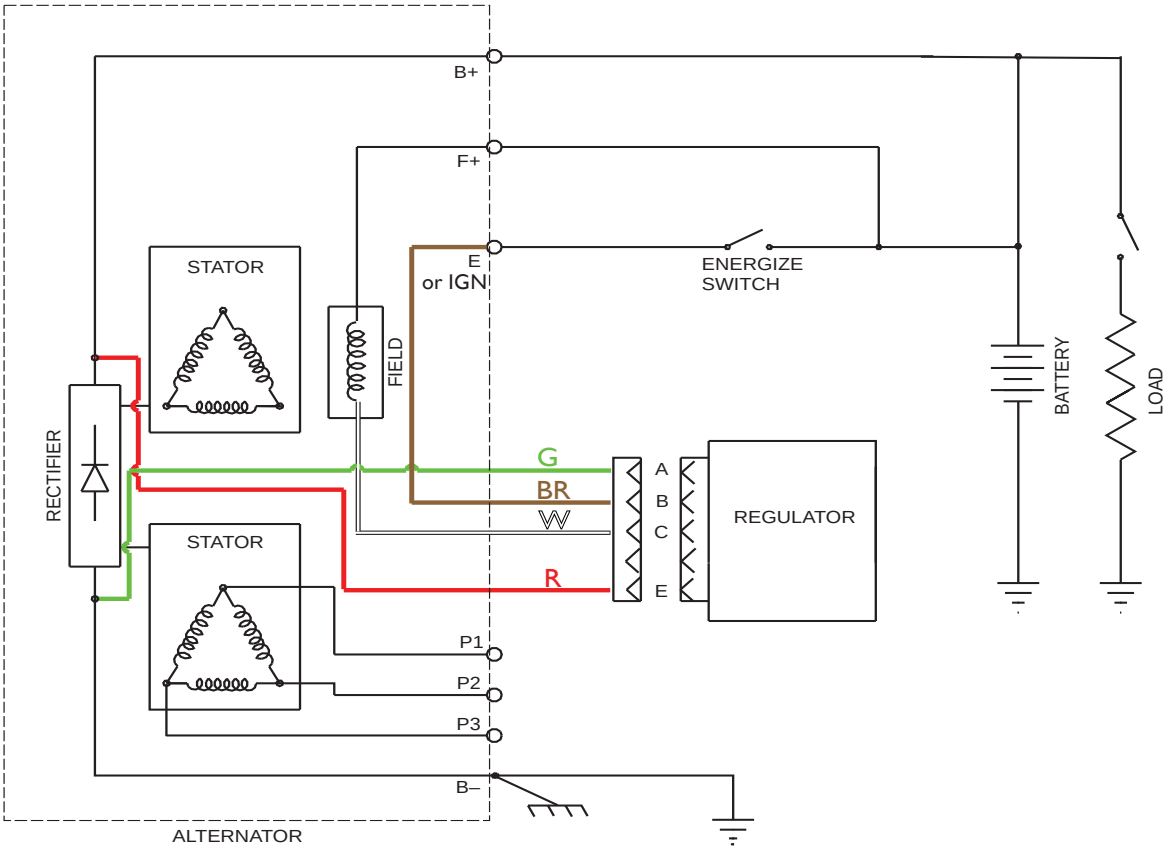

Figure 2 — Alternator Wiring Diagram

Tools and Equipment for Job

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

Identification Record

List the following for proper troubleshooting:

❒ Alternator model number _____

❒ Regulator model number _____

❒ Setpoints listed on regulator _____

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 or regulator. Check: wrong regulator.
High Voltage Output	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 or regulator.

NOTICE

Failure to check for the following conditions will result in erroneous test results in the troubleshooting charts.

Basic Troubleshooting

1. **Inspect charging system components for damage**
   Check connections at B– cable, B+ cable, and regulator harness. Also check connections at 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. **Check drive belt**
   Repair or replace as necessary.
4. **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.
5. **Determine if battery isolator is used in charging circuit**
   Check vehicle wiring diagram. If so, you must jumper isolator before troulbleshooting. See Chart 1 on page 4 for deatils.
6. **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.
7. **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 1.

   If voltage is at or below regulator setpoint, let charging system operate for several minutes to normalize operating temperature.
8. **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.
9. **Battery** is considered fully charged if charge voltage is at regulator setpoint and charge amps remain at lowest value for 10 minutes.
10. **If charging system** is not performing properly, go to Chart 1, page 4.

START HERE ⇨ Chart 1 – System Circuit

Is there a battery isolator in the system?

Yes	No

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 alternator to ground. Does battery voltage exist?

- Yes
- No → Repair vehicle wiring as necessary. Continue test.

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

- Yes → Go to energize switch on engine in energize circuit. Test for battery voltage going into energize switch from battery. Does battery voltage exist?
  - Yes → Make sure jumper wire from alternator B+ terminal to alternator E or IGN terminal is still attached. Test for battery voltage at energize switch E terminal connection. Does battery voltage exist at energize switch?
    - Yes → Energize circuit from alternator to energize switch is good. Energize switch is defective.
    - No → Repair vehicle circuit from E or IGN teminal on alternator to energize switch on engine.
  - No → Repair vehicle circuit to energize switch. Continue test.
- No → Unplug alternator-to-regulator harness. Plug CEN Regulator Bypass Adapter A10-129 into harness plug and touch black lead to ground on alternator case. (If no Adapter is available, connect jumper wire from socket C on the harness to ground). Spark will occur at ground. Touch steel tool to shaft to detect significant magnetism. Is shaft magnetized?
  - Yes → 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 → Regulator is defective.
    - No → Check wiring and connections to alternator. Run engine and re-test charging circuit for operation.
  - No → Alternator is defective.

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

SOCKET CONNECTIONS

Socket A	B–
Socket B	Energize
Socket C	Field –
Socket D	Not Used
Socket E	B+

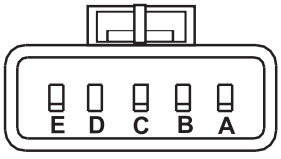

Figure 3 – Alternator-to-Regulator Harness Plug

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 alternator to ground. Does battery voltage exist?

- Yes
- No → Repair vehicle wiring as necessary. Continue test.

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

- Yes → Disconnect jumper. Apply 12 V test light to alternator E or IGN terminal and ground. Does light glow brightly?
  - Yes → Run vehicle. Does charge voltage exist?
    - Yes → System operating normally.
    - No → Jumper B+ terminal on alternator to E or IGN terminal on alternator. Does charge voltage exist?
      - Yes → Repair wiring or ignition switch.
      - No → Contact CEN Service Department for assistance.
  - No → Repair wiring or ignition switch.
- No → Unplug alternator-to-regulator harness. Plug CEN Regulator Bypass Adapter A10-129 into harness plug and touch black lead to ground on alternator case. (If no Adapter is available, connect jumper wire from socket C on the harness to ground). Spark will occur at ground. Touch steel tool to shaft to detect significant magnetism. Is shaft magnetized?
  - Yes → 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 → Regulator is defective.
    - No → Check wiring and connections to alternator. Run engine and re-test charging circuit for operation.
  - No → Alternator is defective.

SOCKET CONNECTIONS

Socket A	B–
Socket B	Energize
Socket C	Field –
Socket D	Not Used
Socket E	B+

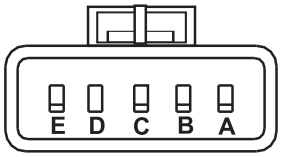

Figure 4 – Alternator-to-Regulator Harness Plug

OLD REGULATOR#		NEW REGULATOR #
A2-119 A2-120 A2-113 A2-707	USE	A2-121

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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