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 if ignored.

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 or low maintenance battery:
  - — Immediately after engine starts, system volts are lower than regulator setpoint with medium amps.
  - — 3-5 Minutes into charge cycle, system volts are higher and amps are dropping.
  - — 5-10 Minutes into charge cycle, system volts are at, or nearly at, regulator setpoint and amps are reduced to a minimum.
  - — Low maintenance battery has same characteristics with slightly longer recharge times.
- Maintenance-free battery:
  - — Immediately after engine start, system volts are lower than regulator setpoint with low charging amps.
  - — 15-30 minutes into charge cycle, volts and amps are still low.
  - — 15-30 minutes into charge cycle, volts increase several tenths. Amps increase gradually, then quickly, to medium to high amps.
  - — 20-35 minutes into charge cycle, volts increase to setpoint and amps decrease.
- 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.

Charge Volt and Amp Values

The volt and amp levels are a function of the battery state of charge. If batteries are in a state of discharge, as after extended cranking time to start the engine, the system volts, when measured after the engine is started will be lower than the regulator setpoint and the system amps will be high. This is a normal condition for the charging system. The measured values of system volts and amps will depend on the level of battery discharge. In other words, the greater the battery discharge level, the lower the system volts and higher the system amps will be. The volt and amp readings will change, system volts reading will increase up to regulator setpoint and the system amps will decrease to low level (depending on other loads) as the batteries recover and become fully charged.

- **Low Amps:** A 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:** A system amps value which can cause the battery temperature to rise above the 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 rates of charge amps.
- **High Amps:** A system amps value which can cause the battery temperature to rise above adequate charging temperature within 2-3 hours. To prevent battery damage, the charge amps should be reduced when the battery temperature rises. Check battery manufacturer's recommendations for proper rates of charge amps.
- **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:** A 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:** A voltage value obtained when measuring voltage at battery positive terminal or alternator B+ terminal.
- **Surface Charge:** A higher than normal battery voltage occurring when the battery is removed from a battery charger. The surface charge must be removed to determine true battery voltage and state of charge.
- **Significant Magnetism:** A change in the strength or intensity of a magnetic field present in the 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:** A normal condition which occurs when the load demand on the alternator is greater than rated alternator output at given rotor shaft RPM.

CEN C524 Alternator Description and Operation

C524 14 V (300 A) 3-phase alternator is externally energized and self-rectifying. 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.

A2-334 and A2-335 regulators used with some of these units are flat temperature compensated. A 15.5 V regulator setpoint is available for battery isolator applications. Both regulators have a P terminal to provide an optional AC voltage tap.

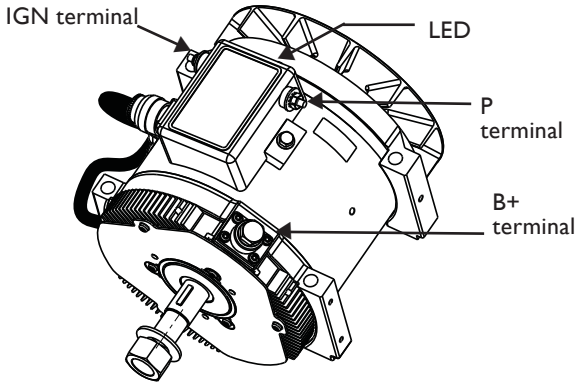


Figure 1 — C524 Alternator/A2-334 Regulator Features

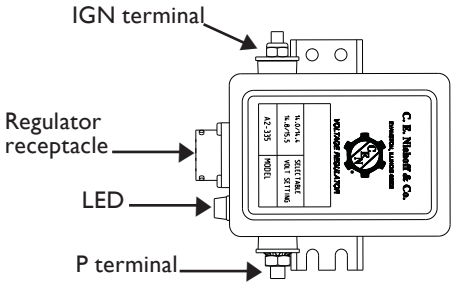


Figure 2 — A2-335 Remote-mounted Regulator Features

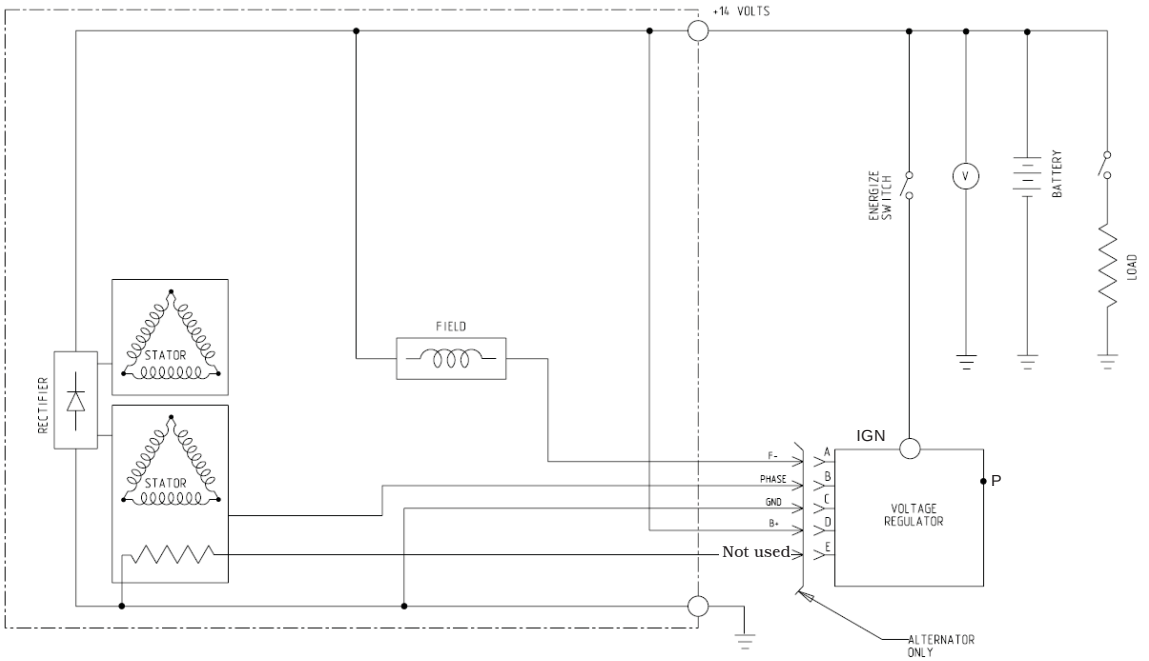


Figure 3 — C524 Alternator with Regulator

Tools and Equipment for Job

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

If no tools are available, monitor LED code.

Identification Record

List the following for proper troubleshooting:

❑ Alternator model number _____

❑ Regulator model number _____

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. 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.

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 16 volts, immediately shut down system. Electrical system damage may occur if charging system is allowed to operate at excessive voltage. Go to Table 1 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 5.

A2-334 and A2-335 Regulators

DESCRIPTION AND OPERATION

A2-334 regulator is mounted directly to the outside of the alternator. **A2-335** regulator is mounted remotely on the vehicle and connected to alternator with extended wiring harnesses.

Main diagnostic feature of regulators consists of a tricolored (green, amber, red) LED located on the end of the regulator. The LED works like a voltmeter, measuring charging voltage. See Table 2 for diagnostic features and LED explanations.

TABLE 2 – Regulator Diagnostics

LED COLOR		STATUS	ACTION
GREEN	Solid	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.
	Solid	System voltage is lower than setpoint—electrical load exceeds alternator rating at present rotor speed.	When loads decrease or speed increases, LED should be solid GREEN. If not, check drive belt and charging system connections.
RED	Flashing	System voltage higher than setpoint.	May occur during normal load switching.
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.

Chart 1 – No Alternator Output – Quick Diagnostic

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

With engine running: Does battery voltage exist at alternator B+ terminal and regulator IGN terminal?

- Yes → With key off, engine off: Does battery voltage exist at alternator B+ terminal?
- No → Repair vehicle harness circuit to IGN terminal on regulator or B+ terminal on alternator.

With key off, engine off: Does battery voltage exist at alternator B+ terminal?

- Yes → With key off, engine off: Unplug alternator-to-regulator harness. Connect DMM on DC volt scale across pins C and D. Does battery voltage exist?
- No → Repair vehicle harness circuit to B+ terminal on alternator.

With key off, engine off: Unplug alternator-to-regulator harness. Connect DMM on DC volt scale across pins C and D. Does battery voltage exist?

- Yes → With DMM on resistance scale, does the field resistance between pin A in harness plug and alternator B+ terminal measure about 1.0 (±0.2) ohms?
- No → Alternator is defective.

With DMM on resistance scale, does the field resistance between pin A in harness plug and alternator B+ terminal measure about 1.0 (±0.2) ohms?

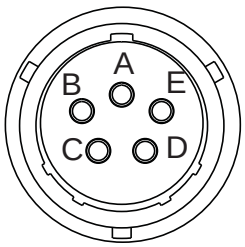
- Yes → Set DMM to diode test.
  Check negative diodes: Connect red lead to pin B in harness plug. Connect black lead to alternator B– terminal. Meter should read OL (over limit). Reverse leads. Meter should read voltage drop.
  Check positive diodes: Connect red lead to pin B in harness plug. Connect black lead to alternator B+ terminal. Meter should read voltage drop. Reverse leads. Meter should read OL (over limit).
- No → Alternator is defective.

Set DMM to diode test.
Check negative diodes: Connect red lead to pin B in harness plug. Connect black lead to alternator B– terminal. Meter should read OL (over limit). Reverse leads. Meter should read voltage drop.
Check positive diodes: Connect red lead to pin B in harness plug. Connect black lead to alternator B+ terminal. Meter should read voltage drop. Reverse leads. Meter should read OL (over limit).

- Yes → With key on, engine off: Momentarily (1 sec.) jumper pin A in harness plug to alternator B– terminal. Touch shaft with steel tool to detect significant magnetism. Is shaft magnetized?
- No → Alternator is defective.

With key on, engine off: Momentarily (1 sec.) jumper pin A in harness plug to alternator B– terminal. Touch shaft with steel tool to detect significant magnetism. Is shaft magnetized?

- Yes → Regulator is defective.
- No → Alternator is defective.



PIN CONNECTIONS

Pin A	F–
Pin B	Phase
Pin C	GND
Pin D	B+
Pin E	Not used

Figure 4 – 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 Dealer, please contact us at:

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