

Ample Power Company

Troubleshooting the Alternator System

Introduction

The alternator system consists of the alternator, the alternator regulator, the ignition switch, batteries, distribution wiring, and in older boats, a battery selector switch. Each of the parts may cause the alternator system to charge improperly, or not at all.

The Battery Selector Switch

In boats that don't follow the Ample Power way of wiring an alternator, a selector switch is used to enable charging either or both batteries banks.

A running alternator has energy stored in its field winding, and suddenly interrupting the alternator output by disconnecting the batteries results in hundreds of Volts appearing at the alternator output. Since this same circuit is powering other devices, such as electronic gear, the high voltage spike can immediately destroy lots of equipment ...not the least of which is the alternator regulator.

Distribution Wiring

Wires falling off the back of alternators is not as infrequent as it might seem. The large cables required to conduct high current are often stiff and, under vibration, tend to loosen the nut on the output stud.

Obviously, if the alternator isn't connected to the batteries, then it won't be able to charge them. Verify that battery voltage appears on the positive output stud of the alternator. Also verify that the negative side of the alternator makes a low resistance connection to the negative distribution point of the electrical system. Don't assume that the case of the alternator is the negative output. Some alternators have *floating* grounds. That is, the negative output comes out on a stud by itself without connection to the case.

The Ignition Switch

When the system fails to charge, the ignition switch is a good place to start looking. You don't need to look at the switch itself, but you do need to see that the alternator regulator is getting voltage when the switch is on. That is, find an input to the alternator regulator that shows battery voltage when the ignition switch is on, and no battery voltage when the switch is off.

Some alternator regulators are enabled via an oil pressure

switch instead of directly from the engine. In this case, the input to the regulator won't have battery voltage applied unless the engine is running.

Battery Temperature Sensors

While the advantages of temperature compensation are clear, sensing temperature does increase the complexity of the alternator system. Faulty temperature sensors can cause an alternator regulator to malfunction ...charge too high or low, or not at all.

Ample Power systems have had battery temperature sensing since early 1987. As of December, 1996, no other company offers this feature. The sensors are silicon devices potted in epoxy inside a battery lug. The lug is designed to attach to the battery post along with normal battery cables. There are now two types of sensors in use.

The original sensor, #1018, uses a single wire that goes back to the regulator. One side of the temperature sensor is attached to the battery lug, while the other side of the sensor exits the epoxy potting material via a small red wire. This type of sensor imposes a voltage drop between the battery and the regulator input. The voltage drop is temperature sensitive, but is approximately 2.4 Volts at 77° F, (25° C). For 3-Step Regulators, the sensing input should be about 2.4 Volts less than the battery voltage.

Since 1992, temperature sensors gained a second wire. The #2018 sensors are still potted in a battery lug, however, there is a red wire and a black wire leaving the epoxy. Both wires are connected to the regulator. When wired into the regulator properly, and with the regulator on, the voltage between the red and black wires is exactly 2.98 Volts at 77° F, (25° C).

Battery Sensing

Ample Power regulators are designed not to charge if battery voltage isn't present on the sensing input. With a voltmeter, verify that the voltage sensing input(s) have the correct voltage on them.

The Regulator

Regulators have a tough life. They usually live in a hot, humid, and perhaps oily, environment. They have to put up with high field currents and switching transients that *kick back* at the regulator. It's no wonder that regulators are a typical cause of failure to charge.

Determining if they work is usually quite easy. Assuming that you've verified proper connections, good temperature sensors, and correct battery sensing inputs, the next test will appear too simple.

Find the field terminal on the regulator, that is, the terminal with a wire going to the field terminal on the alternator. Place a voltmeter on the field terminal. With the ignition switch off, there should be little voltage at the field terminal ...a few millivolts.

Now turn on the ignition switch, (or the oil pressure switch) and observe the voltmeter on the field terminal. After a short delay, the voltmeter should show positive several Volts. Some regulators will immediately show battery voltage, while others, such as the Smart Alternator Regulator ramp up to battery voltage slowly. If the field output tracks the ignition on/off, then the regulator usually works.

Getting Assistance

Free online support is available.