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By Stephen Sommer

Underachieving Alternator?

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I just installed a new high output alternator to improve my battery charging, but it is not putting out the rated current except for maybe the first few minutes after I start charging. The tech support guy that I called said that the problem is probably elsewhere in my boat's wiring. Is that likely, or am I just getting the run-around?

The tech support guy is probably right. That's because there are so many things that can keep a good alternator from charging well.

I will assume that you bought a high output alternator from a reputable manufacturer of upgrade (not OEM) alternators. This means that it will really put out the rated current, at reasonable temperatures and that it is intended to be used with an external "P" type regulator. "P" type regulator, means that the field terminal is supplied positive voltage by the regulator to cause the alternator to output power. Almost none of these assumptions are true if you are attempting to use an automotive alternator. Automotive alternators can be used successfully, but with great care that I will not cover here.

The process of solving such a problem is one of fault isolation. Because you have a new alternator, with a potential warranty issue, start with the alternator itself. In a nut shell, the alternator's job is to produce the rated current (amps) as long as: 1) the field is being supplied full battery voltage, 2) the output voltage is in the neighborhood of normal battery voltage, 3) the shaft is being spun fast enough, and 4) the temperature is not too high. Check each of these conditions one by one.

1) Is the field being supplied full battery voltage? You should be able to determine which wire from the regulator to the alternator is the field wire, by looking at the wiring instructions and the markings on the regulator. The voltage should be within one volt of the battery voltage, to get full output. If you don't have full voltage on the field wire skip on down to "Controlling Your Alternator".
2) Is the output voltage in the neighborhood of battery voltage? Careful here! If the output terminal is not connected to the battery, it could be at hundreds of volts! If the output voltage is below 17 volts, continue on. If the voltage is higher, you have bad wiring, or a bad battery isolator.
3) Is the shaft being spun fast enough? The most common offender here is a loose belt. High output alternators require a lot of horsepower to run. The belts must be kept tighter than many seat-of-the-pants mechanics are comfortable with. If you can turn the cooling fan of the alternator with your hand, the belt may be too loose. The most popular vendor of upgrade alternators' favorite reason for rejecting warranty claims is loose belts that can damage the alternator with external heat from the slipping belt. (They can tell from the "blue-ing" of the overheated metal.) If the belt is tight, try revving up the engine a bit. Some slow idling diesels with small v-belt sheaves don't turn an alternator fast enough. Remember, you shouldn't run a diesel at low idle for long charging periods anyway.
4) Is the temperature too high? You can try to measure case temperatures and compare them with the specs, but problems are usually resolved before it comes to that. Usually, a drop in output is due to a drop in field excitation. If the output drops and you suspect heat, temporarily improve cooling by opening the compartment and using a fan to cool the alternator.

If you have satisfied all four conditions that an alternator must have, then send it back to wherever you bought it, and make sure that you tell them that you checked all these things.

CONTROLING YOUR ALTERNATOR: If you don't have nearly full battery voltage on the field wire, then your regulator isn't "asking" the alternator for full output. The (modern) regulator's first job is to determine the appropriate battery voltage, which depending on battery type, and maybe temperature, will be 14 to 15 volts, during initial charge. Next the regulator compares the battery voltage, as read by the "sense" voltage terminal, to the predetermined appropriate voltage. As long as the "sense" voltage is less than the appropriate voltage, the regulator is supposed to put out nearly full battery voltage on the field terminal. If "sense" voltage is less than 14 volts and it is not putting out battery voltage on the field wire, you have a regulator problem. To be fair, make sure that the regulator has nearly battery voltage on the power input terminal which is often called "ignition" or "run".

If the "sense" voltage is significantly higher than the battery voltage, you need to re-wire the "sense" wire. Properly, the "sense" wire should connect directly to the primary battery being charged. That way the regulator will base charging on the actual voltage in the battery that you care about. Very often the "sense" wire is connected directly to the output of the alternator. This means that the battery voltage will be lower than the "sense" voltage, which will cause greatly reduced charge rates. This is especially true if you have a battery isolator, which will cause nearly a one-volt drop. Long, undersize wire can cause that much loss too. Be careful when changing your "sense" wiring though. Make sure that the "sense" wire is always connected to the battery being charged. If there is a battery switch that can allow a disconnect, you may have a situation where one battery can get no charge while another one is destroyed by uncontrolled overcharging.

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Have a systems problem or question? Ask Stephen Sommer. Email: steve@boatek.com