Tech Tips

by Old_Salt

During recent meetings and gatherings we've been asking your opinion on ways to broaden the appeal for this newsletter. Several folks have suggested that articles on various marine systems or boat maintenance may be beneficial. Hopefully, this column will be a forum for sharing the vast range of practical experience accumulated by our membership. It is also intended to be the place where you, the reader, can submit technical questions and either obtain answers or direction to appropriate reference material.

Since the flood of letters and e-mail has been so magnificently underwhelming in response to previous articles I can safely assume either of two scenarios. One, you loved it but are too embarrassed to ask questions; or two, you haven't understood a word I wrote. In either case I can safely continue my assault on the six chosen topics without fear of criticism or revocation of my membership. In case you don't remember, the topics are; electrical wiring, alternators and regulators, batteries, grounding and bonding, radios and antennas, and instrumentation (depth, speed, GPS, LORAN, etc.).

The previous articles covered wire and connections that comprise the electrical power delivery system of a boat. But what produces the power? Since Friendships spend most of their time away from a pier and power receptacle, it's a safe bet that most of our electrical power production comes from the engine driven alternator. I don't know if there are any boats out there with 12vdc generators, but for the sake of brevity I'm not going to get into them. If you have one and have any questions give me a call, or e-mail me at old_salt@ix.netcom.com.

Most of the problems I've encountered with marine alternators were caused by replacement of the original alternator with the wrong part, or gradual "consumption creep" that overpowers the existing one. The scenarios are quite different, but the results are the same....an unsatisfactory and potentially unsafe electrical system.

As delivered from the factory and installed on a boat the alternator installation was probably well done. However, years of operation in a marine environment eventually take their toll forcing its replacement or addition of power hungry navigation equipment (i.e. the 12-volt blender for the Margaritas) gradually forces recharging the batteries more often. In the either case adding a high output alternator to the electrical system is a good idea. The trick is to do the installation correctly.

If you have a gasoline engine you have to make sure that the replacement unit is certified for "MARINE" use. Units so certified have internal screens and shielded brush assemblies that greatly reduce the potential for ignition of gasoline vapors. Additionally, sealed bearings are normally employed to keep salt moisture out. But buyer beware! Even though you have the original part number it may be wrong and not for a MARINE grade item. The engines used in boats are usually available in several configurations, many of which are industrial.... not marine. Another problem is that an alternate or substitute part number for the original may be called out in the parts catalog and it may not be "MARINE" grade alternator. Check it out carefully or have a marine mechanic/electrician inspect it for you.

Replacement alternators usually don't have pulleys installed on the shaft when taken out of the box. This is good! It forces you to use the original pulley that is more than likely sized correctly. Since the pulley on the engine that drives the alternator is bigger than the alternator pulley, the alternator rotor spins faster than the engine. For instance, if the engine crankshaft pulley is 8" in diameter and it is turning at 1,000 RPM, a 4" pulley on the alternator will turn the rotor at 2,000 RPM. The speed ratio is inversely proportional to the pulley diameter. A modern alternator needs to spin at 5,000 RPM to produce its rated output. If your engine RPM for normal cruising is 3,000 RPM the alternator is only turning at 6,000 RPM, just above the speed it needs to produce its rated output. Higher RPM certainly won't hurt it. They can safely operate at rotor speeds in the 10,000 RPM range.

Gasoline fueled engines normally operate in higher RPM ranges than diesels. If you have diesel power, the alternator pulley's size is more critical than in a gasoline engine installation. Because of the lower engine RPM range involved the pulley on an alternator used with a diesel engine will normally be smaller than one used on a gas engine. If we use the same pulley sizes as in the previous example, 8" crankshaft and 4" alternator rotor pulleys, and use a normal diesel's cruising speed of 2,000 RPM, the alternator is only spinning at 4,000 RPM. Well below the speed needed to reach its rated output. In diesel applications size really matters! And unlike most things in life, smaller is better.

One of the problems I see on older boats directly relates to pulley size. In an attempt to maintain our reputation as frugal Yankees we replace the ancient, rusty, burned-out alternator off the beloved behemoth below decks with one from the old Chevy out behind the barn. The wiring isn't that tough to figure out and the "idiot light" on the engine panel goes out when the engine is up to speed. The voltmeter even reads 12 VDC. But the darn thing just won't keep the batteries charged. The reason is that the alternator isn't spinning fast enough to produce the current needed to recharge the batteries. The boat's engine, being a diesel, won't turn the Chevy's (gasoline powered engine) alternator fast enough because no one thought to change the pulley.

Here's a good way to check the alternator installation. Before you start it up, measure the voltage across the starting battery with a digital meter. You can use an analog meter but be aware that the change in the voltage reading is fairly small and may not be easy to read on an analog scale. A new, fully charged battery should read about 13.7 VDC, but the actual value isn't that important for this test, just remember what the value was. While holding the meter leads across the battery terminals, have some one start the engine. The voltage will drop while the engine is being cranked. This is normal. When the engine starts and you release the starter motor the voltage across the battery should increase, up to the original value that you read before you started it, then slowly beyond that value to about 14.2 VDC or greater. At an idle (600 - 800 RPM) the alternator should be able to maintain an output voltage of about 14.2 VDC across the battery.

If your results are somewhat less than these, you more than likely have a problem somewhere in the charging system. A good place to start troubleshooting it would be to measure the diameter of the pulleys and calculate the RPM of the alternator. If it isn't in the 1800 - 2400 RPM range while the engine is idling it may not have the right size pulley. The best way to determine the minimum RPM for the alternator is to check out the manufacturer's technical data sheet (if you can get a copy). The next best thing is to install an ammeter in series with the battery output and actually measure the charging current going to the battery under varying engine speeds. The ammeter should always read slightly above zero or a greater positive value. It should never read a negative (discharge) value with a good alternator and regulator.

There are several sources of alternators if you need to purchase one. Boat US, West Marine and J.C. Whitney are good mail order sources. The West Marine Master Catalog also has a very informative Advisor section on how to choose alternators and regulators. The last J.C. Whitney catalog I received listed a marine alternator in their marine section that was very reasonably priced when compared with West and Boat US. If you are thinking of upgrading your alternator I highly recommend getting an externally regulated model. But more on that subject in the next article.