Tech Tips: Checking a Marine Alternator or Generator Output

By Bill Whitney

Whether your Friendship is a Class 'A' or a newer sloop, chances are good that it has been modernized with some form of mechanical propulsion to complement her sails. This could take several forms. From the 1920's through 50's it was usually a gasoline engine, but as technology developed after WWll these power plants started shifting to diesel, providing a better safety margin, and as time progressed, less weight. Today we are seeing advances in battery and battery charging technology which have introduced electric propulsion.

We have become used to having this "iron wind" capability to get us where we want to go when the wind quits or shifts contrary to our destination. We also have become used to having the electrical energy from the battery or battery banks. How much energy the battery banks hold is dependent on how many batteries there are, their condition, how well engineered the installation is, and how well fed they are by the generator or alternator driven by the boat's propulsion plant. In other words, how big is "the tank", how well is it connected, and what equipment do you have to keep it full. Since the first two elements of the equation are governed by the builder of the boat, and to a degree by the maintenance it receives, this article will only focus on the alternators, generators and their regulators that keep "the tank" full.

Early gasoline and diesel engines were equipped with generators. Starting in the early 60's, these engines were equipped with alternators. What's the difference? The difference is both mechanical and electrical and, to explain sufficiently, beyond the scope of this article. Suffice it to say that generators produce direct current (DC) using mechanical switches, and alternators create alternating current (AC) and use big diodes (electric switches) to convert it into DC. Alternators are far more efficient and reliable than generators, and have universally replaced generators in this application.

No matter which you have, generator or alternator, the key is how much energy it puts back into your batteries. A key component to this is the regulator that controls the device's output. If you own a voltmeter it is fairly easy to check the health of the components in the system that's keeping the batteries fully charged. Before you begin testing the system you have to make sure the battery or batteries are in good shape and are at least 75% charged. A standard lead-acid battery at rest, that has not been charged or used for 12-24 hours, should read 12.4 volts or higher at the battery terminals. If it is less than 12.0 volts, the battery has a problem and should be replaced. Be sure that the measurement is made directly on the battery posts. If you take the measurement through any of the cabling, a drop in voltage may be caused by a corroded cable connection.

The next step is to check the belt for proper tension. A loose belt will slip on the pulleys and fail to turn the rotor at the correct speed, especially when putting out a high current while recharging the batteries. Be sure to check the belt for wear, cracks or dryness. Worn or damaged belts should be replaced. A rule-of-thumb for belt tension is that the belt should not deflect more than 1 inch on its longest dimension. If it's too tight it will stress the bearings of devices driven by the belt.

Now it is time to start the engine and bring it up to a high idle of 800-1000 RPM. Now check the voltage at the battery again. After 2-3 minutes it should be between 13.6 and 14.2 volts. If it is less than that, measure the voltage at the output of the generator or alternator. This is done by putting the voltmeter's positive (red) lead on the terminal where the big cable is attached and the negative (black) lead on the engine block. If this reading is less than 13.8 volts the generator or alternator is defective. If it is more than 14.8 volts then there is a problem with the regulator connections, the regulator itself, the cables going to the batteries, or the battery switch. In no case should it be over 15.0 volts. In this case you need to clean up all the connections or replace any questionable cables. Remember that you need to check both the positive and negative cable connections. On at least one occasion I've observed that the only problem was a questionable ground connection between the generator/alternator and the engine block.

Note that most alternators have the regulator inside the alternator case where you can't see it. Some custom installations have an external "smart" regulator, which controls the alternator output. In either case the voltages shown above will tell you if things are working correctly or not.