4 ELECTRICAL RECOMMENDATIONS FOR YOUR BOAT

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At this time of year, boaters are usually starting to think about getting the boat ready for the summer. Armed with a to-do list and a bag of brochures from the boat show, it is time to get organized. It is also a good time to look at buying a new boat or a new-to-you boat, but where to start? And when it comes to the electrical, where should you invest your money? We get this question a lot so we decided to give you our top picks for electrical necessities.

Xantrex LinkPro

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BATTERY MONITOR

This is our number one recommendation; a battery monitor is a fuel gauge for your batteries and takes the guesswork out of managing your energy consumption. How deeply you discharge your batteries directly correlates to how many battery cycles you can expect from them. For instance, if you completely discharge your deep cycle, flooded lead acid batteries every time you use them you can expect to get only 50 cycles. For better battery life, it is advisable to keep your maximum depth of discharge to 50 percent, by doing so you will get 300 cycles from those batteries. Basically, managing your battery power with a battery monitor will save you money and in the long run will pay for itself over and over.

When you install your battery monitor, it is important to remember to set your battery type and capacity. Many battery monitors are preset, for example, the Xantrex LinkLite assumes you have 200-amp-hour, lead acid batteries. Your actual battery capacity and type will, most likely, be different so you must change these settings for the battery monitor to give you an exact reading. The other important installation tip is the location of the shunt. Ensure that there are no negative loads (diesel heater or bilge pumps) or charging (solar panels or EFOY) connected directly to the batteries as these will bypass the negative connections on the shunt and will not be seen by the battery monitor. This is the biggest mistake we see in battery monitor installations. The most popular battery monitors on the market are the Xantrex LinkLite and LinkPro, and the Victron BMV-700 and 702.

Xantrex LinkLite

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ENERGY STORAGE

The most common batteries on boats are lead acid, either flooded or AGM (absorbed glass mat) batteries. You can tell the difference because most flooded batteries (deep cycle, for example) have caps on the top and require you to refill the water on a regular basis. AGM batteries are sealed, require no water to be added and are almost maintenance free.

As mentioned earlier, well-maintained, flooded lead acid batteries will give you approximately 300 cycles. AGM batteries will typically provide 450 cycles if the depth of discharge is not brought lower than 50 percent (from 100 percent to 50 percent of capacity). A Firefly carbon foam battery can be taken to 80 percent depth of discharge from (100 percent to 20 percent of capacity) and gives an impressive 1,200 cycles.

So how do you choose which battery is best for you? The first thing to consider is space. Many older boats were designed around a very small house battery bank as the electrical requirements were low, and there were no complicated navigation systems, heating systems or AC appliances (microwave, coffee maker, etc.). If space is limited, you are best to go with a high energy density battery such as the Firefly as it packs double the usable amp hours in capacity as a flooded lead acid battery.

It is always a good idea to keep your starter battery separate from your house batteries. It is one thing not to have a cup of coffee in the morning but a completely different thing if the engine won't start. (Right?)

3

INVERTER

Inverters are used to change direct current (DC) to alternating current (AC). We recommend a pure sine wave inverter because they can run AC inductive loads such as microwaves, TVs and laptops really well. Pure sine wave inverters produce a cleaner power, identical to that in your land-based power from a utility company. We also recommend an inverter/charger combination so you have the benefit

of an inverter combined with the multi-stage charger, which is designed to maintain and condition the batteries, extending the battery life. Xantrex has just released two brand new options that are becoming very popular, the Xantrex XC 1000-watt inverter with a 50-amp charger and the 2000-watt inverter with an 80-amp charger.

4 CHARGING SYSTEM

A. High Output Alternator with a Regulator

An alternator runs when the engine is running so it is important to remember that it is mechanical and spun by the engine. This means that the output is variable depending on the engine RPM, at idle or full cruise, so you have limited control over amperage. In the past, the alternator technology was limited by the half-inch V-belt. A single V-belt could drive a 90-amp alternator, but it was difficult to run a larger alternator without causing some complications such as V-belt slipping.

A few companies had dual V-belts but some companies, like Volvo, switched to the serpentine belt. Engines were no longer just for propulsion they had to charge even larger battery banks. These new serpentine belts allowed for a 165 or 200-amp alternator. Manufacturers even started developing serpentine pulley kits for older engines to allow them to install high output alternators. This new alternator technology allows for higher output at a lower RPM but the greatest advancement is in the refinement of the software that allows the regulator to be smarter and optimize charging.

This opened up the market for higher output

alternators and external regulators. However, the charge profile for AGM lead acid batteries was different than flooded lead acid. They required an external regulator to adjust the voltage, which led to the introduction of multi-stage programmable regulators. Companies, like Balmar and Xantrex, were able to develop software and systems that made regulators even smarter.

An external regulator basically transformed an alternator into a smart, three-phase charging device. Users could even choose pre-set charging voltages based on battery type or could even create their own custom three-phase charging voltages. Furthermore, some regulators now monitor alternator and battery temperature to adjust to the correct charging voltage. When implementing alternator output upgrades, we recommend the Balmar or Electromaax alternator that is high output at low RPM.

The Balmar alternator regulator pulley kit might need to be installed to drive anything over 90 amps. This will switch your drive from V-belt to serpentine. Serpentine is the best option. You'll need to change the DC wiring between your alternator, both positive and negative to house bank, including the fuse to accommodate the larger current produced by the new alternator and/or external regulator setup.

B. Battery Charger

When sizing a charger, the general rule of thumb is that the charge rate should be at least 10 percent of the total amp hours of the battery bank. For instance, a 400-amp-hour battery bank would require a 40-amp charger. Depending on the type of lead acid battery the top end of the charge rate can be higher. For instance, an AGM battery can take up to 40 percent of the battery capacity as a charging amperage. A flooded lead acid battery is a little less, at 25 percent of the battery capacity as a charging amperage. With large battery banks (800 amp hours or more at 12VDC), it is worth considering adding a second charger to ensure that the batteries charge at the right rate of charge to prolong battery life.

C. Solar Panel

One of the most common questions we get about solar panels is how much daily output should you expect from solar panels in the Pacific Northwest? Without getting too involved in a long calculation, there is a shortcut to convert watts, the unit of measure used to quantify the output of a solar panel, and the realistic output in daily amp hours. Simply, take any solar wattage and divide it by either four if you are optimistic on the output, or divide wattage by five if you are conservative. For instance, a 100-watt solar panel should provide optimistically 25 amp hours/day or conservatively 20 amp hours/day.

When you are sizing a solar panel system for your boat, it is good idea to consider having more output than you need on sunny days to offset the cloudy days. Starting with the solar panels, they must be interconnected to the wiring via waterproof MC-4 connectors. These connectors are handy because they allow the connections to be disconnected and reconnected with ease. This makes it easy to store them in the off-season.

With respect to installation, you must use components that will carry as much power as possible back to the batteries. Next is the wiring, each panel should be connected via gauge 10 wire for positive and negative. The reason for choosing such a large gauge wire is to minimize the voltage drop

and therefore maximize the efficiency. The average peak amperage expected from a 100-watt panel is about five amps at 12 VDC. You may be tempted to consider ampacity alone when choosing the right wire, but in a 12/24 VDC system voltage drop is normally the deciding factor. It is much better to spend a few more dollars on the right size wire and reap all the power from the solar array.

D. EFOY

Like solar, the ability to have a charging source that is quiet, vibration-free and emissions-free is really catching on in the marine community. There are three EFOY models, designed specifically for the marine and RV industries, an 80, 140 and 210. The model number indicates the daily energy output, in amp hours, the unit will produce in 24 hours for a 12VDC battery. The EFOY is by no means a replacement for a traditional generator, its real purpose is to offset battery usage and DC loads. It comes with an integrated charge regulator that monitors the charging status of a 12-volt battery bank. The EFOY will start automatically when it senses the battery is low and then switch off when the battery is full. When you install the unit, it is important to select the type of batteries you will be charging, such as flooded or AGM. The EFOY is fully adjustable to match the charge requirements of different battery bank sizes and chemistry.

As for output, running an EFOY 210 for 12 hours a day of continuous duty will provide 105 amp hours. Knowing that a 10-litre fuel cartridge is 925 amp hours of capacity, you could run an EFOY 210 at 50 percent (12 hours out of 24 hours) for almost nine extra days until you would need to change the fuel cartridge. Last summer, an EFOY client boated 30 continuous days without plugging into a marina and one container of fuel lasted 25 days. Having installed many of these EFOY systems aboard local cruising boats, our experience is that most boaters on the West Coast use two fuel cartridges per season.

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We are often asked for our recommendations and we always say, "it depends on how you use your boat." If you boat from dock to dock, then alternative charging sources may not be necessary. If you anchor for weeks at a time you will most certainly want to entertain solar for the summer and possibly an EFOY to kick in on the overcast days. Before you start any electrical installation, it is a good idea to do your homework and to speak with a professional to ensure that you are getting the best value for your money.

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Jeff Cote is a systems design engineer and owner of Pacific Yacht Systems, a full-service shop delivering marine electrical and navigation solutions for recreational boats. Visit their website and blog for info and articles on marine electrical systems, projects and more. pysystems.ca