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POWER UP

A Proper Inverter System Requires Good Components — and a Professional Installation

If you're thinking of adding an inverter to your boat, it's important to understand that several different components are needed not only to produce 120-volt-AC electricity from a 12-volt-DC battery bank, but to efficiently recharge that battery bank as well.

A well-designed system includes the inverter/battery charger itself, a large, separate battery bank, a high-output alternator, a "smart" regulator and an accurate monitoring device.

Most importantly, all these components have to be installed properly, following ABYC standards. Unless you really know what you're doing, the installation is best left to a top marine electrician.

Determining Your Load Requirements

Before choosing these components, you have to do your homework. First determine what equipment you want to power with your inverter. Make a list of all 120-volt-AC gear except for your air-conditioning system and hot-water heater, which, because of their high power requirements, should be run off your generator or shore power only.

Find the power requirement of each item in its instruction manual or on its back panel. This is usually given in amps at 110 to 120 volts. Convert that number into a 12-volt power rating by multiplying it by 10.

A basic household refrigerator usually requires 3 amps when running on 110 to 120 volts AC. The 12-VDC equivalent is 30 amps. Now estimate how long that unit will run during a 24-hour period. If well-insulated, this unit may run 40 percent of the time, which equates to 288 amp-hours of use over a 24-hour period (30 amps x 24 hours x 0.40 = 288).

Do this for every AC appliance you'd like to power with your inverter, and then do it for all your 12-volt-DC gear, such as cabin lights, fans, anchor light, navigation

equipment, etc. (don't multiply the 12-VDC amperage ratings by 10). Estimate on the high side to be safe, and then add everything up. This will give you your estimated daily power requirements in amp-hours.

Choosing the Right Inverter

To determine how big an inverter you'll need, estimate which 120-volt-AC items you want to run at the same time. Inverters are rated in Watts, so multiply your peak DC amperage usage by 12 to convert to Watts (power in Watts = voltage x amps). If all the items you turn on draw 100 amps at 12 volts, you'll need at least a 1,200-Watt inverter. But it's wise to specify a unit that has at least 20 percent more capacity, so in this case specify a 1,500-Watt inverter.

Today, the cost of a full sine wave inverter is close to that of a modified sine wave model. While most appliances will work OK on the latter, sensitive electronics and an odd assortment of products such as bread makers and laser printers will work only with full sine wave inverters. Many inverter models also include a high-end battery charger, something you'll want as part of your overall electrical system.

Bigger Banks Are Better

The inverter gets its electrical energy from a battery supply that must be matched to your overall load requirements. Think of your house battery bank as a fuel tank. Instead of gallons, you'll want to know how many amp-hours your battery bank has.

The rule of thumb in determining the optimum size of your house bank is that it should be three times your average daily load requirement. Why three times larger? First, you shouldn't allow your batteries to discharge more than 50 percent of their total amp-hour capacity. If you start with a hefty 1,000 amp-hour bank, you can use only 500 amp-hours of it.

Secondly, alternators will recharge the bank to 85 percent of its total capacity in the shortest amount of run time, (the last 15 percent can take three times as long) leaving you with a 35-percent window of power. In the case of a 1,000 amp-hour battery bank, you really have only about 350 amp-hours of usable energy unless you return to shore and charge up with your battery charger or run a very long time using your engine-driven alternator.

There are many types of large, 12-volt batteries. Don't make the mistake of using an engine starting battery for your house battery. These are designed to deliver cold cranking hours, period. They are not efficient, deep-cycle batteries, regardless of how big and heavy they are.

An economical house battery is the ever-popular 6-volt "golf cart" cell that can be wired in a series-parallel arrangement to create a large, powerful bank. These are designed to provide about two to four years of heavy use. And, they have a small footprint, which makes installation easier. Even better are the more expensive



“scrubber-sweeper” cells that will last three to five years with heavy use. Over the years, I’ve had excellent results with the Trojan brand.

Your house battery bank should be installed as close to the inverter as possible to minimize cable length. Nothing kills a battery faster than high heat (except a dead short, of course), so it’s best to keep your house batteries out of the engine room.

Keep a Close Eye on Your Battery’s Condition

Because of today’s accurate, digital amp-hour meters, forget the old tried-and-true system of splitting your house battery into two circuits, switching from one to the other on odd/even days. It’s better to create one large battery bank, which maintains its proper voltage over a longer period, than one half its size. This will allow your gear to run more efficiently at a higher voltage because a large battery bank will maintain its 12-plus-volt output over a longer period.

To make sure you don’t run out of “electrical fuel,” you’ll want an accurate amp-hour meter that monitors your battery bank. Don’t rely on old-fashioned, analog voltage meters, as they don’t tell you what’s really going on with your battery. Sophisticated units such as those marketed under the Xantrex/Link name will monitor your battery, telling you its exact voltage, how many amps are being used at that moment, how many amp-hours have been used since the last charge, and what the amperage rate is during charging cycles — all vital data.

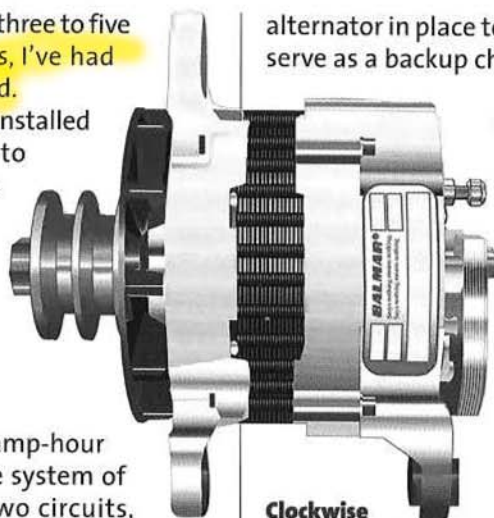


Recharging Your Battery Bank

Factory-installed alternators are designed to keep your engine starting battery charged. You’ll want to add a

high-capacity alternator with a “smart” regulator to recharge your house system while underway. There are many variables to consider when matching the alternator to your engine and your specific power requirements. Pulley ratios, belt widths and torque requirements are all important here, as is the overall power curve of the alternator itself. For example, if you do a lot of idle speed trolling, you’ll want the alternator to deliver a good amount of its power at low rpm.

Big alternators, ones that can deliver 220, 270 or even 300 amps, require as much as 10 to 13 hp from your engine, so a double-belt system is necessary to harness your engine’s crankshaft power. Check the belt tension on a regular basis, because a slipping belt causes friction, which causes heat — a sure way to shorten the life of your expensive alternator. Leave the factory-installed



Clockwise from opposite: Xantrex MS2000 sine wave inverter/charger; Balmar Series 95 alternator; Trojan T-105 deep cycle battery.

alternator in place to charge your starting battery and to serve as a backup charging system.

To get the most out of your alternator, a “smart” regulator system will properly manage the rate of charge that it delivers to your battery bank. Units such as the Xantrex/Link 2000R provide accurate monitoring of two separate banks and can be programmed to properly regulate your high-capacity alternator, matching its output to the battery’s characteristics and current condition.

While plugged in to shore power, you’ll want a high-performance, smart battery charger. Some inverters have built-in chargers; others are stand-alone products. It’s interesting to note that the biggest chargers are rated at about 120 to 140 amps, making the alternator the more powerful charging device.

Of course, if you have a generator, it can power your battery charger, giving you an excellent, alternative way of recharging while anchored out.

Playing It Safe

There are many high-quality inverters, batteries, alternators and smart chargers on the market. Some of the top brands to consider include Xantrex (it now owns Heart, Pro-Sine, Trace and Link) and Charles Industries. A good selection of high-output alternators is marketed under the Balmar name. But an inverter system is only as good as its installation. While it’s hard to get electrocuted with 12 volts, using the wrong-sized wire or making a mistake can cause a serious fire. And since an inverter is virtually silent, it’s easy to forget that 110 volts are being supplied to your AC outlets.

I highly recommend hiring a qualified marine electrician to design and install your system. If your boat came with a system, it may be wise to have an outside expert check it anyway. A number of times I’ve seen boatbuilders create a potential disaster because they simply didn’t understand the system as a whole.

When it’s done right, you’ll enjoy the peace, quiet and freedom of having all the power you need from a high-performance inverter system. — G.S.

RESOURCES

Xantrex Technology 800-670-0707; www.xantrex.com
Charles Industries 847-806-6300; www.charlesindustries.com
Trojan Batteries 800-423-6569; www.trojan-battery.com
Balmar Alternators 360-435-6100; www.balmar.net
Marine Electric Systems 410-647-5001