Inverters Give AC Power at Sea

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If electrical appliances and power tools have become necessities on your boat, but you object to the noise and expense of a continuously running genset, chances are that you've looked into the option of an inverter. A modern inverter can be real useful aboard a boat, but it's important to understand a little about its characteristics.

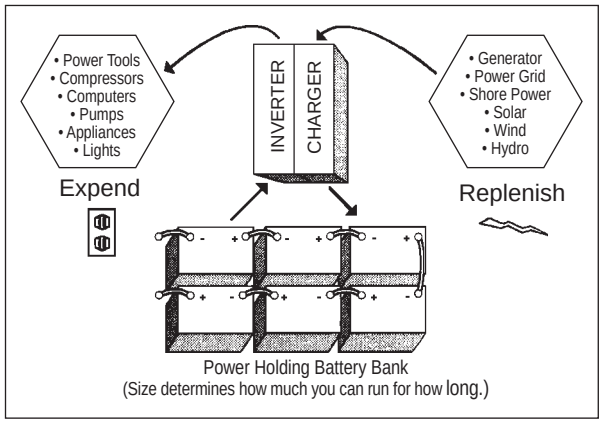
An inverter changes 12-volt DC from your batteries to 120-volt (or 115 or 110) alternating current, the same as household power. It can run anything, from a computer to a freezer to an electric drill; and if sized correctly, it can run them all at once.

In light-duty applications, where demand is less than, say, 2,000 watt-hours per day and the main engine runs most of the time, an inverter may eliminate the need for an auxiliary generator altogether, saving capital, fuel, weight, and aggravation. For bigger demands a generator is necessary. If demand is moderate but the main engine is run only briefly each day or not at all, a combination of inverter and genset may work best. You can power the heaviest loads and charge the batteries by running the genset a few hours a day, then run refrigerators, computers, microwaves, and the like with quiet inverter power the rest of the time.

There are several things to know before selecting a modern inverter.

Every inverter is one of two types: line frequency or high frequency. Line frequency inverters are larger and heavier than high-frequency units but are simpler, and most models come with a built-in "smart" battery charger. High frequency units use newer technology, are lighter and more compact, and are a little cheaper per unit of output, but that difference diminishes when you add the cost of a good multi-stage battery charger. They draw more standby power than equivalent line-frequency units, although in either case the draw is usually less than one amp.

Most modern inverters produce what is commonly known as a "modified sine wave," but which would be more accurately described as "modified square wave." Their pulse-width-modified sine wave more nearly approximates household power than did the old square wave. The are quite efficient (up to 95%), and adequately drive resistance loads (like heaters) and most induction loads like power tools and refrigerators.



Inverters can convert 12-volt direct current from batteries to 120-volt alternating current, providing power to appliances, tools, and computers on board. Illustration shows simple diagram of the inverter cycle.

But modified sine wave energy causes problems in some applications. For example, some variable-speed motors (found in electric drills) perform poorly, as well as some electric clocks and timers (including breadmakers). Some AC battery chargers either don't work or can be destroyed. Some motors are noisier. Microwaves work but take nearly twice as long to cook. Some computer screens show interference. As one AC power specialist puts it, modified-sine-wave problems are "device specific."

The solution: the true sine-wave inverter. The quality of the output wave is so good that they operate the full range of tools and appliances just as well as household power. The tradeoff is expense; these units cost about a third more for the same output, they are less efficient, and some models have a standby draw of more than one amp. They can cause RF interference with some on-board electronics, a problem that usually can be overcome with proper filters.

Most inverters now in use are the modified-sine-wave type, and they are adequate for most service. The trend is probably toward the true-sine-wave system for its added capabilities, but that's a choice each owner has to make.

Key to success with any inverter is proper sizing of both the unit itself and the battery bank that powers it. Inverters are inefficient if underloaded, and will overheat and shut down if overloaded; so it is important to calculate an AC energy budget to determine how many watts of electricity you expect to use, then buy a unit that meets your maximum needs. Calculate only operating demand; induction motors draw start-up surge power two to three times as great as their operating draw, but inverters are made to supply start-up surge for several seconds before dropping down to their rated output.

Batteries must be true deep-cycle, and banks sized to match the demand. Inverter efficiency decreases rapidly as battery voltage goes down. A rule of thumb is you need amp-hour capacity of at least 20% of the rated output of the inverter. Battery charging capacity must provide full replacement of consumed amperage, including the 5% to 15% lost to inverter inefficiency, on a daily basis.

Most makers offer an optional remote panel. The best include on-off controls, operating parameter resets, battery charger controls, and a battery monitor, all in one compact touch-pad panel. They cost $200 to $300, but are well worth it.

Speaking of cost, if you are not an experienced AC/DC electrician you'll probably need to have a pro do the installation. Depending on the complexity of your systems, you could pay as much for the panel, wires, and installation as for the inverter itself. ✦