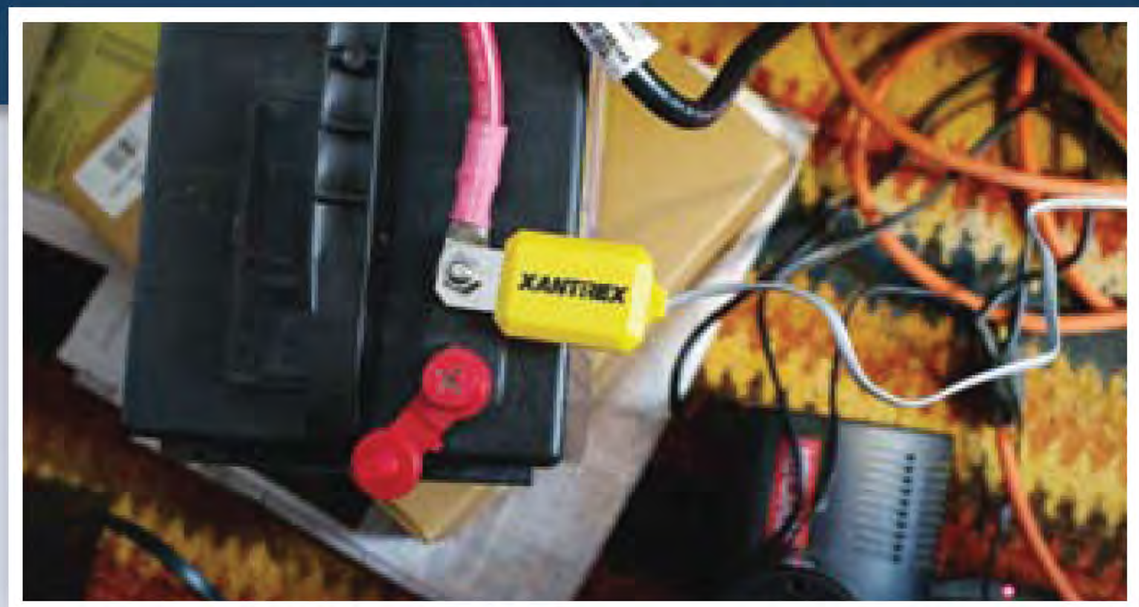

The Xantrex ProSine 2.0 was one of the test products featuring a built-in sensor to measure battery temperature.

Gauging Performance

PS *bench tests marine chargers for function and features.*

Temperature dramatically affects battery performance. At higher temperatures, the chemical activity inside a battery is amplified considerably. In the long term, this higher level chemical activity will reduce the life of a battery.

The best chargers incorporate a temperature sensor that mounts on the battery or one of its posts. The sensor adjusts voltage outputs from the battery charger based on real-time data input.

Many chargers available have a temperature compensation adjustment mounted on their case, and although this is better than nothing, it's still a compromise because all that's being accomplished is that the installer is making a judgment call on the average ambient temperature in the location the charger is mounted. So, one of the things *Practical Sailor* testers considered in our comparison was the availability of a temperature sensor. All but the ProMariner units in our test group have an optional sensor available; the Mastervolt, Magnum, and Xantrex sensors are included.

VOLTAGE AND AMPERAGE CALIBRATION

When studying battery manufacturer's recommendations for ideal charge regimens, you learn quickly that the actual numbers are all over the map. We're talking here about very subtle differences, in the 10th-of-a-volt range. Keep in mind that the voltage difference between a fully charged battery and one that's discharged to 0 percent is only approximately 0.9 volts, and you can begin to understand why these subtle differences are significant.

For testing purposes, amperage is the determining factor in how long it takes to achieve a certain state of charge. It's interesting to note that with any sealed battery, it takes approximately 60 percent of the total charge time to get the battery from a 0 percent state of charge to 90 percent. The remaining 10 percent will take 40 percent of the total time required.

In terms of battery technology, the driving factor is a given battery's internal resistance. This is a huge variable among the different technologies and different manufacturers.

The battery's internal resistance affects what is known as its charge acceptance rate. We know, for example, that a typical AGM battery has a much higher acceptance rate than a traditional flooded-cell battery, but again, the actual acceptance rate will be a controlling factor in how quickly a given battery can be recharged and what the actual charge regimen, in terms of voltage and amperage, should look like.

So with these thoughts in mind, *PS* testers compared manufacturers' methods to deal with this fine-tune calibration, as well as the specific course settings they provide for the different battery technologies.

Many chargers available five or 10 years ago provided only two course settings: one for flooded cells and one for gel cells. Times have changed, and these two settings are simply not ideal with the battery technologies available today.

This may seem like nit-picking—and it would be with smaller installations of only one or two batteries. However, improper settings will reduce battery life expectancy, and our assumption is that since we are talking about inverter-charger units, the battery bank being charged may easily consist of at least two batteries—more likely three or four because of the demand

load on the inverter side. This represents a significant financial investment in batteries, one worth maximizing the return on. At the end of the day, it really is all about individual cost/benefit analysis.

Fine tuning of the charging regimen based on the battery vendor's specific recommendations will be the best way to ensure the maximum cycle life of the batteries and an acceptable return on your battery investment.

AC RIPPLE AND ITS IMPACT

AC ripple, simply put, is the amount of AC leakage past the rectifier set, and there is usually some (electronic filtering) as it converts generator or shorepower voltage to a usable form of DC current to charge a battery. Excessive AC ripple from any battery charging source can cause battery overheating, and in the case of sealed batteries, excessive gassing and ultimately premature cell dry out (loss of electrolyte).

AC ripple is a very heady topic that goes well beyond what we have space to explain here, but suffice to say, it varies depending upon the charge phase and the internal resistance of the battery being charged. For that reason, all of our comparative AC ripple tests were conducted with the chargers connected to the same battery during the final float phase of the charging cycle.

To keep things simple, a generally accepted industry standard for AC ripple from a battery charger is a maximum of 0.4 volts AC. Generally speaking, chargers using a high-frequency converting transformer perform extremely well in this regard. Our tests bear that out, but we also found that several of our traditional low-frequency units did extremely well in this area.

You can see the test results in the Value Guide on page 16.

EMI/RFI EMISSIONS

As we did in the evaluation of these devices' inverter function (February 2010), testers measured the amount of electromagnetic interference (EMI) and radio frequency interference

The Tripp Lite MRV2012-UL measured considerable AC ripple leakage during our tests. Excessive ripple can result in a battery overheating.

produced by each of the units during charging (in the bulk phase). We established a "safe zone of separation," a minimum safe distance for mounting the inverter-chargers away from other equipment that may be either magnetically or noise sensitive.

To test for EMI, we scanned each unit under load with an A.W. Sperry EMF-200A Electromagnetic Field Radiation Tester. For our radiated noise tests, we used a Grundig G2000A AM / FM shortwave radio (frequency spectrums from 540-1700 kHz, 88-108 MHz and 2.3-26.1 MHz) and a Standard Horizon handheld VHF radio (160 MHz).

The results—and our suggested minimum distance for mounting these away from sensitive electronics—appear in the Value Guide on page 16.

THE PHASES OF CHARGING

The 2005 report on dedicated battery chargers provided a comprehensive description of what should happen during each phase of battery recharging. (That archive article is posted online along with this review, and subscribers will find it at *www.practical-sailor.com*.)

There is one point highlighted in that article that we want to reiterate. Some new chargers offer a manually selectable "equalization" phase. This phase is essentially a controlled overcharge. As mentioned in the 2005 article, PS feels that if we wanted to boil our batteries to death, we'd simply connect them to a traditional constant-rate battery charger. We want to re-emphasize this point today.

It's getting harder to even find non-sealed batteries for marine use. The equalization phase should never be used on sealed batteries. It is a sure fire way to destroy the best of new technology batteries.