

Batteries Get No Respect

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Installed deep in the bowels of the boat, out of sight, with no moving parts, batteries all too often don't get the respect—and the maintenance—they deserve. But they are expensive and often difficult to replace, and are crucial to the vessel's effective operation, so let's look at what it takes to keep your boat's batteries up to par.

First, it's important to know what kind of batteries you have. Every boat should have two banks, one for starting and one for general DC electrical use (the "house" bank). Starting batteries are of a specific construction, with many thin plates, designed to deliver high output for a short time. House batteries should be of "deep cycle" construction with fewer, thicker plates, which deliver lower amperage over a longer period. The two banks should be isolated from one another, at least by a selector switch outside the engine room; and preferably supplied by separate alternators.

Both starting and house batteries can be any of three types: lead-acid, gel, or absorbed glass mat (AGM). The former is the least expensive and most common; the latter two are often termed "maintenance free" and carry correspondingly bigger price tags.

For best results the battery storage capacity has to be sized to the electrical energy demand of the boat, and the alternator(s) have to be sized to the battery capacity. Alternator output at cruising engine speed should be 25-35% of battery bank storage capacity. Furthermore, to get optimum performance, especially from your house batteries, the alternator output has to be matched to the battery through a modern stepped-charge "smart" regulator. An internal or external automotive-type regulator is OK for starting batteries since they discharge only 3-5% in normal use.

("Automotive-type" in this context means the single-stage on-off regulator that quickly tops up a lightly discharged battery. All engine room electrical components—especially those used on inboard gas

engines—should be ignition-protected, not standard automotive issue.)

For a primer on marine battery selection and sizing, see the Boatkeeper series article "Getting Started with Marine Batteries" published in *Pacific Fishing* June 1997 issue, and available through Alaska Sea Grant at www.uaf.edu/seagrant/boatkeeper/.

Gel and AGM batteries are "maintenance free" only in the sense that they normally do not lose water during recharging so it's not necessary (or possible) to check the fluid level of each cell and add distilled water if it is depleted. It is possible to overcharge these types of batteries and "cook" the insides but since there's nothing you can do to repair the damage, they are in that sense maintenance free.

Keep Them Charged

All batteries have a finite life, and the single best way to prolong it is to keep them fully charged. Deep cycle battery life is calculated in "cycles" or the number of times it is discharged and re-charged. Discharging them less than fully, and recharging them quickly (that is, soon, not necessarily rapidly) is the best way to ensure a full useful life. Avoid discharging more than half their rated capacity.

To replace the energy that has been drawn out, batteries "make" energy by breaking down the surface of their plates chemically. Recharging restores the plate surface somewhat, but the further the plates are deconstructed the less they are able to repair themselves with subsequent recharges. Starting batteries are shot after only a few dozen complete discharges (in battery terms a discharge is when the energy stored is reduced to half of its full-charge level), whereas good deep cycle units can sustain 300 to more than 1,000 discharges, depending on the quality of the battery and how well it is maintained.

Most boat operators can expect to replace batteries every three to five years, and

more frequently if they buy cheap ones or don't take good care of them.

Keeping batteries charged on a working boat isn't a problem, with properly sized and functioning alternators and good cables with clean connectors. But once a boat is tied up or hauled out, or even sits a few days on anchor, if there's no genset running a charger, problems can occur. Allowing batteries to drain—and allowing them to stay that way for more than a few hours—assures shortened battery life. Furthermore, at winter temperatures a discharged battery can freeze, cracking the case and leaking highly corrosive acid into the engine room or battery locker. All marine batteries should be mounted in fluid-tight boxes that contain any leaking acid.

How do you know if they're staying properly charged? A volt meter at the helm is a far more useful tool than an automotive ammeter for monitoring battery health, and a digital volt meter is best. A fully charged 12-v battery should read 12.6 v on the meter and if it drops to 12.2 it's discharged; 10.5 v and it's a goner. A little five-buck plastic hydrometer (be sure it's a battery, not anti-freeze, hydrometer) allows you to check the state of charge in each cell. Remember, if you have one bum cell, you have a bum battery, because the bad one will suck the life out of the others.

Keep Them Topped Up

If you have lead-acid batteries, fluid levels will drop. Because the charging process creates a chemical reaction that "boils" the acid, water and hydrogen gas are vented out through the caps. (This hydrogen gas is explosive, which is why battery compartments have to be vented and located away from sources of spark.) At least once each operating month pull the caps and check fluid levels on each cell of each battery. The level should be below the top of the case (to allow for expansion) but over the tops of all the plates. Use distilled water (available at

any grocery or drug store) to top up each cell individually. Tap water can be used in a pinch as long as mineral content is low.

Never add acid to a battery except at original installation.

Keep Them Clean

While checking fluid levels, check the condition of the terminals, the cable clamps, and the tops and overall cleanliness of the batteries. Corrosion commonly forms on the terminals and clamps, causing resistance that prevents full charging. The alternator and regulator may be working fine, but the battery weakens because the full output of the regulator doesn't get into the battery's cells. Dirt collecting on the battery top can attract moisture which eventually creates a path for voltage to "leak" out of the battery in the form of a low-grade short circuit. Corrosion can be cleaned from the terminals with a solution of baking soda and water; just be sure it doesn't get into the cells.

Use care, and the correct tools, when removing cable clamps to clean terminals. Don't use hammers, vice grips, or brute force. Beating on terminals can crack the case, ruining the battery. Use a terminal puller, and then use a battery terminal scraper-reamer and wire brusher to clean the terminals. When reattaching, be sure they are clamped firmly in place. Finally, coat terminals with petroleum jelly or a battery terminal sealer compound.

Connect the cables with good marine cable clamps held in place with hex head nuts; no wing nuts, no stainless steel washers (resistance can cause heat buildup and reduce recharging capacity), and no multiple cables off individual terminals.

Some Battery Maintenance Tips

- Ensure all batteries in each bank are of the same type, and regulator is correct kind and adjusted for that type of battery.
- Know each battery's age (as indicated on the punch label on top) and assume that battery life will approximate the warranty period unless proven otherwise.
- Change out batteries when they show signs of diminished capacity rather than wait until they fail altogether.
- Ensure that batteries are correctly installed. Ensure they are immobilized and can't shift in a severe list or even a rollover. Be sure that tops

are covered by non-metallic material and protected from shorting in case a tool or other metal item should drop onto the top.

- Use an installed volt meter or electronic battery monitor to keep track of charge level. Test individual cells with a hydrometer, and wear eye protection when using it. Specific gravity of a fully charged battery (adjusted for temperature according to instructions on the tester) is 1.265. If a cell tests as low as 1.160 it is three-fourths discharged.
- Establish a routine of checking wet cell battery fluid levels regularly, and keep distilled water on hand for topping up.
- Keep terminals, tops, and cable clamps clean and free of corrosion.
- Establish a system for keeping batteries charged when the vessel is not in use. If possible remove them from the boat for storage where they can be charged periodically. If not, use an installed battery charger if shore power is available. "Smart" chargers can be left connected to the batteries and will supply current as needed to maintain an appropriate level of charge. If a source of power for battery chargers is not available, set up a solar panel system or wind generator to keep batteries charged over the winter. ♦