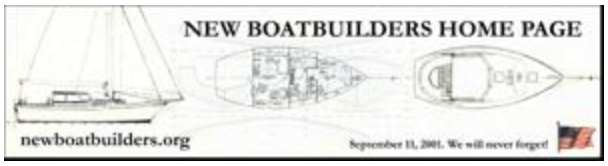

NEW BOAT BUILDERS HOME PAGE

Questions about batteries seem to come up on every boating forum. The top questions seem to be;

1. What type battery should I use, starting or deep cycle?

2. How big (capacity not physical size) of a battery should I use?

3. Who makes the best batteries?

Batteries, for some reason, seem to be a mystery to most people. So here is my contribution to Batteries 101. This is taken directly from my website at http://newboatbuilders.com.

Batteries

Almost all recreational boats use a 12 Volt DC system, and to supply the power for it they use 12 volt batteries. But there are different types of batteries, that come in different sizes and capacities, and have different inside construction. How does one know which batteries to use, when they all look pretty much the same on the outside?

So first let's cover the basics on batteries. I am only going to discuss 12V DC. There are other systems such as 48V and systems that use both 12V DC and 120V AC. But to simplify this I will stick to 12V, since most boats have 12V DC systems. The simplest have a single 12V battery for starting the engine, running instruments, lights, and a few electronic gadgets such as GPS or depth sounders.

The next step up from this is a boat that has a starting battery and then a second battery for running electrical equipment. In particular, bass boats usually have a separate battery to power the trolling motor.

Then there are larger boats with all kinds of electronic equipment, beyond the basic stuff, such as GPS or depth sounders. These boats can be equipped with computers, TVs, VCR's, sound systems, microwave ovens, radars, and so on. These boats generally have a starting battery for each engine and a bank of batteries running all the other equipment. They may have a generator, a charger, an inverter (DC to AC), and converter (AC to DC). They will also have an AC electrical system for AC equipment.

There are three types of 12V batteries that are commonly used; Lead-Acid wet cell, AGM, and Gel Cell. The wet cell is the lead-acid battery that we all are familiar with because we have them in our car. It is called a wet cell because it contains a liquid, a dilute acid, that acts as an electrolyte to transfer electrons to the plates. As the battery is discharged and recharged the liquid level goes down, and occasionally distilled water has to be added to keep the liquid at the correct level. When charging, it is best to open the caps on the top of each cell so that any pressure build up is relieved. These batteries give off hydrogen gas while charging so they must be in a well ventilated place. The photo on Basic Electricity Page 1 , shows wet cells.

AGM stands for Absorbed Glass Mat. This battery has lead plates, like any battery, but has glass mat material between the plates that absorbs and holds the liquid electrolyte. The other difference is that this is a "sealed" battery. They are also called Sealed Valve Regulated (SVR) batteries. In theory you never have to add any liquid to the battery. In fact, there is no way to add liquid. But a common misconception is that these batteries do not out gas, that is, give off hydrogen gas while charging. So people install them in places that aren't ventilated. This is a mistake. Under normal charging

conditions they will not out gas, but they do have a small valve in the top of each cell that, if the battery overheats while charging, will open and release hydrogen. These batteries are very sensitive to charging voltage and temperature. Over charging will result in overheating, out gassing, and a significant shortening of the life of the battery because it dries out the mat.

Gel Cell batteries, like AGM, are SVR batteries. However, the electrolyte is not a liquid; it is a jelly like substance. These batteries are sealed and do not require adding liquid after many discharges and recharges. However, like the AGM batteries, they are sensitive to charging voltage and, if over charged and over heated, will out gas and lose some of their life.

In addition to these three types, batteries are also classified as starting, or SLI (starting, lighting and ignition), deep cycle, and combination starting/deep cycle. Starting batteries are used primarily for starting the engine and powering the ignition and lights. This requires a battery that can release a large current (amperes, or amps) very rapidly, on larger engines upwards of 1000 amps. Starters require a lot of amperage because of the heavy load trying to turn over an engine. To achieve this, starting batteries are built with many thin plates. The plates are made of a spongy like material composed primarily of lead. They are capable of being rapidly discharged and recharged. However, this also means that the voltage from the batteries will quickly drop to a level that is too low, causing overheating of the starter and, if also used to power electronic equipment, problems with the operation of the equipment.

Deep Cycle batteries on the other hand, are designed to release energy slower. They have much thicker plates. True deep cycle battery plates are solid lead. They can be upwards of ¼ inch thick but generally range from .07 inch to .11 inch. Golf cart batteries and fork lift batteries are true deep cycle batteries. They do not release as high an amperage as a starting battery but will maintain the voltage level for a much longer period, so they are used on boats, and other recreational vehicles, as “house” batteries to run all of the electronic equipment and appliances. They also require charging at a slower rate than starter batteries. The draw back is that many of the golf cart type batteries are six volt so you have to buy twice as many. However, there are true deep cycle batteries available in 12V. On an occasional basis deep cycle batteries can be used as a starting battery but may not turn over the engine as fast as a starting battery.

Then there are combination batteries that have both thick and thin plates and are used for both functions. These are often sold as “marine” batteries. Most RV/Marine “deep cycle” batteries fall in this category. They are perfectly adequate for the use they are put to and will last for many years with proper maintenance.

All batteries are rated by cold cranking performance, also known as cold cranking amps or CCA. This is a measure of how many amps the battery can deliver for 30 seconds and maintain the voltage at 12V. Basically the higher the CCA rating the longer the battery will maintain its voltage. Batteries are also rated by amp-hours. 1 amp for 1 hour is 1 amp-hr. Generally the rating is based on how many amps the battery will discharge for 20 hours until the charge drops to 10.5 volts. The higher the amp hour rating the longer the battery will power your equipment. Beware, some battery manufacturers rate them at 100 hours and some at 8 hours. If they produce a data sheet for the battery it should give you the 20 hr rate.

Batteries are also classed by Group. Most common are Group 24 and 27. It is a common misconception that this has something to do with the capacity of the battery. This is a myth. The Group number is solely based on the outside physical dimensions of the battery, and the type of battery terminals it has, that is, top mounted or side mounted. For instance a Group 24 battery is 10 ¼ inches by 6 13/16 inches by 8 7/8 inches. A Group 27 battery is 12 1/6 inches by 6 13/16 by 8 7/8 inches. Here are two links to a chart of BCI Group sizes http://www.rtpnet.org/teaa/bcigroup.html. Consumer Reports on Battery Groups and CCA Ratings . This battery is a Group 24.

There is a lot more information available about batteries on the web. Go to Ike's list, and scroll down to the Electrical links. You will find many references there to batteries.

Battery Chargers

Of course if you have batteries, you need a way to charge them.

The typically automotive charger is what is known as bulk rate. It pumps current into the battery at a constant rate. If it is rated at ten amps then it constantly charges at ten amps. This is not really good for a battery because you need to keep track of what is going on and not allow the battery to overcharge. But they can be used to give the battery a quick boost. They should not be used for long term charging and maintenance.

Most chargers sold today are smart, or regulated chargers. They have a small computer built in that senses the charge state of the battery and as the battery reaches full charge, reduces the amperage to avoid over charging, over heating and destroying the battery. When the battery reaches full charge the charger stops charging. They are often called three stage chargers because they use three stages to charge; bulk, absorption and float. Bulk is used when the battery is deeply discharged and can accept recharge at the highest rate. During absorption voltage stays constant and the current slowly tapers off. Float is used after the battery has reached full charge to maintain the battery. This used to be called trickle charge. Some have a forth level which is equalization. Equalization is a process that brings each cell in the battery to the same charge level. Equalization is usually performed before the float stage. The more sophisticated of these chargers can tell you the state of the battery, if you have

shorted plates (plates touching each other), or if the battery is no longer any good. Some also have a temperature sensor that you can hook to the battery. This type is a must when charging AGM or Gel Cell batteries so that they do not overheat and ruin the battery.

When charging Gel Cell and AGM batteries the charger also need to be voltage regulated and temperature regulated. That is, you can set the voltage range so that it does not rise too high or go too low and the charger senses the internal temperature of the battery so it does not get too hot. The voltage range of the battery varies from brand to brand and battery type. Charging at too high a voltage can shorten the life of the battery. Many of the chargers set the voltage automatically. It is always best to use the charger that is recommended by the manufacturer.

For boats or RVs that have 120V AC systems as well as 12V DC, a good option is a converter/charger. A converter changes 120V AC to 12 V DC to run all of your DC equipment without using up your batteries. A converter/charger has a built in battery charger that senses the level of charge on the batteries and automatically re-charges them. The converter can be run off of shore power or off a generator. But, if you have AGM or Gel Cells you must know if the charger is voltage and temperature regulated.

Also, if you have AC equipment but no generator or shore power, a device called an inverter can take the 12 V DC from your batteries and make it into 110 V AC to run your TV or computer. However, this will drain your batteries very rapidly so you need a larger battery bank to use an inverter on a regular basis.

How about charging amps? How many charging amps should you have, 10, 20, 40? Well, the larger the CCA of the battery then the larger the amperage of the charger should be. Also, it depends on how many batteries you have. If you are charging a single battery you do not need as many amps as if you are charging a bank of two or three batteries. A 10 amp or 20 amp charger is adequate to recharge a single starting battery, but a 40 amp charger is much better for charging a pair of deep cycle batteries.

Some battery manufacturers use a rule of thumb to determine the charging amperage for a battery. For wet cells this is CCA/8, or the Cold Cranking Amps divided by 8. So if you have a 220 CCA battery this would be 26 amps. For AGM batteries it is CCA/20, but check the battery owner's manual. If you had two batteries in parallel, it would be 2 X CCA/20

However, for both Gel Cell and AGM batteries it is critical that the charger be voltage regulated and temperature sensing, to get the maximum life out of the battery.

Last but far from least: for safety's sake, on a boat a charger, or converter/charger must be "marine" and ignition protected. Look for a UL marine listing or a statement that it meets USCG regulations, or 33 CFR 183.410. This means it is ignition protected and will not ignite any gasoline fumes that may be present.

Here are some good links on batteries.

Wind & Sun http://www.windsun.com/Batteries/Battery_FAQ.htm#Battery%20Charging

The ABCs of AGMs http://www.zimmermanmarine.com/docs/AGM%20article.pdf

The MK Battery SVRL Manual http://www.mkbattery.com/pdf/technical_manual.pdf

Car and Deep Cycle Battery FAQ: http://www.batteryfaq.org/

Answer to question Nunber 3. Almost all batteries sold in the USA and Canada are made by a hand full of manufacturers, rebranded and sold under hundreds

of brand names. Also Vision in China makes many different brands for the US and Canadian market and they are the largest battery manufacturer in the world. In th US Johnson Controls us the largest and they are number two in the world.

See Battery brand names and Manufacturers http://www.batteryfaq.org/

So, many of the brands you see at Sears, K-Mart, WalMart, auto parts stores, and marine suppliers are actually made by Vision, Johnson Controls or a few other manufacturers. In fact the Die hard you buy at Sears for $100.00 may be excactly the same battery you buy at WalMart for $49.95.

This is true of most batteries sold as "marine" batteries. But it is not necessarily true of Deep Cycle Batteries. Many of these are sild under the manufacturers name such as Trojan, and Rolls Royce.

So the best battery is the one that fits your needs at the best price. Determine the capacity and then shop for a good price. Most batteries, if well maintained will last 5 to 7 years. Remember, I said well maintained. That does not mean sitting on the garage floor or in the boat's bilge all winter. It means a good quality charger, with a good battery management system to keep the battery fully charged, and it means you checking the fluid levels on lead acid batteries, at least once a month.

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