A Short Primer of Lead-Acid Battery Types

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The common types of lead-acid batteries are presented here in order of worst to best. The "life expectancies" that we've listed for various battery types are the average that we've learned to expect with only reasonable care over the years. Please don't take these figures as a performance guarantee. We've dealt with novices who can destroy the best battery within six months, but we've also been blessed by meeting a few super conscientious people who can make their batteries last more than twice the average.

Car Batteries

The most common type of lead-acid battery is the automotive battery, sometimes called "starting batteries." This type of lead-acid battery has many thin lead plates and is designed to deliver hundreds of amps for a few seconds to start a car. Starting batteries are only designed to cycle about 10% to 15% of their total capacity and to recharge quickly from the alternator after discharging. They are not designed for the deep cycle service demanded by remote home power systems, and will fail fairly quickly when used in a deep-cycling application.

"RV" or "Marine" Deep-Cycle Batteries

This generic category includes most of the 12-volt batteries that Sears, Montgomery Ward, K-Mart, etc. sell as "deep cycle," "RV," or "marine" batteries. They are always 12-volt, and usually have between 80- and 160-amp-hour capacity. These batteries are a compromise between starting batteries and true deep-cycle batteries, as many of them are actually put into starting battery service by RV users who simply don't know better. They will give far better deep-cycle service than starting batteries, and may be the ideal choice for a beginning system that you plan to expand later. Life expectancy for these batteries is typically two to three years.

"Telephone Company" or Lead-Calcium Batteries

During the past 15 years telephone companies have been upgrading much of their switching equipment from the old style 48-volt relay type to newer solid-state equipment. When a telephone station is changed over, the huge battery bank that ran the old equipment is sold or recycled. Occasionally these shallow-cycle lead-calcium batteries are used in remote power

systems. The typical life expectancy for these batteries is 15 to 20 years, although there are some on the market that claim 50 years or more. These batteries can be used in remote power systems, if you treat them carefully. These are shallow-cycle batteries that rarely experienced more than a 15% cycle in telephone service. If you are careful never to discharge them deeply, these batteries can give years of excellent service.

While phone company batteries can sometimes be found cheap, or even free for the hauling, their sheer weight and size make them difficult to contend with. Some of these batteries weigh close to 400 pounds per 2-volt cell. Because cycle capacity is limited to 15% or 20%, you have to buy, move, and install five or six times more battery mass than is required for true deep-cycle batteries. Remember, that phone company battery may be rated at 1,680 amp-hours, but you can only use 20% of that capacity or 336 amp-hours, which isn't much by renewable energy standards. Unless you can find these batteries almost free, we don't recommend them.

Sealed Batteries

Sealed batteries have the acid either gelled or put into a sponge-like glass mat. They have the advantage/disadvantage of being completely liquid-tight. They can operate in any position, even sideways or upside down, and will not leak acid. Because the electrolyte moves more slowly, these batteries cannot tolerate high rates of charging or discharging for extended periods, although their thinner plates will allow high rates for a short time. Their sealed construction, which makes them ideal for some limited applications, makes it impossible to check individual cell conditions with a hydrometer. Although these cells are "sealed," they do have vents to prevent pressure build-up in case of gassing. Many PV charge controls will push charging voltage too high for sealed batteries. Premature failure will result due to loss of water vapor. We recommend sealed batteries only in situations where hydrogen gassing during charging cannot be tolerated, or the battery is going to be moved and handled a great deal, or in conditions where the battery needs to fit into unique, tight spaces. Boats, UPS computer power supplies, and remote expeditions are the most common uses. Special lower voltage charge controls must be used with these batteries. Life expectancy is two to five years for most AGM (absorbed glass mat) batteries, and five to ten years for the higher quality, but more difficult to manufacture, gel cell batteries. Most sealed batteries are AGM types.

True Deep-Cycle Batteries

True deep-cycle batteries are specifically designed for energy storage and deep-cycle service. They tend to have larger and thicker plates. This is the type of battery that is best suited for use with renewable energy systems. They are designed to withstand having a majority of their capacity used before being recharged. They are available in many sizes and types, the most common being 6-volt and 2-volt configurations for ease of movement. Once in place, the multiple batteries are series and/or parallel connected for your basic system voltage. These batteries are built to survive hundreds or even thousands of 80% cycles, though for best life expectancy we recommend 50% as the normal maximum discharge. This leaves you a 30% reserve for real emergencies. Never use the bottom 20% unless you like buying new batteries. The less deeply you regularly cycle your batteries, the longer they will last. The three most commonly available batteries within this group are the "golf cart" types with a three- to five-year life expectancy, the L-16 series with a seven- to ten-year life expectancy and industrial forklift-type batteries with a 15- to 20-year life expectancy. Deep-cycle batteries are usually your best battery investment.

We often recommend the golf cart types for small to medium-sized beginning systems. They make relatively inexpensive "trainer" batteries. Do your learning, make your mistakes, and in three to five years, when they wear out, you'll be in a much better position to judge your needs and what you're willing to pay for them.

New Technologies?

Compared to the electronic marvels in the typical renewable energy package, the battery is a very simple, relatively antiquated, electrochemical package. Tremendous amounts of research

have been directed lately into energy storage technology. Auto manufacturers are desperately searching for a lightweight battery with high energy density and low cost - The Magic Battery. There are currently several dozen battery technologies under intense development in the laboratory. Several of these new technologies are bearing fruit now for cell phones, laptops, and hybrid vehicles, but are still far too expensive for the amount of energy storage required in a renewable energy system.

The possibilities of lead-acid technology are far from tapped out. Lead-acid batteries are also in the laboratory. This old dog is still capable of learning some new tricks. For now we must coexist with traditional battery technology, a technology that is nearly 100 years old, but is tried and true and requires surprisingly little maintenance. The care, feeding, cautions, and dangers of lead-acid batteries are well understood. Safe manufacturing, distribution, and recycling systems for this technology are in place and work well. Could we say the same for a sulfur-bromine battery?