RV Battery Savvy

To properly maintain and extend the life of your RV batteries you need to have a basic understanding of what a battery is and how it works. Batteries used in RVs are lead acid batteries. Lead acid batteries have several cells connected in series. Each cell produces approximately 2.1 volts, so a 12-volt battery with six cells in series produces an out put voltage of 12.6 volts. Lead acid batteries are made of plates, lead and lead oxide submersed in electrolyte that is 36% sulfuric acid and 64% water. Lead acid batteries don't make electricity they store electricity. The size of the lead plates and the amount of electrolyte determines the amount of charge a battery can store.

Now it's very important that you use the right battery for the type of application. The battery used to start and run the engine is usually referred to as a chassis battery or a starting battery. Vehicle starters require large starting currents for short periods of time. Starting batteries have a large number of thin plates to maximize the plate area exposed to the electrolyte. This is what provides the large amount of current in short bursts. Starting batteries are rated in Cold Cranking Amps (CCA). CCA is the number of amps the battery can deliver at 0 degrees F for 30 seconds and not drop below 7.2 volts. Starting batteries should not be used for deep cycle applications.

The battery or batteries used to supply 12-volts to the RV itself are commonly referred to as house batteries. House batteries need to be deep cycle batteries that are designed to provide a steady amount of current over a long period of time. Starting batteries and marine batteries should not be used in this application. True deep cycle batteries have much thicker plates and are designed to be deeply discharged and recharged over and over again. These batteries are rated in Amp Hours and more recently Reserve Capacity.

The amp hour rating is basically how many amps the battery can deliver for how many hours before the battery is discharged. Amps times hours. In other words a battery that can deliver 5 amps for 20 hours before it is discharged would have a 100 amp hour rating 5 Amps X 20 Hours = 100Amp Hours. This same battery can deliver 20 amps for 5 hours 20 Amps X 5 Hours = 100 Amp Hours. Reserve Capacity rating (RC) is the number of minutes at 80 degrees F that the battery can deliver 25 amps until it drops below 10.5 volts. To figure the amp hour rating you can multiply the RC rating by 60%. RC X 60%

The two major construction types of deep cycle batteries are flooded lead acid and Valve Regulated Lead Acid. Flooded lead acid batteries are the most common type and come in 2 styles. Serviceable with removable caps so you can inspect and perform maintenance or the maintenance free type. In VRLA batteries the electrolyte is either suspended in a gel or a fiberglass-mat. Gell cell batteries use battery acid in the form of a gell. They're leak proof and because of this they work well for marine applications. There are several disadvantages to gell cell batteries for RV applications. Most importantly they must be charged at a slower rate and a lower voltage than flooded cell batteries. Any overcharging can cause permanent damage to the cells. Absorbed Glass Mat, or AGM Technology, uses a fibrous mat between the plates which is 90% soaked in electrolyte. They're more expensive than a standard deep cycle battery but they have some advantages. They can be charged the same as a standard lead acid battery, they don't loose any water, they can't leak, they are virtually maintenance free and they are almost impossible to freeze.

The life expectancy of your RV batteries depends on you. How they're used, how well they're maintained, how they're discharged, how they're re-charged, and how they are stored all contribute to a batteries life span. A battery cycle is one complete discharge from 100% down to about 50% and then re-charged back to 100%. One important factor to battery life is how deep the battery is cycled each time. If the battery is discharged to 50 % everyday it will last twice as long as it would if it's cycled to 80%. The life expectancy also depends on how soon a discharged battery is recharged. The sooner it is recharged the better.

What does all of this mean to you? That depends on how you use your RV. If most of your camping is done where you're plugged into an electrical source then your main concern is just too properly maintain your deep cycle batteries. But if you really like to get away from it all and you do some serious dry camping you'll want the highest amp hour capacities you can fit on your RV.

Deep cycle batteries come in all different sizes. Some are designated by Group size, like group 24, 27 and 31. Basically the larger the battery the more amp hours you get. Depending on your needs and the amount of space you have available, there are several options when it comes to batteries. You can use one 12-volt 24 group deep cycle battery that provides 70 to 85 AH. You can use two 12-volt 24 group batteries wired in parallel that provides 140 to 170 AH. Parallel wiring increases amp hours but not voltage. If you have the room you can do what a lot of RVers do and switch from the standard 12 volt batteries to two of the larger 6-volt golf cart batteries. These pairs of 6-volt batteries need to be wired in series to produce the required 12-volts and they'll provide 180 to 220 AH. Series wiring increases voltage but not amp hours. If this still doesn't satisfy your requirements you can build larger battery banks using four 6-volt batteries wired in series / parallel that will give you 12-volts and double your AH capacity.

The 2 most common causes for RV battery failure are undercharging and overcharging. Undercharging is a result of batteries being repeatedly discharged and not fully recharged between cycles. If a battery is not recharged the sulfate material that attaches to the discharged portions of the plates begins to harden into crystals. Over time this sulfate cannot be converted back into active plate material and the battery is ruined. This also occurs when a battery remains discharged for an extended period of time. Sulfation is the number one cause of battery failure. The second leading cause of battery failure is overcharging. Overcharging batteries results in severe water loss and plate corrosion. The good news is both of these problems are avoidable.

Before we talk about battery maintenance we need to talk about battery safety. Lead acid batteries contain sulfuric acid which is extremely corrosive and can cause severe burns or even blindness. And the hydrogen gas that batteries produce when they're charging is very explosive. When you work around batteries you need to wear goggles and gloves, remove all jewelry and do not smoke or use any open flames. Caution: **If you accidentally get battery acid on your skin, flush it with lots of water** and if it gets in your eyes you need to flush with low pressure water for 15 minutes and call a doctor.

Battery maintenance is actually very simple. By performing theses maintenance procedures every three to six months you can extend the life expectancy of your RV batteries. You should make these checks more often in hot temperatures or during heavy battery usage.

The first thing we want to do is visually inspect the battery for any obvious damage. Any fluid on or around the battery may be an indication that electrolyte is leaking from the battery. A damaged or leaking battery should be replaced immediately. Inspect the battery terminals, cables, and connectors for any damage and for good connections. Look for any signs of corrosion. Corrosion can be neutralized with a 50/50 mixture of baking soda and warm water. Use one pound of baking soda to one gallon of water. Clean any dirty battery terminals and the insides of cable clamps with a post and clamp cleaner. If you remove any battery cables always disconnect the negative battery cable first. When you reconnect the clamps to the terminals connect the positive cable first. Never over tighten the battery terminals. Warning: Do Not over tighten terminals. This can result in broken battery posts, post meltdown and / or fire. When you finish, spray the clamps with a battery terminal protector.

Checking the electrolyte level on a regular basis can save your flooded lead acid batteries. Check the water level monthly and if you leave your RV plugged in with the batteries being charged by the converter battery charger check it bi-monthly. If your converter doesn't have a three stage charger the battery is getting a constant charge of 13.5 volts. When the batteries are topped off this voltage is too high for a float charge and it can boil off the electrolyte over time. When you add water only use mineral free water. Distilled water is best and only fill the cell to 1/8 inch below the fill well. Overfilling cells will cause battery acid to overflow. When this happens the battery will lose some of its capacity and corrosion will build up on and around the battery. Water should only be added after fully charging the battery unless the water level is below the plates.

Follow these steps for watering the battery. Remove the vent caps and look inside the fill wells. Check the electrolyte levels. The minimum level required for charging the battery is at the top of the plates. If it's below the plates add enough distilled water to cover the plates before you charge the battery. Fully charge the battery before adding more water. When the battery is charged remove the vent caps and check the electrolyte levels. Add distilled water until electrolyte level is 1/8 inch below the fill well. Replace and tighten all vent caps. **Warning: Never add battery acid to a battery.**

Visual inspections of our RV batteries are important, but that won't tell us the actual condition of our batteries. We need to test the batteries to determine their state of charge and overall condition. There are a couple of different ways to check your batteries state of charge. You can measure the voltage with a digital voltmeter or check the specific gravity of the acid with a hydrometer. Testing the specific gravity is the preferred method but measuring voltage has its advantages. If you have sealed batteries your only choice is to measure voltage and measuring voltage can give you a quick picture of the batteries depth of discharge so you know when they need to be recharged.

If the battery state-of-charge is below 70% the battery needs to be recharged before you test it. The battery should not be tested if it has been charged or discharged in the last 6

hours and preferably 24 hours. This is called an open circuit voltage test. To measure the voltage you need a good digital voltmeter. Using the DC voltmeter check the voltage and compare it to this chart.

% State Of Charge	Specific Gravity Corrected 80 F	Open Circuit 12-Volt	Open Circuit 6-Volt
100	1.277	12.73	6.37
90	1.258	12.62	6.31
80	1.238	12.50	6.25
70	1.217	12.37	6.19
60	1.195	12.24	6.12
50	1.172	12.10	6.05
40	1.148	11.96	5.98
30	1.124	11.81	5.91
Discharged	1.120	11.80	5.90

Whenever possible you should avoid discharging a battery below 40%. Battery readings that are off of this chart indicate the battery was left discharged too long or the battery may have a bad cell.

The preferred method for testing the battery's state of charge is to check the specific gravity reading of each cell. You can purchase a hydrometer at an auto parts store for less than 10 dollars. The electrolyte is a solution of acid and water so you need to wear goggles and gloves and avoid skin contact. Remove the vent caps and check the electrolyte levels. There has to be enough electrolyte for the hydrometer to pick it up. If you have to add any water you'll have to charge the battery and then let it sit for at least six hours before testing. Fill and drain the hydrometer at least twice in each cell before taking a sample. Make sure there is enough electrolyte in the hydrometer to support the float. Take the reading and record it then drain it back into the cell. Test all of the cells and replace the vent caps. If your hydrometer does not compensate for temperature you must correct the readings to 80 degrees F. Add .004 for every 10 degrees above 80 degrees F and subtract .004 for every 10 degrees below 80 degrees F.

Compare the readings to the chart.

The specific gravity readings should be at 1.277 + or - .007. If any of the readings are low check and record the voltage levels, put the battery on a complete charge then take the specific gravity readings again. If any of the readings still remain low check the voltage levels again, and perform an equalization charge on the battery. Equalizing is an overcharge performed on flooded lead acid battery after it has been fully charged. It reverses the buildup of negative chemical effects like stratification, a condition where acid concentration is greater at the bottom of the battery than at the top. Set the battery charger on equalizing voltage and charge the battery. The battery will begin to gas and bubble vigorously. Test the specific gravity every hour. Equalization is complete when the specific gravity readings no longer rise during the gassing stage.

If any readings still register low one or more of these conditions may exist:

The battery is old and approaching the end of its life.
The battery was left in a state of discharge too long.
Electrolyte was lost due to spillage or overflow.
A weak or bad cell is developing.
The Battery was watered excessively previous to testing

Batteries with these conditions should be taken to a specialist for further testing

It's important to keep in mind that what you take out of your batteries must be put back in and if it's not done in a timely manner the battery sulfates and can be permanently damaged. Many RV converter chargers have a fixed output voltage of 13.5 volts and over time this can boil off the electrolyte in the battery. You need a three stage charger that can provide a bulk charge then an absorption charge and finally a float charge. There are RV converter chargers on the market that will do this.

If you purchase a multi-stage battery charger you need to know the charging current limitations of the battery being charged. When selecting a charger, the charge rate should be between 10 and 13% of the battery's 20-hour AH capacity. For example, a battery with a 20-hour capacity rating of 225 AH will use a charger rated between approximately 23 and 30 amps. For proper charging always follow the instructions that come with the battery charger.

Batteries should be charged as soon as possible after each period of use or whenever they reach a 70% state of charge or below. The batteries should only be charged in a well ventilated area and keep any sparks and open flames away from a battery being charged. Check the electrolyte levels before and after charging batteries.

If you put your RV in storage it's a good idea to remove the batteries and put them in storage too. This is quite simple to do. When you're removing the battery always remember to remove the negative terminal first. Clean the batteries with a 50/50 mixture of baking soda and water if necessary. Check the electrolyte level and add distilled water if necessary. Test the battery state of charge and charge any batteries that are at or below 80%. A discharged or partially charged battery will freeze much faster than a charged battery. Store the batteries in a cool dry place but not where they could freeze. Batteries in storage will loose their charge. Test the state of charge every month and charge batteries that are at or below 80% state of charge. Completely charge the batteries before re-installing them next spring. For optimum performance equalize the batteries after they are fully charged.

Mark Polk is the owner of RV Education 101. RV Education 101 is a North Carolina based company that produces professional training videos, DVDs and e-books on how to use and maintain your RV. Our goal is to make all of your RVing experiences safe, fun and stress free.
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