

## Batteries and Chargers

In the February issue of the *Blue Beret*, there was a question in the Tech Help Group column concerning batteries. The Airstreamer asked what brand and type of battery we would recommend and how he should maintain them. He had been having bad luck with the life of his current batteries. This article prompted some emails questioning what is the best type of battery as well as how to keep them charged during the winter months.

One of the biggest killers of batteries is sitting stored in a partly discharged state for a few months. As a general rule, a 50% charge is considered a discharged battery.

One of our committee members, Ray Putnam, WBCCI #7007, has put together a nice article based on the February column of his own experiences with batteries and chargers. Ray hopes you will find this informative and help make your battery decisions easier.

### Ray's Thoughts

Someone asked what is the best battery for your Airstream - Absorbed Glass Mat (AGM) or Lead-Acid. AGM is a type of lead-acid battery with fine glass fibers in a gel. An AGM battery is sealed. Lead acid (liquid-acid) batteries have sulfuric acid in them and are vented due to the vapors the sulfuric acid gives off. When you charge an AGM battery you don't remove the sealed cell covers. When you charge a lead-acid battery (with a single stage charger) you should remove the cell covers to vent it.

With batteries, I like to deal locally because that is where the service is. There are all kinds of brands. A battery is only as good as its warranty. I look for a five-year warranty. Before we get into batteries and chargers, please don't forget battery security. Most battery boxes do not have locks. You can get a very inexpensive lock at most hardware stores (I got mine at ACE) that will replace the turn button and give you an extra level of security. We have had club members go to the storage lot and find their batteries gone. On that issue we have also had club members go to the storage lot to get their trailer and found their trailer gone. Don't forget those hitch locks too!

Please understand that while I am a maintenance engineer, I don't like to have to do a lot of maintenance on my Airstream. I go Airstreaming to relax and get away from work. When I considered batteries, I wanted a battery that met the requirements for the trailer needs and at the same time reduced my need to check and maintain the battery. My choice was a deep cycle AGM battery. There is no fluid to check or refill. And, there are no fumes like a liquid-acid battery has.

The next thing I had to do was make sure the battery would fit into the Airstream battery box. I measured the size of the interior of the box and checked for fit before I bought the batteries. I tried two methods and have settled on the latter as the best for me. First, I tried two six-volt batteries wired in series to get the 12-volt requirement. It worked fine but was a bit more work. The six-volt batteries, if you can find one that will fit, are deep cycle batteries that will outlast 12-volt batteries. They are used on electric golf carts, etc. The battery box had to be modified so they would fit. Second go around I used 12-volt AGM deep cycle batteries wired in parallel which fit the existing battery box. That is what I use on my current Airstream trailer.

In the course of the battery work I learned about battery chargers. Many RVs have single stage chargers as part of the power conditioner (the unit that changes 120-volt power to 12-volt trailer power when you hook up). You will have to check your trailer to ascertain if your charger is single stage or a multiple stage charger. Single stage chargers only charge at one rate - "high." Charging at a high rate consistently can prematurely wear out a battery. Liquid-acid batteries get hot and the acid boils off which makes the acid level too low. If you find low fluid in time, you have to add distilled water to bring the fluid level back up to the fill point (just at the bottom of the neck sticking down into the battery). You may be able to save the battery, or if you don't find it in time the battery will just get hot and expand (the sides bulge) and the battery dies. There can be some danger associated with this occurrence. AGM batteries are not vented and so do not "boil off." While batteries like to be charged to function

properly, they don't like to be overcharged. Again, consistent overcharging prematurely wears out any battery. However, batteries like to be kept at full charge.

If you have a multiple stage charger as part of your power conditioner, then there is a built in sensor that ramps up the charging voltage depending upon the batteries' requirements for charging. When the battery is charged the charger ramps down and becomes a battery maintainer. A battery maintainer won't overcharge your battery and won't overheat it.

There are two ways to go from a single-stage charger to a multiple-stage charger-maintainer. The least costly way is to utilize your battery disconnect (some have a pushbutton that opens a relay, and some are a manual switch that opens the battery connection to the trailer 12-volt system). Once the battery is disconnected from your trailer system, you can hook up a battery maintainer (Battery Tender is a brand I like, but, there are others) to your battery and forget it until the next time you go out in the trailer. Be wary of so-called trickle chargers. Unless they have the capability to adjust the charge rate based upon the battery charge don't go there. When you are ready to go, just reverse the process, and put the battery back in the circuit. Most trailer-to-tow-vehicle connections are wired so that while you are driving, your tow vehicle will keep the battery charged. If you don't have a 110-volt receptacle near the trailer to plug the battery maintainer into, then you might have to remove the batteries and take them to a location where you can set them up with the hook up to the battery maintainer.

The long-term best way to eliminate the single-stage charger issue is to replace it. Interestingly enough there are several after-market direct replacements made for RVs that correct this condition. I will give you my references at the end of this article – you may even find other choices. The actual job of replacing the power conditioner/single stage battery charger, into a multiple stage battery maintainer only takes about an hour. Once this has been completed one only has to plug the trailer in to 110-volt power just like hooking up at a camp site and your battery will be charged in multiple stages by the (now) built-in multiple stage battery maintainer. Just like above if you don't have a receptacle near the trailer to plug the trailer into then you might have to remove the batteries and take them to a location where you can set them up with the hook up to a battery maintainer.

As I said above, batteries like to be fully charged. A fully charged battery is a happy battery! If you are dry camping and using 12 volt power in the trailer, it is possible for the battery to get low enough that the refrigerator or furnace won't work properly (your lights might work but be dimmer than usual). A 12- volt refrigerator won't work much below 12 volts. Likewise the furnace (with an automatic igniter) won't work much below 12 volts. A battery fully charged is 12.7 volts. Installing LED lighting to replace incandescent or fluorescent lighting can help reduce the electric load. Having a solar charger can help recharge your battery. You might even have to use a generator to recharge. I have a 130-watt portable solar charger (I don't like mounting stuff on the trailer that might detract from the Airstream look) that connects to the battery and can, in direct sunlight, recharge the batteries in about two to three hours after each night of dry camping. Zamp Solar makes several sizes and everything is figured out for you. There may be other brands. I also carry a generator. If you have one you may not need it. If you don't have one – you will surely need it!

For my new converter/charger I went to [BestConverter.com](http://BestConverter.com). I bought the Progressive Dynamics Intelli-Power upgrade (there are other choices too). There are three Progressive Dynamics models depending upon the size of the unit you already have - PD 4635 (35 Amp), PD 4645 (45 Amp) and PD 4655 (55 Amp). It is important to match the amperage of the converter/charger you already have with your new converter/ maintainer – bigger is not better. With my PD 4645 converter/charger on, I measured 13.2 to 13.6 volts at the Trimetric battery monitor talked about below. This is looking at the output of the converter/charger, not the battery. With the battery disconnected from the converter/charger, I measured 13.0 volts at the battery. You will find that the site has a wealth of information to assist you in this endeavor. As an engineer I like to be able to monitor what is going on with the battery charging. On the same site you will see information about a battery monitor. I like – the Trimetric battery monitor. They supply plenty of information about installation. "The Trimetric battery monitor will count and total the exact amp hours discharged from and returned to your battery bank. This is the most accurate way to continuously monitor the state of charge of any deep cycle battery. Know exactly when to run the generator and when to stop. No more guessing - real time 'fuel gauge' for your batteries." I found that the installation of the

Trimetric battery monitor was more work than installing the new power conditioner/battery maintainer! I also found a digital readout 12-volt plug-in monitor on Amazon for a lot less cost and no installation at all – just plug it into the 12-volt outlet in your trailer and read it. Now, I have both!

Finally, a brief note about battery sulfation. “Sulfation - During battery use, small sulfate crystals form, but these are normal and are not harmful. During prolonged charge deprivation, however, the amorphous lead sulfate converts to a stable crystalline and deposits on the negative plates. This leads to the development of large crystals that reduce the battery’s active material, which is responsible for the performance.” Hence, reduced performance due to sulfation. Some think that a battery will not develop sulfation if it is always kept fully charged. This is incorrect. All lead-acid storage batteries will develop sulphate during their life time. This includes the new sealed “dry batteries”, also known as AGM batteries. Batteries develop sulfation each time they are used (discharged – recharged). If they are overcharged, undercharged or left discharged for just a few days, they will rapidly develop sulfate. Even when stored fully charged sulfate will form **without a frequently applied maintenance charge**. Your battery must be charged enough to prevent it from dropping below 12.4 Volts (2.07 volts/cell). Using or storing batteries in temperatures above 75°F accelerates the rate of self-discharge and increases sulfation dramatically. The discharge rate has been shown to double, as does sulfation, for every 10°F rise above room temperature. Bottom line – If you aren’t camping keep a battery maintainer on your batteries.

If you are comfortable with the work described here feel free; if you aren’t, your local RV shop should be a good source for help.