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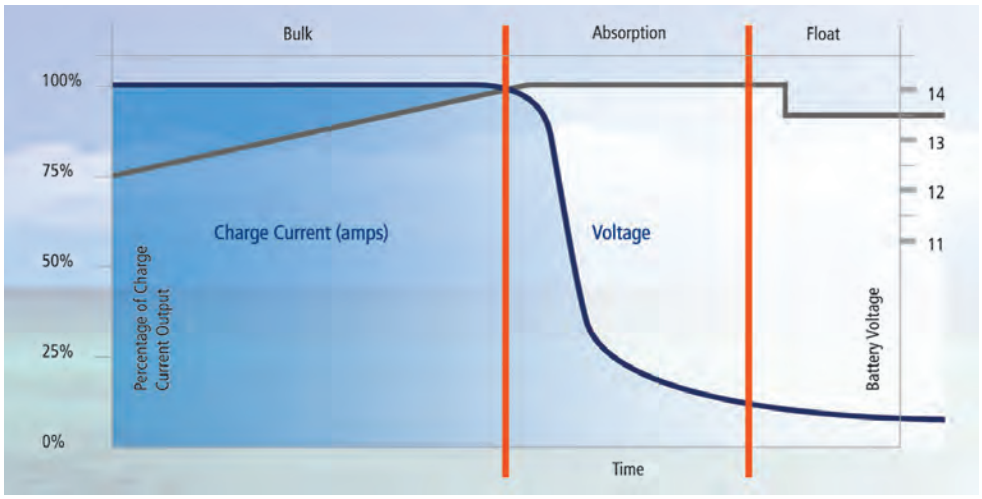
The Inside Scoop on Battery Chargers

Tech Doctor Investigation into the Mysterious World of Battery Chargers

By Don Wilson



"Why is my battery not charging?" is a common question that plagues many. Unfortunately, there is no clear cut, one-stop shop on answers as the reason varies widely. Many folks simply don't understand how batteries work, not to mention the broader scope of battery technology, chargers and electricity.

So … how exactly does a charger work?

There are many different types of chargers with different technologies, algorithms, sizes and options, but the bottom line is that a charger works because its voltage is higher than the battery voltage which causes current to flow to the battery. In most simplistic terms, the voltage differential causes current to flow from the source (charger) to the load (battery). However, I'm the first to admit that the devil is in the details. For instance, while a lead-acid 12-volt battery needs exposure to at least 14 volts in order to fully charge, if the voltage is higher it will cause it to gas out, drying the cells which will, eventually, cause damage.

What is multi-stage charging?

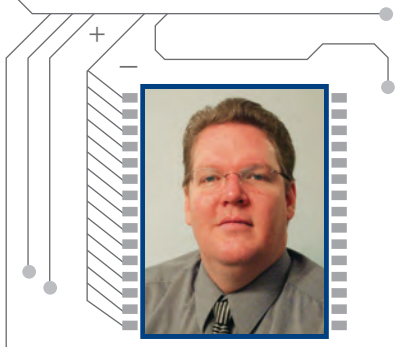
In the above example, the 14-volt threshold is not only critical, but also potentially dangerous. So, the term multi-stage charging means that the voltage differential changes throughout the charging cycle. We'll use the typical 12-volt liquid lead acid battery as an example.

The first charge stage would be the BULK stage which gets as much current into the battery as fast as possible without damage. The charger will attempt to discharge 14.4 volts at its maximum current in order to achieve the charge. Anything higher can cause heat build-up; lower will slow the charge rate. With this in mind, once the voltage differential equalizes (battery voltage meets the charger voltage, approximately 85% charged), we enter the absorption stage.

In the absorption stage, the charger maintains the 14.4 volts, but the current will slowly drop as the battery increases in resistance (caused by an increase in charge level). Absorption stage will top off the battery state of charge. Once the battery is "full", the charger will drop its voltage to 13.4 and transition to the float stage. The float voltage level is high enough to keep the battery "full", even if DC loads are turned on, but low enough to prevent persistent gassing of the battery which can cause long term damage.

Why do some chargers have a battery temperature sensor?

The examples I have used are for the absolute ideal scenarios using a liquid battery, a proper sized charger, and a moderate temperature. However, the battery's reactions to voltage differential changes with different temperature levels. When a battery is warmer, it has an easier time accepting current, but when it's colder, it has a higher resistance to current. So, more complex chargers utilize a battery temperature sensor to determine the ability of the battery to accept a charge and will adjust the voltage (higher voltage when cold, lower voltage when warm) to give an



TECH DOCTOR DON WILSON *has worked in technical capacities in the automotive, RV and marine fields and for the military since 1989 and has extensive experience in designing and troubleshooting onboard electrical systems. A former customer service manager dealing with electronic issues, Wilson currently serves as a technical instructor for the RV industry's RVIA Trouble Shooter Clinics and is a full-time sales application engineer for Xantrex Technology USA Inc.*