A Sulfated Battery

How many times have you heard the expression, "The Battery Won't Take A Charge" or "The Battery Won't Hold A Charge?" More often than not, the culprit is hardened sulfate on the battery plates. Below we will attempt to explain what that means, what the causes are, and some measures to prevent the sulfate from permanently damaging your battery.

Let's look inside a battery cell. Basically, there are the positive plates, the negative plates, separators (to keep the plates apart), and electrolyte (sulfuric acid and water).

In normal use, battery plates are getting sulfated all the time. When a battery is being discharged the lead active material on the plates will react with the sulfate from the electrolyte forming a lead sulfate on the plates. When there is no lead active material and or sulfate from the electrolyte remaining the battery then is completely discharged. After a battery reaches this state, it must be recharged. During recharge, the lead sulfate is reconverted into lead active material and the sulfate returned to the electrolyte.

When the sulfate is removed from the electrolyte the specific gravity is reduced and the reverse takes place when the sulfate is returned to the electrolyte. This is why the state of charge can be determined with the use of a hydrometer.

If a battery is left standing in a discharged condition the lead sulfate will become hard and have a high electrical resistance. This is what is normally called a sulfated battery. The lead sulfate may become so hard that normal recharging will not break it down. Most charging sources, engine alternators and battery chargers, are voltage regulated. Their charging current is controlled by the battery's state of charge. During charging, battery voltage rises until it meets the charger's regulated voltage, lowering the current output along the way.

When hard sulfate is present, the battery shows a false voltage, higher than it's true voltage, fooling the voltage regulator into thinking that the battery is fully charged. This causes the charger to prematurely lower it's current output, leaving the battery discharged. Charging at a higher than normal voltage and low current may be necessary to break down the hardened sulfate.

Hardened sulfate also forms in a battery that is constantly being cycled in the middle of its capacity range (somewhere between 80% charged and 80% discharged), and is never recharged to 100%. Over time, a portion of the plate's active materials turns into hard sulfate. If the battery is continually cycled in this manner, it will lose more and more of its capacity until it no longer has enough capacity to perform the task for which it was intended. An equalizing charge, applied routinely every three to four weeks, should prevent the sulfate from hardening.

In both cases, the fact that the battery "won't take a charge" is a result of improper charging procedures which allowed the sulfate to harden. In most instances, it is possible to salvage a battery with hardened sulfate. The battery should be charged from an outside source at 2.6 to 2.7 - volts per cell and a low

current rate (approximately 5 Amps for small batteries and 10-Amps for larger ones) until the specific gravity of the electrolyte starts to rise. (This indicates that the sulfate is breaking down.) Be careful not to let the internal temperature of the battery rise above 125° F. If it does, turn the charger off and let the battery cool. Then, continue charging until each cell in the battery is brought up to full charge (nominal 1.265 specific gravity or higher).This time needed to complete this recharge depends on how long the battery has been discharged and how hard the sulfate has become.

The next time your batteries don't seem to be taking or holding a charge, check the specific gravity with a hydrometer. If all cells are low even after a long time on charge, chances are you've got some hardened sulfate that has accumulated on the plates. By following the instructions outlined above, the problem may be corrected.

With a sealed battery the same problem can exist. Unfortunately hydrometer readings cannot be taken to determine the problem. If you subject a sealed battery to overcharging you may lose the electrolyte and ruin the battery.