Preliminary Notes From the EDTA Trenches

by Stan Krute

I was quite excited by the articles in HP #20 on using EDTA to rejuvenate lead-acid batteries. I've done some experimenting of my own the past few weeks, and want to share the early results.

About My Battery Pack

I have eight Trojan L-16 batteries in my pack. Each battery consists of three cells. Each cell has a voltage a bit over 2 volts. The cells are connected in series, so each battery has a voltage a bit over 6 volts. A pair of batteries is then connected in series, to produce a voltage a bit over 12 volts. The four battery pairs are then connected in parallel, which keeps the voltage at 12 volts while upping the amperage.

My battery pack has been in use for 6.5 years. Much of that time has been rough. During the first 5 years, I was working away from home for extended periods. I didn't have solar panels. I didn't have Hydro-Caps. Though I'd leave the batteries well-charged, they'd slowly discharge and get low on electrolyte while I was gone.

For the past 1.5 years, things have been better. I've been home, have a roof full of solar panels, and have Hydro-Caps installed. I'm able to make sure the voltage and electrolyte levels stay healthy.

Lead-acid batteries are unforgiving, however. Those first 5 years did some damage. Though I don't have fancy instrumentation, I could tell that the pack had lost its snap. It discharged too quickly, and woke up too slowly in the morning as the sun and panels started pouring energy in. The voltage variance between cells was growing.

A Modified Plan of Action

Then came the EDTA article. I was excited. I decided to act.

Richard Perez mentioned that the technique he and George Patterson used was not only radical, but difficult. They had flushed and drained their experimental batteries several times. These L-16s are big, heavy batteries. So he suggested a treatment modification: just add the EDTA to the batteries. No repeated flush and drain. I asked what would happen to the crap the EDTA would form when it combined with the trouble-making lead sulfate it was removing. Richard said that this chelate should settle to the bottom of the battery cases, and there was plenty of room for it there, since the battery plates only come within an inch or two of the case bottoms.

Rounds One and Two

I purchased 1 kilogram of EDTA, which by the way stands for ethylenediamine-tetraacetic acid. The kind I purchased is a Tetrasodium Salt: Hydrate manufactured by the Sigma Chemical Company of St. Louis, Missouri. Its chemical formula is $C_{10}H_{12}N_2O_8Na_4$. On December 20th I added 24 tablespoons of the chemical to 36 ounces of warm distilled water. I shook it up, then set it next to the wood stove. After 10 minutes the solution was clear and fully dissolved. I added 1.5 ounces of the solution to each of my batteries' cells. Thus, each cell received 1 tablespoon of the chemical in solution.

Two and a half weeks later, on January 7th, I repeated the procedure, adding another 1 tablespoon of the chemical in solution to each cell.

Some Non-Numeric Observations

I'll get to numbers in a moment, but first want to share a few qualitative observations.

First: The battery pack feels perkier. Its voltage rises faster in the mornings. It doesn't go so low at night, as I sit draining it with my big evening load: computer, printer, large computer screen, color television, and fluorescent light (20 amps all told).

Second: the cells in two of my batteries had an especially noticeable reaction when the EDTA solution was added on January 7th. There was immediate bubbling, and within an hour a large amount of white material coated the tops of the plates. It looked like a small snowstorm had occurred in those cells. Two weeks later, the material is still there, although there is less of it. This white material, which I assume is a product of the EDTA reaction, also formed in the other battery cells, but to a much lesser degree. I am keeping a careful eye on these two batteries; so far there is no major voltage degradation.

Third: there are white deposits on the tops of each cell around the HydroCaps. I assume this is also the EDTA chelate. It is greatest on the two cells noted in the previous paragraph.

Why Cell Voltage Data

In a healthy battery pack, the voltages of the individual cells are equal. In a sick pack, the cell voltages vary. Since I currently lack the instrumentation required to take direct battery pack performance data – the ratio of watts in to watts out – I rely on cell voltage data as a health indicator.

I've taken cell voltage data on four occasions: just before EDTA treatment 1, just before EDTA treatment 2, two days after EDTA treatment 2, and twelve days after EDTA treatment 2. We've printed the first, second, and fourth data samples.

About the Data

I have eight batteries. Each data sample shows the measured voltage of each of the three cells in each battery.

Beneath each battery's voltage I derive seven statistical measures. These help analyze the raw cell voltage data.

First is the difference between a cell's voltage and the average voltage of all cells in the pack. This is given as a positive number for each cell in the battery. We want this to be as small as possible.

Second is the average of these cell::pack deviations for the three cells in the battery. We add up the three cell deviations and divide by three. We want this to be as small as possible.

Third is the difference between a cell's voltage and the average voltage of all cells in the battery. This is given as a positive number for each cell in the battery. We want this to be as small as possible.

Fourth is the average of these cell::battery deviations for the three cells in the battery. We add up the three cell deviations and divide by three. We want this to be as small as possible.

Fifth is the average voltage of all cells in the battery.

Sixth is the standard deviation of cell voltages. This is figured by applying the standard deviation formula you'll find in any statistics