
Keep Batteries Alive Through Better Battery Charging

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Keeping Radios Alive Through Better Battery Charging

Radios and Communications equipment are a major expenditure, with the procurement process for a new system taking as long as two years. Often, a bid contract is awarded to a single source vendor for the radios, transmission equipment and consumables. While this is convenient, and often saves money at the time of the award, it could ultimately be more expensive when the time comes to replace equipment and purchase more consumables. One category where this is most evident is batteries and chargers. An all-in-one bid for radios, chargers and batteries often includes a battery replacement program for the first year or two. But in the 10-15 year life cycle of a radio, battery replacements can eventually exceed the cost of the radio. An up-front investment in a better charger will actually save an agency many thousands of dollars in battery and labor costs.

The standard trickle charger delivers a steady, low-level positive current, takes 10 or more hours to charge a battery and doesn't terminate at maximum capacity. Batteries are left in the charger overnight, increasing the likelihood of overcharging and heat generation, or pulled out of the charger before being fully charged, resulting in inadequate charged capacity and a shorter life for the battery. The extended low charge rate enables chemical reactions to localize on the electrode surface, leading to dendrite growth and oxidation.

When NiCd and NiMH batteries aren't discharged prior to charging, "memory effect," begins, hastening the early demise of batteries. Electrodes oxidate, dendrite growth is accelerated and other reactions occur which reduce capacity. To minimize these problems, users must be trained to drain the battery (i.e. run the radio down) before charging, to charge the battery fully, and to remove it from the charger before overcharging occurs.

Most "fast charger" systems charge the battery in two to six hours, maintaining the a high constant current/constant voltage (CC/CV) rate until a specified voltage is reached and then decreasing current to trickle charge remaining available capacity. At full capacity, a trickle charge maintains voltage, or charging is automatically terminated.

Few end-users realize that, when the "green light" comes on after one or two hours, the battery has only reached ~80% capacity. Users are instructed "to achieve full capacity, leave the battery on charge for up to two more hours," but most people remove and use the battery at first light. High-rate, constant current chargers and their misuse cause deterioration, resulting in reduced capacity, rapid wear-down and fewer charge/discharge cycles for the battery.

Pulse charging offers a significant improvement on the standard CC/CV routine, but it's not the breakthrough that it was hyped to be. Most pulse chargers insert one positive and one negative pulse of fixed size and then follow the trickle charge or the CC/CV routine. "Negative pulse" or "burp charging" schemes use a pre-programmed, repetitive cycle of positive charging pulses, rest periods and discharge pulses.

So you see, **It's not the battery, it's the charger!!** Short battery life and decreasing capacity result when low-tech chargers are operated without regard to the cumbersome list of "rules for good battery management." If a proper, 12-16 hour first charge is neglected, problems will appear even sooner. Without proper management, batteries designed to last four years are replaced every one or two years.

There are two kinds of battery maintenance programs: 1) A radio technician is assigned the troublesome job of conditioning, rotating, charting and recycling batteries in hopes of keeping them in operation longer. 2) An intelligent charging system can maintain the batteries in peak condition for more than four years, without any special operations on the part of the user.

An optimal charging solution should be responsive to conditions within a battery and flexible in its delivery of energy based on the response. The ACTivators by Advanced Charger Technology use the patented **enrev** Battery Operating System (BOS) to obtain real-time feedback. They measure the state of the battery, and implement a charging waveform that adjusts to the inconstant state of the battery. ACTivators deliver maximum available capacity with every charge, rapid charge times and thousands of charge/discharge cycles, consistent and reliable radio performance, while eliminating complicated battery management protocols.



Firefighters tend to charge batteries when they're not dead, which gives them real memory problems, and leave them in the OEM charger too long, which burns them up. That never happens with the ACT chargers. They charge a lot faster and batteries last a lot longer. They extend the battery life between charges, they're easy to use, and every time I charge (old batteries), it seems to increase the capacity a bit. If I could change every charger to an ACT charger, I'd do it in a second," says Dennis West, San Bernardino County Emergency Operations Center.

The **enrev** algorithm enables a much higher charge current, and effectively "conditions" batteries as they are charged, eliminating the need to discharge first, and terminates without overcharging. It manages the transfer of energy into the battery efficiently and without detriment, enabling batteries to perform at or above their rated capacity for up to 2000 cycles. It takes 20-30 minutes to fully charge a 1000 mAh NiCd battery and 45-60 minutes for a NiMH. New batteries can be properly formatted in only two hours.

"We're saving a lot of money with the ACT chargers," adds Capt. Jody Hall of the Fort Mojave Mesa Fire Department. "I only spent about \$200 on batteries when I normally spend about \$1200 in the first half of this year. The firefighters love them, because in 30 minutes, they've got the battery charged and ready to go, and it's easy to use. We're definitely getting more time out of the batteries, when we're out on a fire."

Whether you're a large agency spending 10s of thousands of dollars on batteries each year, or a small one spending hundreds. Remember when you're going through the procurement process that you get what you pay for. Whether it's battery chargers or antennae, if you settle for the inexpensive or free product your source provides without doing your research, you could be paying for that freebie for many years to come.