

# Peak Power for Cordless Tools

Follow a few simple rules to get the best performance from your rechargeable batteries

BY FRED SOTCHER



Cordless power products have been one of the great growth industries of the last few years. By the middle of 2000, there were an estimated 431 million cordless products in the United States alone, according to the Rechargeable Battery Recycling Corp. Many woodworkers have embraced cordless tools, but the performance and life span of the rechargeable batteries has left many owners disappointed. With replacement batteries costing more than \$100 for a 24-volt model, averaging a third of the power tool's original price, this is a serious handicap.

For 30 years I ran a company that specialized in electrical equipment designed to test portable tools. As part of our research, we performed extensive long-term tests on batteries and studied every new charger as it became available. I learned that the way we use cordless products has a major influence on their performance. If you are getting fewer than five years of use or 500 charges from your batteries, your recharging procedure may be at fault. A clear understanding of how the batteries and chargers work will help you maximize service from your cordless tools.

## **Battery packs are made up of individual 1.2-volt cells**

Three types of batteries have been used in cordless tools. The lead acid variety, used in some early cordless tools, never caught on because of its bulk and the fact that the voltage declines over the discharge period.

The nickel-cadmium (Ni-Cd) battery, on

the other hand, stores a great deal of energy in a small, relatively light package. The voltage output remains constant, allowing the product to be used at full capacity until the charge has been depleted.

The nickel-metal-hydrate (Ni-MH) battery is the newest. This battery has characteristics similar to the nickel cadmium but offers up to 30% more storage capacity, which translates to a longer run time between charges. Nickel-metal-hydrate batteries require a special charger. While a nickel-cadmium battery can be charged in a nickel-metal-hydrate charger, the reverse is not true. In mid-1999, a survey found that 85% of cordless tools used nickel-cadmium batteries, with the balance mostly nickel-metal-hydrate and a few lead batteries. However, the proportion of nickel-metal-hydrate powered tools is growing, with some manufacturers, including Makita, moving toward having only entry-level tools using nickel-cadmium batteries.

Most cordless tools, with either type of battery, use a battery made up of two or more sealed cells. Each cell produces 1.2 volts; the batteries come in multiples of that. Common sizes are 6, 9.6, 12, 14.4, 18, 19.2 or 24 volts. The higher the voltage, the more energy available but at greater cost and weight.

### Chargers have experienced rapid growth in sophistication

There are three kinds of chargers: basic, standard and microprocessor. While basic chargers are very similar to each other, the other two are offered in a great variety of models. As manufacturers have learned more about batteries, better circuits have been developed and an ever-wider selection of chargers has become available.

Despite this profusion, some characteristics are common to all batteries and chargers. A battery loses some of its charge over a period of months. It holds each charge longer and will have a longer total life if it is stored in a cool place. As a battery is charged, its temperature abruptly rises as it becomes fully charged. Any effort to charge it further results in additional heating, drying out the cells, which vent to avoid excessive pressure buildup.

Universal tips include: Don't recharge a battery until a reduction in performance is noted; allow the battery to cool before charging; never place a short circuit across a battery; never fully discharge a battery

## BATTERY BASICS

### STANDARD BATTERIES

Both nickel-cadmium and nickel-metal-hydrate batteries are made up of a collection of individual cells. Each cell provides 1.2 volts, and popular combinations include 9.6, 12, 14.4, 18 and 24 volts. The downside to more power is greater bulk and weight.



### ADVANCED BATTERIES

This recent design includes smaller, lighter-weight cells, heat dissipation plates and a memory chip built into the battery. The chip records the history of each cell when the battery is plugged into the charger to determine the optimal charge for each cell.







1. Insert the cool battery in the charger. Keep the battery and charger away from sunlight and other heat sources.



2. After reaching full charge, let the battery cool before using it in a power tool.

**EXTENDING THE LIFE OF A BATTERY**  
A rechargeable battery ought to last for about five years or 500 charges. If you're not getting that kind of life from your batteries, improper use and recharging techniques may be at fault. Consider getting a third spare battery, which can actually save you money in the long haul because you won't have to rush the recharge cycle every time a battery drains.



3. Use the battery until you note a reduction in a tool's performance, but don't allow the battery to become completely exhausted.



4. If the battery is warm from being in use, allow it to cool for about a half hour before recharging.

because it can cause one or more of the cells to charge in reverse, permanently reducing the useful capacity of the battery; allow the battery to cool from the charge before using it in a power tool; all chargers work best if they are kept out of the direct sun and away from other heat sources.

**Basic chargers have no frills**—This unit is about 2 in. square, with a 120-volt plug on one side and a small cord that makes two electrical contacts with the battery. There are no indicator lights or start buttons. This type of charger provides a continuous small charge to the battery, requiring up to 10 hours for a full charge. Even after the battery has been fully charged, the charger keeps operating,

overheating the cells and drying them out. This is the reason why a rechargeable flashlight that has been plugged in for months or years fails to work. With this type of charger, it is best to use the battery-operated device until it requires a charge, connect it to the charger for the time indicated in the instructions, then unplug it. This time should not exceed 24 hours.

**Standard chargers are still the most common**—The majority of cordless power tools rely on the standard charger. The charger is 4 in. to 8 in. in size and has a socket on top for the battery, which is removed from the tool for charging. The unit has one or two lights to indicate that the power is on and that a charge is being ap-

plied to the battery. Three electrical contacts are made with the battery, and charging normally takes 15 or 30 minutes.

This charger provides a high current during the charge period. When the battery has been charged, a thermal switch opens. In most cases this turns off the charger, so the battery can remain in the charger until it is needed. A few older chargers reduce the current to a very low level, but this will reduce the life span of the battery.

If you commonly use a nickel-cadmium battery for only a short time and then recharge it, the capacity of the battery will sometimes be reduced. The same problem can occur if you apply a slow charge to it for a prolonged period. You can typically restore the full capacity by using the bat-

tery until you note a significant reduction in output, then fully recharge the battery.

The error most people make is to recharge the battery when it is first removed, and still warm, from the power tool. Recharging a warm battery causes the charger to shut off early, reducing the charge and thus the energy available for its next use. The best charging procedure is to use the tool until there is a reduction in performance but before all power is exhausted. Allow the just-used battery to cool for at least 30 minutes before charging. Replace the battery with a second one from the charger. If you own a third battery, it can be charged while you are waiting for the just-used battery to cool. The battery can be left in the charger as the charging current drops to zero, and will not turn back on until either the charge button has been pressed or the battery has been removed and reinstalled in the charger. Some older chargers of this type do not have a button to start the charge cycle; they might switch back to a charge cycle following a power interruption, thus reheating the battery and reducing its life.

**Microprocessor-based chargers are the way of the future**— Offered with newer and more powerful cordless tools, a microprocessor-based charger has four electrical contacts with the battery. The fourth contact allows the charger to monitor the temperature of the battery. The charger waits for the battery to cool off before starting the charging cycle, allowing it to charge the battery fully. This type of charger often has lamps to indicate that the battery is too hot to start charging or that the battery is not accepting the charge and should be discarded.

The microprocessor-based chargers designed for nickel-metal-hydrate batteries normally recharge at a fast rate until a 90% capacity has been achieved, then at a slower charge rate to complete the charge. The microprocessor in some chargers provides the charge current in pulses to reduce heating. Although a microprocessor-based charger is much more forgiving of the recharging procedure you use, it is still best to recharge the battery when you notice a reduction in the tool's performance—but before the battery is exhausted. □

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## RULES FOR CHARGERS

### THE BASIC CHARGER

Of limited use in the workshop, these chargers still have many applications around the house.

- Use the tool until a marked reduction in performance is noted but before the battery has been completely exhausted.
- If the battery is warm, allow it to cool before recharging.
- Recharge the battery for no more than 24 hours.
- Store the tool in a cool place.



### THE STANDARD CHARGER

These chargers are most familiar to woodworkers but are far from idiot-proof.

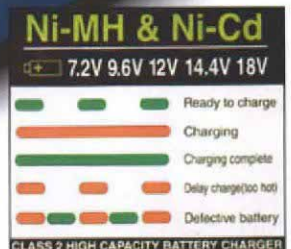
- Use the tool until a marked reduction in performance is noted but before the battery has been completely exhausted.
- If the battery is warm, allow it to cool before recharging.
- Never short out the battery.
- Batteries and charger should be stored away from sunlight and other heat sources.
- Do not charge a battery that has already been recharged.
- Remove the fully charged battery from the charger if it is not going to be used for several weeks.



### THE MICROPROCESSOR-BASED CHARGER

A growing number of tools come with these new, sophisticated chargers.

- Most of the rules applying to basic and standard chargers are taken care of by the memory chip in the charger, but certain advice for their use still applies.
- Use the tool until the power is nearly exhausted.
- Keep the battery and the charger away from heat sources.
- Do not short out the battery.



**Double-duty.** Microprocessor-based chargers are designed for Ni-MH batteries but will often handle Ni-Cd batteries as well.