

**PROPER CHARGING: EVERYTHING YOU NEED TO KNOW
ABOUT BATTERIES AND CHARGING METHODS**

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If you want to use your batteries for as long as possible without losing capacity, before buying a charger, make sure it's suitable for the battery type and familiarize yourself with the charging methods.

Battery performance directly depends on its capacity, measured in milliampere-hours (mAh). The higher the capacity, the longer the device will work. However, achieving the stated capacity depends significantly on how you charge the battery.

Reliable Charging: Battery performance typically degrades for two reasons: overcharging (prolonged current flow after reaching maximum charge) partially or completely destroys the battery's ability to store energy. Regularly charging a partially discharged battery is equally harmful. The battery 'remembers' the peak charge reached, only a portion of the charge is actually stored, and consequently its capacity decreases. This is known as the 'memory effect'.

Brief Postscript: Today, any AA battery with a nickel-metal hydride (NiMH) or nickel-cadmium (NiCd) cell should be discharged and recharged to its optimal capacity.

Proper battery charging is crucial not only for optimal operation. Incorrect handling can cause the battery to overheat, swell, leak, and in the worst case, even explode.

To charge these two batteries you need fast charging and also the exact time when it becomes constant. In this case, the current remains constant while the voltage changes as the battery charges.

To avoid confusion (which is clearly detrimental to batteries), many chargers sold in stores are only for nickel-cadmium and nickel-metal hydride cells.

Chargers designed for lead-acid batteries and lithium-ion (LiPo) batteries are significantly different. In the field of radio electronics and de-

vices with engines, the tasks of batteries include only powering onboard electronics and radio control devices designed for batteries.

The strength of direct current is measured in Amperes and is the most important parameter for each nickel-cadmium and nickel-metal hydride battery (voltage in V).

In this case, all elements of the battery pack should also vary during constant current charging depending on the charge level.

A higher current is also used; trickle chargers use constant voltage for charging lead-acid batteries.

Constant Current or Constant Voltage?

We need to consider the current I (in Amperes) and voltage U (in Volts). Battery charging can occur with either constant voltage or constant current. In the first case, the nominal voltage is required; in the second, the corresponding current.

We've already mentioned that one of the main dangers is overcharging batteries. After the battery is fully charged, the charger must stop supplying current. How is this achieved?

With constant voltage, it's quite simple: if the voltage on the battery equals the voltage of the power source, the current flow stops because the potential is equal.

Determining the End of Charging by Voltage Drop (-dV Method)

The -dV peak is based on determining the beginning of the full charging process. The charger calculates it based on the voltage and ends the charging process.

Measuring sensors are used for accurate temperature determination. To avoid significant cases of final processor overcharging, temperature determination is used.

Therefore, the rule: The value corresponding to one-tenth of the capacity/current is rounded to approximately 1100 mAh for optimal charging. Constant-current (stable) charging of the element (sometimes implemented as a uniform charge with a current of about 270 mA). This charger is called 'intelligent' because it allows for individual charging of each device separately. Equally important!

To calculate the charging time, divide the battery capacity by the charging current. For a battery with a capacity of approximately 1000 mAh and a charging current of about 270 mA, the charging time is approximately five hours.

Reverse-pulse charging, on the one hand, accelerates the element's response (it's capable of delivering more energy), but on the other hand, it accelerates its discharge. To avoid this shortening of the battery's lifespan, each cycle should be reduced, usually ensured by a multi-module structure, and for some devices, with $(C/10)$.

Therefore, each device has a series of training cycles. In most devices, the so-called training current is much lower. Determining the crystal capacity of the battery is simpler.

Based on the provided text, the following conclusions can be drawn:

Proper battery charging is key to their longevity and efficiency. Incorrect methods (overcharging, incomplete discharge) lead to reduced capacity, overheating, and even damage to the batteries.

It is important to choose a suitable charger. Make sure it is compatible with the battery type (NiCd, NiMH, LiPo, etc.) and has current and voltage control functions, as well as overcharge protection.

It is recommended to use high-quality chargers with advanced features. Such devices provide more precise control over the charging process, extending the lifespan of the batteries. Devices based on temperature change analysis are preferable.

There are two main charging methods: constant current and constant voltage.

For two batteries, constant current charging is important, while for lead-acid and LiPo batteries, constant voltage charging is preferred.

Monitoring the charging process is crucial. Modern chargers use various methods to determine the end of charging, such as measuring the voltage drop (dV/dt) and monitoring temperature, to prevent overcharging.

Not all usage patterns are beneficial for batteries. Accelerated discharge (reverse pulse) can be harmful to a battery.

Following optimal charging guidelines is important: current strength matters, and using a uniform charging method is preferable.

In summary, the essence of the text is that proper battery charging is a science in itself, requiring a careful approach and knowledge of the basic operating principles of various types of batteries and chargers.

Neglecting these principles can lead to a significant reduction in battery lifespan and even damage to the batteries. By developing batteries, we are developing the future.