



THE BEST CHOICE FOR MANY USES

Rechargeable batteries save money and resources and often are the best choice for many uses. But they are best when matched to the right applications and there are some instances when they are not recommended.

WHY RECHARGEABLE BATTERIES ARE GOOD TO USE

- **Save Money** - While rechargeable batteries cost more initially, they can be reused hundreds of times and last for years, if used properly.
- **Protect the Environment** - Batteries contain corrosive materials and heavy metals. Their manufacture, transportation and disposal can impair human health and the environment. In California, batteries are banned from landfills and must be either recycled or handled as hazardous waste. Using rechargeable batteries greatly reduces the number of overall batteries required and disposed of.
- **Conserve Resources, Prevent Waste** - Because rechargeable batteries can be used over and over, far fewer need to be manufactured and transported than when using single-use disposable batteries.

WHEN TO USE RECHARGEABLE BATTERIES

Rechargeable batteries are a good choice for most frequently-used devices such as wireless mice/keyboards, telephone headsets, radios, cameras, calculators, walkie-talkies, remote controls, non-emergency flashlights, toys, dispensers and faucets with automatic sensors, and much more.



WHEN NOT TO USE RECHARGEABLE BATTERIES

Do Not Use for Emergency Equipment

The voltage of single-use alkaline batteries drops at a predictable rate while they are in use. Rechargeable batteries, while generally longer-lasting, remain at a steady rate up until their power is nearly completely discharged and then drop precipitously. Safe use for some emergency equipment requires that the remaining life of a battery be apparent, but this can be difficult to assess with rechargeable batteries. Therefore, they are not good choices for the following:

- Emergency equipment (ie: flashlights, radios, emergency medical devices, etc.)
- Low-power-use devices in difficult-to-access areas (ie: field monitoring devices or ceiling clocks)



TYPES OF RECHARGEABLE BATTERIES

The most popular and readily available “household type” rechargeable batteries today are Nickel-Metal-Hydride (NiMH). There are a number of other rechargeable battery technologies as well, some newly emerging and especially appropriate for specific uses.

- **NiMH (Nickel-Metal-Hydride)** - Environmentally preferable because they avoid toxic heavy metals like cadmium. They provide about twice the capacity of NiCD batteries. Several types of NiMH batteries are available, including “high capacity” (longer-lasting than alkaline batteries in digital cameras) and “low self-discharge” (LSD), which are pre-charged and ready to use. NiMH batteries are good choices for most battery needs, with virtually no “memory loss” effect such as in NiCD batteries. Most NiMH batteries need to be charged before their first use and lose power over time when unused or used infrequently. However, the LSD version significantly reduces power loss and can be used in applications operated irregularly.
- **NiCD (Nickel-Cadmium)** - The cadmium in NiCD batteries creates an environmental hazard. However, NiCD batteries hold their charge longer than NiMH batteries when not in use and produce an initial high rate of discharge, making them a good choice for power tools. NiCD batteries also are recommended for outdoor solar lighting because they maintain their strength better in cold weather than NiMH batteries. NiCD batteries can appear to lose “capacity memory” unless they are regularly and fully discharged before recharging. They are not recommended for digital cameras.
- **NiZN (Nickel-Zinc)** - Higher (1.6V) voltage than standard NiMH (1.2V) batteries, with stronger power retention. Appropriate for high drain devices such as cordless power tools, cordless phones, and digital cameras, but currently limited sizes (primarily AA).
- **Rechargeable Alkaline** - These batteries have a long shelf life and can be used in any applications for which alkaline single-use batteries are used (both run out quickly in high drain devices such as digital cameras). They are particularly recommended for low-drain uses and for devices used intermittently. They can be recharged a limited number of times (6-35 times, compared to NiMH batteries that can be recharged up to 1,000 times).
- Other types of rechargeable batteries such as Li-Ion (Lithium-Ion), Silver-Cadmium, small sealed Lead-Acid flat plates, and Silver-Zinc are available, although generally accompanying specific types of equipment (e.g. medical electronics, laptops, wheelchairs).

BATTERY PERFORMANCE

- Rechargeable batteries usually indicate milli-amp-hours (mAh), a measure of their energy storage capacity. Higher mAh generally indicates longer power output, although specifics are affected by factors such as the equipment’s drain demand and the operating temperature.
- Many rechargeable batteries must be charged before the first use, although some NiMH (LSD versions) arrive pre-charged and ready for use.
- Batteries “self-discharge” over time, and rechargeable batteries generally lose more capacity faster than disposable batteries. However, the rate of loss varies by type of battery, with NiCD as well as NiMH-LSD and other types reporting long shelf lives and low capacity loss.

- Charged but unused NiMH batteries can lose their charge rapidly in warm weather.
- Remove batteries from devices that will be unused for an extended period of time.
- Store charged batteries in dry conditions at normal room temperature. It is often recommended that charged batteries be stored in freezers, but manufacturers now discourage this.

CHARGING AND STORAGE FOR PROLONGING BATTERY LIFE

CRITICALLY IMPORTANT - Match batteries to chargers specifically designed to charge that type of battery, e.g. NiMH batteries should only be recharged in chargers designated for NiMH. In addition, charging stations should match the size of battery, such as AA, AAA, C, D or 9-volt.

Failure to match the type of charger to the battery can result in inadequate recharging, overheating, damage and safety issues. (It is normal for NiMH batteries to become warm while charging, but not hot.)

Time to charge may vary. Older or less expensive chargers are typically less powerful and often less effective, taking up to 7 hours to charge batteries. More efficient chargers may charge a set of batteries in as little as 15 minutes but may only charge AA and AAA sizes. There is typically no drawback to a short charge time and charging at high speeds (i.e., quick charging) can reduce the number of times a battery can be recharged.

BEST CHOICE CHARGERS

Look for Smart Chargers, which have added features to increase the safety, convenience, and performance of your batteries, such as:

- **Automatic Charge Protection:** This feature will automatically stop charging when batteries are full, preventing overheating or overcharging which can compromise battery chemistry and performance.
- **“Trickle Charge”:** This feature senses when a battery is fully charged and automatically initiates “maintenance mode” or “trickle charge”, which charges at approximately the same rate at which NiMHs naturally lose charge. This allows batteries to be stored in the charger between uses. If storing a rechargeable battery longer than a few days, it is better to take it out of the charger and keep at room temperature.
- **Individual Stations:** This feature has individual stations for each battery rather than paired or circuit stations. Since chargers without individual stations will often stop running when the first battery is fully charged, they can prevent the second battery from reaching a full charge. Some dual-station chargers keep going until the second battery is fully charged, which can overcharge the first battery that reaches a full charge.



TROUBLESHOOTING

Not charging all the way?

- Gently rub battery ends with a clean pencil eraser or cloth to remove any residue
- Try completely discharging them and completely charging them again
- Try “cycle charging” - 15 mins in the charger, 10 mins out - repeat 4 times followed by a full charge
- For more information, see www.calrecycle.ca.gov/ReduceWaste/power/rechbattinfo.htm and the FAQs on battery manufacturers’ websites.

BATTERY SAFETY

Never keep any type of battery near keys, coins, or other metal objects. Contact between metal surfaces can cause a short circuit, producing enough heat to burn skin. High heat can result in internal battery pressure caused by excess formation of oxygen or hydrogen gas—in the case of a pressure increase a safety vent in the battery will emit the excess gas, resealing when the pressure is relieved.

SPECIFICATIONS AND NIMH BATTERIES COMPARISON

Specifications for AA, AAA and D size rechargeable batteries are recommended in the report:

Charging Ahead, researched and prepared for the San Francisco Department of the Environment:

www.sfapproved.org/sites/default/files/files/general-files/sfa_rpn_charging_ahead_july2016.pdf

Appendix C of the report provides a detailed comparison of over 50 brands and types of NiMH rechargeable batteries analyzed for the report and specifications:

www.sfapproved.org/sites/default/files/files/general-files/sfa_report_RPN_SFE_Rechargeable%20Batteries_Appendix%20C_070616a.xls

RECYCLING

All batteries contain hazardous substances including lead, cadmium, mercury, or strong corrosive materials. These will contaminate the environment or cause harm to humans if not disposed of properly.



California State law requires all types of batteries to be recycled or disposed as hazardous waste. They can no longer be thrown in household or business trash.

- Alameda County residents can drop-off batteries at four Household Hazardous Waste Facilities around the County. See www.household-hazwaste.org for more information.
- There are many retailers that accept most types of batteries for recycling, plus pick-up options. For battery recycling locations near you, use the **Recycle Where?** website, located at: www.RecycleWhere.org.

Updated November 2016. For additional information, visit www.StopWaste.org/EPP.