Nickel Cadmium Batteries

Battery Usage Precautions, Safety, Handling, Maintenance, Recycling

⚠️ CAUTION!

1. Charging:
   1.1 Rapid Charging: Follow recommended charge rate and charging methods for rapid charging. Only use batteries specifically recommended for fast charging.
   1.2 Trickle charging: Use recommended trickle charge rate of 0.02-0.05 It mA. The correct current value depends on the particular device and application.
   1.3 Charge Temperature: a. Charge batteries within recommended ambient temperatures specified for the battery type and charge method.
      b. Ambient temperature affects charging efficiency. 10 °C – 30 °C is the best temperature range.
      c. At temperatures below 0 °C, the gas absorption reaction rate is not fast enough causing gas pressure inside the battery to rise. This may cause the gases to escape through the safety vent thus leading to leakage of alkaline gas and deterioration in battery performance.
      d. Charging efficiency drops at temperatures above 40 °C. This can disrupt full charging and lead to deterioration in performance and battery leakage.
   1.4 Parallel charging: Parallel charging of Unicad batteries is not recommended and sufficient care must be taken during the design of the charger when charging batteries connected in parallel. Contact U&C for further information on batteries that can be used for this purpose.
   1.5 Reverse Charging: Never attempt to charge with the polarity reversed. This can cause increase in gas pressure, which can activate the safety vent and lead to alkaline electrolyte leakage, rapid deterioration in battery performance, battery swelling or rupture.
   1.6 Overcharging: Avoid overcharging. Repeated overcharging can lead to deterioration in battery performance. The excessive heat accumulated per each charging cycle during overcharge can significantly shorten the battery life. A choice of –ΔV or Temperature control charging cut-off circuit is critical for avoiding overcharging and ensuring a long battery life.

2. Discharging
   2.1 Discharge end voltage: Overdischarge and reverse charge of battery can deteriorate battery characteristics. Install an over-discharge cut-off circuit to avoid this and to optimize battery performance. The recommended discharge cut-off voltage is 1V/cell.
      However, for batteries with large number of cells in series a higher end-voltage per cell is recommended to avoid over-discharge. The recommended discharge cut-off voltage for a battery with n cells in series is given by:
      1-6 cells in series: n V
      7-20 cells in series: (n-1)*1.2 V

For very high-discharge rate applications, an end-voltage lower than 1V/cell should be considered.

2.2 Discharge temperature a. Discharge temperature within the recommended ambient temperature range.
      b. Discharge current affects battery performance.
      Discharge efficiency is best within current range of 0.1 It-0.5 It mA.
      v. Discharge capacity drops at temperatures below -10 °C and above 50 °C. Operating outside the range can lead to rapid deterioration in battery performance.
   2.3 Over-discharge: Over-discharging damages battery characteristics. Avoid shipping the battery pre-installed in the equipment and do not leave the battery connected to the equipment for long periods of time.
   2.4 High-current discharging: High-current discharge can lead to heat generation and decreased discharging efficiency. Use high-drain series batteries for continuous and pulse high-current discharging. Consult U&C for your particular application.

3. Storage
   3.1 Short-term Storage temperature and humidity:
      a. Store batteries in a dry location with low humidity, no corrosive gases and at a temperature range of -20 °C to 45 °C.
      b. Storing batteries in very humid locations or at other than recommended temperature range can cause batteries to rust or leak.
   3.2 Long-term storage (2 years, -20 °C to 35 °C)
      a. Long-term storage can accelerate battery self-discharge and lead to deactivation of reactants. Store in recommended range of 10 °C to 30 °C.
      b. Long-term storage can cause temporary loss of battery capacity. The original capacity can be restored by repeated charge-discharge cycles.
      c. Charge batteries at least once a year to prevent leakage and deterioration in performance due to self-discharge.

4. Service life
   4.1 Cycle life: Batteries used under proper conditions of charging and discharging can be used over 800 cycles. Significantly reduced service time after complete charging means that the life of the battery has been exceeded. At the end of service life, an unusual increase in internal resistance or an internal short-circuit failure may occur. Chargers should therefore be designed to ensure safety in the event of heat generated upon battery failure at the end of service life.
4.2 Service life with long-term use. Battery performance deteriorates with use and with prolonged storage because of the deterioration in chemical products involving internal chemical reactions. Under proper usage and charge conditions, a battery will last 3 to 5 years. However, when used in other than recommended conditions, significant shortening of service life, damage to product and deterioration in performance can occur.

5. Design of products that use Unicad batteries

5.1 Connecting batteries and products. Never solder a lead wire and other connecting materials directly to the battery. Doing so will permanently damage the battery’s internal safety-vent, separator and other parts made of organic materials.

To connect a battery to a product, spot-weld a tab made of nickel or nickel-plated steel to the battery’s terminal strip, and then solder a lead-wire to the tab in as short a time as possible.

Use caution in applying pressure to the terminals in cases where the battery pack can be separated from the equipment.

Avoid mechanical or loose connection methods such as springs as this can cause oxidation of the terminals, which will cause poor conductivity. The terminals need to be periodically cleaned with a dry cloth once every month to remove any oxidation deposits on the terminals.

5.2 Correct Polarity. Care must be taken during the design of the battery pack to ensure batteries and the connector cannot be inserted in reverse. Also, caution must be given to certain structures or product terminals, which can cause short-circuiting more likely.

5.3 Materials for terminals in products using the batteries. Use alkaline-resistant material for the products contact terminals and surroundings in order to avoid problems and damage due to corrosion in case of alkaline electrolyte leakage when the safety vent is activated, due to improper use. Nickel, Nickel-plated steel are high alkaline-resistant metals. Copper, aluminium, tin, zinc and brass are low alkaline-resistant metals.

5.4 Ambient Temperatures in use. Install batteries far from heat-generating parts or products such that the recommended ambient temperatures for use, charging, discharging and storage are maintained. The best battery position is a battery compartment that is composed of an alkaline-resistant material, which isolates the batteries from the products’ circuitry.

5.5 Installation in equipment. Never design an airtight battery compartment. If the batteries are abused, internal gassing may occur which may be released by the cell safety-vent. The vented gases are potentially flammable and may cause a fire or an explosion in the presence of a source of ignition (sparks generated by a motor switch, etc.). Care should be taken during the design of the battery compartment to ensure proper air-ventilation.

6. Other precautions. Batteries should always be charged completely prior to use. Be sure to charge correctly.

7. In order to ensure safe battery use and optimize battery performance, please consult with U&C for the specific application regarding voltage and current ratings for use and product design prior to final-use of battery-operated product.
**WARNING!**

Prohibited items regarding battery handling. U&C assumes no responsibility for problems resulting from batteries handled in the following manner:

- Never disassemble a battery, as the electrolyte inside is strongly alkaline and can damage skin and clothes.
- Never attempt to short-circuit the terminals of a battery. Doing so can damage the product and generate heat that can cause burns.
- Never dispose off a battery in fire as this can cause the battery to rupture. Never place batteries in water, as this causes batteries to cease to function.
- Never solder anything directly to a battery. This can permanently damage the safety-vent, the separator and other organic materials in the battery.
- Never insert the battery with the negative and positive terminals reversed, as this can cause the battery to swell or rupture at the same time may cause permanent damage to the product or circuitry.
- Never reverse charge or overcharge at higher than rated currents. Doing so causes rapid gas generation and increased gas pressure causing the batteries to swell or rupture. Charging with an unspecified charger or specified charger that has been modified can cause batteries to swell or rupture.
- Do not use a battery in an appliance or device for which it was not intended. Differences in specifications can damage the battery or appliance.
- Never use old and new batteries or batteries with different amount of charges together.
- Never use batteries with dry primary or Ni-MH or Li-ion batteries are with another manufacturer’s batteries. Differences in battery characteristics, voltages and capacities can cause electrolyte leakage, degrade battery characteristics or damage to the batteries or the product.
- Never charge/discharge batteries under conditions that are outside the recommended specifications without first consulting with U&C.
- Never alter, modify or tamper with the cell, battery parts or configuration provided in the original condition. Never attempt to service the battery or any of its components by yourself. This will void all warranties provided for the battery product.
- Never leave an uncharged battery connected to a device that constantly drains stand-by current.

**DANGER!**

- Unicad alkaline rechargeable batteries contain a strong colorless alkaline liquid electrolyte (usually KOH). The alkali is extremely corrosive and will cause skin damage upon contact. If exposed, the alkali can damage eyes and lead to permanent loss of eyesight. If any contact occurs with the skin or eye, immediately flush the exposed area with lots of clean water and consult a doctor.
- To avoid serious personal injury due to heat generation, battery leakage or rupture, carefully observe the warnings and precautions outlined in this section.

**Battery Maintenance**

- Periodic visual inspection of the battery is recommended. Ensure that there is no electrolyte leakage or swelling of the cell case as these indications develop if the battery is mechanically abused or not used according to recommended conditions.
- Periodically clean any exposed parts of terminals with a dry cloth once every month to remove any oxidation deposits on the terminals or other exposed battery parts.
- To avoid accelerated self-discharge and loss of performance of batteries upon storage, periodically cycle the battery with a charge-discharge cycle. For long-term storage, recommended period is once every 6 months.

**Battery Shipping and Transportation**

Unicad sealed cylindrical batteries can be shipped in normal packaging conditions without special handling. However, proper care should be taken to ensure that the batteries are properly packaged with alkaline-resistant cushioning material according to specifications to avoid mechanical damage and excessive vibrations during transportation.

**Battery Disposal & Recycling**

When the battery has reached the end of its life, the battery should be recycled or disposed of properly. Do not dispose of in fire or water as this may cause the battery to explode causing personal injury. Properly insulate the battery terminals prior to disposal. Unicad rechargeable batteries contain harmful elements like Cadmium. Recycling Nickel Cadmium batteries is highly recommended to keep these batteries out of landfills and solid waste stream and thus preserving the environment. In some countries or regions, recycling of batteries is the law. Contact your state or local authority for information on battery disposal regulations or for locations of battery recycling sites. Contact RBRC (1-800-8-BATTERY) or visit their website www.rbrc.org for information on recycling regulations and their battery-recycling program in the United States.