

## BATTERY STORAGE

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Battery storage dramatically affects their performance or can even leave them useless. With many differing chemistries, questions on battery storage are not out of the ordinary. It is in the best interest of anyone ordering batteries to know how to properly store them ahead of time to get the most out of their investment. In all cases, batteries should be stored with no connection to a load.

### **Lithium-ion (Cylindrical and Polymer)**

Lithium-ion battery storage issues and questions are increasingly common. The length of time lithium-ion batteries are being stored will help determine the proper storage conditions. Ideally, lithium-ion batteries (and batteries in general) should be stored at approximately room temperature and 50% relative humidity, but that is not always possible. A general temperature range that they can be stored short-term (~1 month) is -20°C-45°C and -10°C-35°C long term (≥ 1 year).

Improper storage of lithium-polymer packs and cells can lead to swelling, leaving the cell or pack unusable. A common situation is where a shipment of lithium-polymer packs is received, then left on the shelf for months or even over a year. To the surprise of the owner, they will often find their lithium-polymer packs swollen, with little to no capacity, and unable to work in their application. This can be prevented by following simple storage rules such as keeping the packs charged, charging within 45 days of delivery, and keeping the batteries within standard storage conditions.

Storing lithium-ion batteries at full charge is not recommended. A State of Charge (SoC) of around 40-60% is recommended. The batteries do not self-discharge a significant amount when stored at ambient conditions, so longer-term storage is possible at 40-60% SoC. This prolongs the battery's life. Much of the time, lithium-ion batteries are shipped at about 30% SoC, but these should be charged within approximately 45 days of being received to avoid under-discharge condition of the batteries.

### **Primary**

As with any other battery, ambient conditions are best for primary cells. It is particularly important to consider storage for primary cells since they cannot be recharged. Primary cells also have a relatively long shelf life when stored at ambient conditions. In the most extreme cases, lithium primary batteries/cells have been stored for up to 20 years in the proper conditions. Storing primary cells in freezing temperatures is not recommended.



## NiMH

Again, depending on how long a NiMH battery is being stored dictates the conditions that they can be stored. There's more restriction for longer-term storage. Storage can also vary by the cell manufacturer, but a good rule of thumb would be to keep NiMH batteries at -20°C-35°C. For short-term storage (<1 month) -20°C-50°C is acceptable, but again, -20°C-35°C is the preferred temperature range along with 50% relative humidity for NiMH batteries. Greater than one year of storage would also require charging around once a year to avoid cell degradation or damage.

## NiCD

Ideal storage temperature for NiCD batteries again varies by the manufacturer, but the typical range is -20°C-45°C. NiCD batteries should be fully charged and discharged once a year when stored long-term (≥1 year). It is recommended to discharge NiCD batteries to approximately 40% SoC before storage.

## SLA

Sealed Lead Acid batteries must be top-charged every so often when stored. Typically, SLA batteries need to be top-charged every 6 months of storage. The allowable temperature range for storage is -20°C-45°C, and they can be stored for up to 2 years before damage to the cells.

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## REFERENCES:

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