Recommendations for storage of lithium cells and batteries (LS and LSH ranges)

October 2014
Poitiers, France

Storage parameter	What may happen	Consequences	Recommendations
Duration	Micro parasite consumption of active materials inside lithium batteries occurs spontaneously and continuously during the entire duration of storage before use. This process also leads to the accumulation of a layer of non-conductive crystals at the surface of the lithium electrode.	1) *"Self-discharge"*, loss of active materials, entailing a decrease of the available capacity (Ah) at time of use. 2) *"Passivation"*, with risk of transient low voltage readings when the battery-powered equipment is turned on.	Do not store lithium batteries and cells for too long periods of time. Observe the First In/First Out principle. Even if the storage duration before use can go up to 10 years (at 20°C) without any major damage or risk of leakage, the recommended storage duration should not exceed 3 years.
Temperature	Higher storage temperature speeds up the passivation and self-discharge processes. Also contributes to the formation of a passivation layer harder/slower to disrupt at operation startup.	**T < 10°C:** Self-discharge rate and risk of transient low voltages readings when the equipment is turned on can be neglected. **T 10-30°C:** yearly loss of restorable capacity about 1% for LS products; about 2.5% for LSH products. Small risk of passivation as long as the storage duration does not exceed 5 years and/or initial low voltage readings lasting less than 1 second are tolerable by the application. **T > 30°C:** self-discharge rate multiplied by ~ 1.7 at 45°C and by ~ 5 at 70°C. More serious risk of initial low voltage readings at the onset of discharge	- Storage room maintained at a temperature not exceeding 30°C. - Use air conditioning in hot climates. - Limit excursions at T above 30°C to less than 30% of the storage time before use. - In case of risk of extended exposure at uncontrolled temperatures, think about using temperature detectors on packaging. - After 2 years of storage with possible excursions at T > 30°C, apply a preventive depassivation procedure (for ~ 1 minute, drain a 10-200 mA current, according to Saft recommendations).
Humidity	Excessive humidity may induce corrosion on the exposed metal parts of lithium cells/batteries	Development of rust spots on containers and connection terminals. (Low risk with LS cells that are all stainless steel.)	Do not to expose lithium cells/batteries longer than 80% of time at RH > 80%

Ventilation	In case of a leak or accidental vent of lithium cells or batteries, ventilation of the storage room will help in dispersing corrosive vapors.	Contamination and corrosion of cells and batteries neighboring the leaking/vented ones.	Make sure that natural ventilation exists in the storage room.
Cleanliness	Accumulation of dust and dirt. Storage corridors blocked.	Potential hazards not quantifiable but dirty storage room likely to be associated with other mishandling problems + difficulty in taking quick action in case of fire.	Storage rooms complying with standards in force for technical products. Battery Information Sheets issued by the manufacturer to be prominently displayed
Stored quantity	Excessive accumulation of cells and batteries on shelving.	In case of fire, the heat produced may makefire-fighting difficult.	Do not store more than 400 individual cells / 150 battery packs per square meter of shelving.

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Summary:

Condition	Duration	Temperature	Humidity	Risks
Optimum	**Less than 3 years**	**Less than + 30°C**	**Less than 80%**	**Minimum ***
Scenario 1	Less than 3 years	Less than + 30°C	More than 80%	Risk of external corrosion on metal power terminals of cells and battery packs
Scenario 2	Less than 3 years	30/70°C	Less than 80%	Low voltage when the apparatus is turned on for less than 1 second
Scenario 3	Less than 3 years	30/70°C	More than 80%	Low voltage when the apparatus is turned on for less than 1 second + risk of external corrosion of metal power terminals of cells and battery packs
Scenario 4	More than 3 years	Less than + 30°C	Less than 80%	Loss of capacity >°3% (LS) and 6% (LSH) in relation to new condition.
Scenario 5	More than 3 years	30/70°C	Less than 80%	Loss of capacity >>>°3% (LS) and 6% (LSH) in relation to new condition + low voltage from battery packs when the apparatus is turned on for 0.1 to several seconds.
Scenario 6	> 3 years	30/70°C	> 80%	Loss of capacity >>>°3% (LS) and 6% (LSH) in relation to new condition + low voltage when the apparatus is turned on for 0.1 to several seconds + risk of external corrosion of metal power terminals of cells and battery packs.

* For each particular application, consult Saft to have optimum storage conditions and commissioning operations.

	Process implemented	Potential hazards	Recommendations
In case of fire	Heating of cell/batteries entailing an increase to battery internal pressure. Above 120-140°C, degassing, may be violent (explosion) with emission of corrosive vapors. Beyond 182°, fusion of lithium, internal short circuiting of elements with general uncontrolled heating. Beyond 200-250°C, increased risk of explosion and ignition of melted lithium.	Emission of irritating and corrosive vapors. Risk of explosion with ejection of shrapnel. Lithium fire.	As long as cells/batteries are not open (no lithium fire characterized by intense red flames), water spraying may efficiently contribute to cooling and fire control. In case of uncontrolled heating with lithium fire, do not use water but use Lith-X or Class D type extinguishers. Wearing of safety clothing mandatory in rooms involved.