



Handbook for Lithium battery products

1 Introduction

With lighting fixtures becoming more portable, lightweight, and powerful, they require batteries that offer many hours of battery life before recharging.

The typical lifespan of these lighting fixtures should easily exceed 5 years; however their batteries, even if handled properly, will feature a shorter life.

The lithium batteries used in products are made of individual cells connected together. **When the temperature of one or more cells rises above a safe limit, a chain reaction can be triggered which can generate excessive heat in a very short time. This can cause flames or even an explosion within a few minutes. Recharging a lithium battery increases its temperature, as well as storage or transport in high ambient temperatures.** This article contains a few general safety suggestions on how to handle battery operated products. It is always recommended to read the safety instructions contained in the product user manual. **General safety instructions for devices containing lithium batteries is also available on the www.prolights.it website and here: [LINK](#)**

2 What is the life cycle of a lithium-ion battery?

According to [Battery University](#) a Lithium-Ion battery's average life span is **2 years** or **300 charge cycles**, when the device is operated correctly. Rechargeable Lithium-Ion batteries do have a limited lifespan and will slowly lose their ability to retain charge over time. This reduction in capacity is permanent and called aging. As the battery's capacity reduces there is a reduction of the run time of the product.

When not in use or stored, the charge in a lithium-ion battery will slowly deplete (self-discharge). Make sure to check and charge your batteries regularly.

3 Why batteries overheat

Lighting fixtures powered by lithium-ion batteries are perfectly safe if used as intended, however there have been reports of overheating in battery powered electronics products across multiple industries and applications. Failures typically happen when products are used incorrectly or without supervision. Excessive heat is the real enemy for any battery. High temperatures can damage the internal components on both a physical and chemical level.

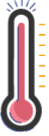



When excessive heat is combined with a full charge, Li-ion battery faces the most stress which presents the highest potential for overheating. Li-ion batteries that have reached the end of their life and/or that have been exposed to stress, may appear to operate normally but will become more sensitive to overheating and mechanical shock.

It is strongly recommended to keep the battery and the device away from heat sources and direct sunlight.

Charging in extreme cold or high temperature reduces the battery's ability to accept charge and exceeding the recommended charge level can harm the Li-ion. Batteries that have

reached the end of their life or have been exposed to stress, are most susceptible to overheating.






Why batteries overheat

			
Heat is the real enemy	Recharge and use in excessively hot or cold environments	Exhausted batteries are more susceptible	Shock or mechanical damage also from transport and use of the product

4 Five signs that your batteries need to be replaced

In addition to the typical average lifespan of the battery, there are common signs that indicate a battery needs to be immediately inspected and potentially replaced before using.

Five signs that your batteries need to be replaced

		
2 years or 300 charging cycles	overheating	swelling
		
	deterioration	cracks on the shell

Age: The expected lifespan of a Lithium Ion battery is **2 years** or **300 charge cycles**, whichever comes first. Once your battery passes the standard lifespan, it is time to consider replacing it.

Overheating: If one unit becomes more than 10°C hotter in normal use, or during charging than other units in good condition.

Performance: if you observe that performance and runtime of the battery considerably deteriorates

Swelling: Chemical reactions create gases that expand and push on the outer shell of the battery.

Other visible evidences: typical visual indicators that tell you a battery needs to be inspected and replaced are:





- Pools of vented gases that condensate on top of the battery can dry into a white dust. Sometimes, this dust can be from a nearby battery so routine preventative maintenance is key.
- Cracks or openings on the outer shell of the battery are a serious matter. If there are cracks or openings, seek immediate assistance from a specialised service technician.

5 How storage affects batteries life span

It is important to consider that the event industry can be highly seasonal. Battery-powered fixtures may be subject to periods of intense use alternating with periods of low use. Proper storage of these fixtures will help to preserve the lifespan of the battery pack and decrease the risk of overheating. To maximise the batteries life, always avoid storing fixtures with **0%** or **100%** charge. Before an idle period, make sure the battery has some charge, ideally **50%** - **60%**, before storage. If the battery is stored with some charge, it will last longer before fully self-discharging. It's recommended to conduct long-term storage as near as possible to ambient temperature . As a result, stay away from extremely cold rooms or heat sources, keep it in a cool and dry environment. Moreover, if you're not using the battery operated fixture for more than a few weeks, make sure all cables are disconnected from the charger or mains.

If the storage period is extended, periodically inspect the state of charge of the fixtures and make sure that the state of the battery is not extremely low, restoring the charge level at **50/60%**.

How to storage devices with built-in lithium battery effectively

			
50/60 % charged	room temperature	inspect regularly	disconnect all cables

6 Safety recommendations during recharging, use and transportation





Most potential failures and overheating, with consequent ignition of fires or explosions, occurs during the recharging process, as the lithium batteries are exposed to their greatest stress. During the recharging process, it is recommended to follow some general rules to reduce the risk of accidents and damages.

- Battery powered fixtures should always be supervised when on charge, and never charged unattended.
- Choose a cool and dry location for charging, away from any source of heat and away from any flammable object. The temperature should not be below 5°C and not above 35°C (41 to 95 °F).

- Immediately stop using a fixture or disconnect the charger if its temperature rises more than **10°C (18°F)** above a normal charge.
- To maximise battery life, consider charging to only 70% where the full runtime of the unit is not required.
- Be sure to transport projectors with lithium batteries with care in order to prevent shocks or damage.

Although batteries can operate in a wide range of temperatures, this does not mean they can be charged under the same conditions. Fixtures should be brought to a temperature above 5°C before charging.

Safety recommendations during recharging phase

	+5/+35°C			
never charge unattended	choose a cool and dry location	charge away from flammable object	70% recharge grants greater lifespan	never overcharge

In summary:

- Never leave a fixture unattended when charging
- Do not charge a fixture that shows any visible signs of damage, malfunction, alteration or moisture inside
- Always charge fixtures with their flight-case lid open
- Charging a battery is most effective when its state-of-charge (SoC) is low.
- Filling a battery beyond full state-of-charge turns excess energy into heat and gas. With Li-ion, this can result in a deposit of unwanted materials. Prolonged overcharge causes permanent damage.
- Use the original charger provided by the manufacturer for the intended battery specification. Do not charge if it is different.
- Check the temperature of the device when charging. Temperature should not rise more than **10°C (18°F)** above ambient temperature when reaching full charge.
- Remove battery when warm.
- Charge at room temperature, in a dry environment and away from heat sources. Do not charge below freezing.

7 What to do if a battery overheats or catches fire

If a battery overheats, hisses or bulges, immediately move the device away from flammable materials and place it on a non-combustible surface. If at all possible, remove the battery and put it outdoors. **Simply disconnecting the battery from the charger may not stop its destructive path.** A small Li-ion fire can be handled like any other combustible fire. For best results use a foam extinguisher, CO₂, ABC dry chemical, powdered graphite, copper powder or soda (sodium carbonate).

Water-based extinguishers are not recommended because the lithium metal can react with water. In an emergency they can be used to prevent a fire from spreading to other inflammable materials. During a thermal runaway, the high heat of the failing cell inside a battery pack may propagate to the next cells or adjacent battery pack, causing them to become thermally unstable. A chain reaction can occur in which each cell disintegrates on its own timetable. A pack can thus be destroyed in a few seconds or over several hours as each cell is being consumed.

A recap about how to operate in case of fire:

- Douse Li-ion battery fires with a Class D fire extinguisher (Li-ion contains little lithium metal reacting with water.)
- If a Class D extinguisher is not available, douse a lithium-metal fire with water to prevent the fire from spreading.
- For best results dousing a Li-ion fire, use a CO₂ foam extinguisher, ABC dry chemical, powdered graphite, copper powder or soda (sodium carbonate). Reserve the Class D extinguishers for lithium-metal fires only.
- Be aware of cell propagation as each cell might be consumed on its own time table when hot. Place a seemingly burned-out pack outside for a time.