# FAQ - Lithium-Ion Batteries

## What is a lithium-ion battery? And what types are there?

A lithium-ion battery is a rechargeable battery that nowadays supplies mobile phones, tablets and tools as well as e-bikes and electric cars with energy. The lithium-ion battery offers many advantages such as high energy density and a long shelf life.

Lithium batteries are basically divided into lithium metal batteries and lithium ion batteries. Lithium-metal batteries are generally not rechargeable and contain metallic lithium. Lithium-ion batteries, on the other hand, no longer contain metallic lithium, but a lithium compound (lithium oxide) and are rechargeable. They are often referred to as „rechargeable batteries“.

## Why are lithium-ion batteries so dangerous?

Improper handling of lithium-ion batteries increases the risk of fire. The growing popularity of lithium-ion batteries in particular is also increasing their fire risk. There are numerous examples of fires in connection with lithium-ion batteries, such as exploding mobile phone batteries or e-bike batteries.

## How does a lithium-ion battery work?

The metal at the negative pole of the battery is graphite in which lithium is embedded. Lithium cobalt dioxide is located at the positive terminal. If you connect the battery to the socket, the positively charged lithium ions move from the positive terminal to the negative terminal. If you use the battery in an appliance, the electrons are absorbed by the ions. The negatively charged ions then move back to the positive terminal and are recharged here.

The two electrodes are protected from direct contact by a separator and remain largely electrically neutral during the charging and discharging process due to the migration of the lithium ions. The separator also plays an important role in protective circuits, e.g. in the event of a temperature increase due to overcharging. Various mechanisms ensure that the separator is impermeable and the current

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flow is therefore interrupted. The electrolyte (electrically conductive substance), which promotes the transfer of electrons at the electrodes and in which the lithium ions move, usually consists of (flammable) organic solvents with a lithium conducting salt (often lithium hexafluorophosphate LiPF6).

## How does a fire start in a lithium-ion battery?

Improper handling causes temperature increases in the cells, which can lead to fires in lithium-ion batteries. An increase in temperature leads to an increase in internal resistance, which causes the temperature to rise further, especially with high current flows (fast charging, car and e-bike batteries). This first reaction phase leads to an increase in pressure within the cell and to the bursting of the pressure relief valves. In the second phase, the further increase in pressure and chemical reactions lead to the outgassing of cell components. In the third reaction phase, the cell finally breaks down („thermal runaway“), possibly resulting in fire and explosion.

The depressurisation or fire and explosion results in the release of toxic and hazardous substances such as hydrofluoric acid and organic compounds, as well as carcinogenic nickel and cobalt compounds. Hydrogen is also frequently produced, which forms flammable mixtures with air (oxyhydrogen gas). The flammable gas is also produced by the DC voltage applied to the terminals if the batteries are covered with extinguishing water, for example.

## What precautionary measures can I take?

Do not short-circuit or mechanically damage the battery (pierce, deform, dismantle, etc.). Do not heat or burn. Keep battery cells away from small children. Always store battery cells in a dry and cool place. If handled properly, the battery cells are safe to use. Incorrect handling or circumstances that result in improper operation can lead to leaks of battery contents and decomposition products and thus to violent reactions that endanger health and the environment. In principle, contact with leaking battery components can pose a risk to health and the environment. Adequate personal and respiratory protection is therefore required in the event of contact with conspicuous battery cells (leakage of substances, deformation, discolouration, dents, etc.). Escaping substances (gaseous or liquid) can react violently, e.g. in combination with fire.

## How do I fight a lithium-ion battery fire?

Act quickly, purposefully and preferably with water. Personal safety has priority. Leave the room immediately in the event of intensive smoke development or gas release. In the case of batteries with a plastic housing, not only the thermal hazard, as with all batteries, but also the splintering effect must be taken into account. When storing large quantities of batteries and possibly high power or many small batteries in many packaging units, no general protection concept is yet publicly available in the literature, so holistic fire protection concepts must be drawn up in individual cases. When fighting fires involving batteries containing lithium, it is particularly important to prevent chain reactions of individual cells and to contain the fire quickly and effectively from a safe distance directly at the burning battery or to allow it to burn down in a controlled manner.

Water applied in a spray jet has proven to be the preferred means for this purpose. The cooling effect of water effectively inhibits the spread of fire to battery cells that have not yet reached the critical temperature for ignition. The „thermal runaway“ that takes place within a cell is also slowed down. As a side effect, water extinguishers are often also suitable for any surrounding fires that may occur.

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The new extinguisher in the GLORIA family offers you precisely these properties. So play it safe and convince yourself of the new GLORIA water fire extinguishers with special suitability for lithium-ion batteries: The portable water-cartridge operated fire extinguisher with very good ecological and maintenance-friendly properties, approved in accordance with DIN EN 3 for fire class A. Due to its proven special suitability for burning lithium-ion batteries, the extinguisher can be used on batteries up to 600Wh.

## A compact summary of our top 10 product highlights:

- Top product for home
- Special suitability for lithium-ion batteries
- Confirmed sustainability
- Creditable towards basic equipment according to ASR A 2.2
- Use on electrical equipment
- Cartridge technology
- Special nozzle
- Standardised spare parts
- Increased safety
- Special hose assembly


For further product information from our lithium brochure, simply scan the following QR code or visit our website at **www.gloria.de**:

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Other extinguishing agents such as sand, metal fire powder or similar substances are only suitable as extinguishing agents to a limited extent, as they only have the effect of covering the source of the fire. The covering effect therefore supports the „thermal runaway“. When the cover is removed, a strong deflagration can occur due to the sudden supply of oxygen to the possibly still hot smouldering fire. These „extinguishing agents“ are therefore more likely to protect the surrounding area. CO2 and nitrogen only have a very short, low cooling effect and are therefore not suitable.

## What measures do I need to take in the event of an accidental release?

Electrolyte may escape if the cell housing is damaged. Leave the danger zone immediately until the vapours have dissipated. Ensure maximum ventilation of the area. Avoid skin and eye contact as well as inhalation of vapours. Leaking batteries must be sealed airtight in a plastic bag together with universal binder. Electrolyte traces can be bound with universal binding agent and soaked up with dry household paper and then packed in an airtight bag. Avoid direct skin contact by wearing protective gloves. Rinse with plenty of water. Personal protective equipment appropriate to the situation must be used (protective gloves, protective clothing, face protection, respiratory protection). Defective cells, electrolyte and binding agents should be disposed of properly.

## First aid measures

If contact with ingredients occurs, remove contaminated clothing and rinse the affected areas thoroughly with water for at least 15 minutes. In the event of eye contact, contact a doctor in addition to rinsing thoroughly with water.
If burns are caused, they must be treated accordingly. It is also strongly advised to contact a doctor. Leave the room immediately in case of intensive smoke development or gas release. In the event of large quantities and irritation of the respiratory tract, consult a doctor. If possible, ensure adequate ventilation.