Storage & charging of lithium-ion batteries

This guidance highlights some of the hazards associated with the storage and charging of lithium-ion batteries.

RISK ADVICE LINE

Having read this guidance should you have any additional questions on this topic or other risk related matters, as a valued Ecclesiastical customer you can contact us through our 'Risk Advice Line' on 0345 600 7531 (Monday to Friday 9am - 5pm, excluding bank holidays) and one of our in-house risk professionals will be able to assist. Alternatively you can email us at **risk.advice@ecclesiastical.com** and one of our experts will call you back within 24 hours.

For queries about your policy cover or claims please contact your insurance broker.

Lithium-ion batteries are widely used lightweight rechargeable batteries that power an extensive range of electrical and electronic devices.

They including the following categories:

Consumer electrical and electronic devices - mobile phones, digital cameras, laptop computers and tablets.

Medical devices - diagnostic equipment, patient monitors and handheld surgical tools/equipment.

Industrial equipment — cordless power tools, telecommunications systems, wireless security systems, and outdoor portable electronic equipment.

Automotive applications — including battery-electric vehicles, hybrid-electric vehicles, plug-in hybrid-electric vehicles, and light-electric vehicles.

While the rate of failures associated with their use is small, batteries can present a fire risk when charged incorrectly, short circuited, damaged, transported or stored incorrectly

Lithium-ion battery design

A lithium-ion battery is an energy storage device in which lithium-ions move through an electrolyte from the negative electrode ("anode") to the positive electrode ("cathode") during battery discharge, and from the positive electrode to the negative electrode during charging. Lithium-ion batteries are generally more expensive than alternative battery chemistries but they offer significant advantages, such as high energy density levels and low weight-to-volume ratios.

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Why lithium-ion batteries fail

Short circuiting, overcharging, electrolyte breakdown and damage are the main reasons for lithium-ion battery failure. The main line of defence against short circuiting is a thin and porous slip of polypropylene that keeps the electrodes from touching. If that separator is breached, the electrodes come in contact, and a short circuit will occur. The batteries are also filled with a flammable electrolyte, one that can combust when it heats up, then really get going once oxygen hits it.

Even if a device is well designed, dropping it and subjecting it to long-term wear and tear can do damage to its volatile power source. One way to tell if the battery is damaged is if it looks misshapen, this is evidence that the chemicals inside the battery are producing gas in a way that they shouldn't. That swelling also creates its own pressure within the battery housing, which could lead to a puncture or conflagration.

Exposure to heat / fire and thermal runaway

When a lithium-ion battery is exposed to heat there is a danger of thermal runaway (an exothermic reaction which cannot be stopped) which generates multiple explosions and flaming.

Safe storage of lithium-ion batteries

There is currently no legal standard for safe storage. Good practice is to store batteries in a dedicated fire compartment, fitted with a sill, explosion relief panels and ventilation extraction, much like a conventional flammable liquids store.

Further guidance on storage can be found in RC61 Recommendations, for the storage, handling and use of batteries. This is available to download free from **www.riscauthority.co.uk**

Fire detection & extinguishment

Fire protection measures for battery storage areas should be proportionate to the risk and be based on the findings of your fire risk assessment.

Conventional fire detection in the form of smoke / heat detectors can be too slow to detect fires involving lithium-ion batteries as thermal runaway will already be in progress by the time of detection. Thermographic detection is better as it can pick up heat increases before the point of breakdown.

Water in the form of sprinklers is the best form of extinguishment since it both cools and extinguishes, but water, foam or water with F500 Encapsulating Agent can also be used.

Risk Management

In order to reduce the risk of fire from charging lithium-ion batteries, it is recommended that you put the following precautions / measures in place:

You should set up a dedicated charging area, ideally a separate fire compartment within the premises, fitted with a sill, explosion relief panels where appropriate and ventilation extraction.

- All batteries should be stored, charged and used in accordance with the manufacturer's instructions
- Inspect your battery regularly for signs of damage, such as crushing, cuts or punctures. Do not use a battery that has received a sharp blow, been dropped or is in poor condition.
- No flammable or combustible material, other than that associated with the chargers, should be stored within 2 metres of the charging area
- Batteries must not be left to charge unattended overnight or when the premises are unoccupied.
- A minimum of 1 x 9 litre water with F500 Encapsulating Agent fire extinguisher should be provided within the charging area.
- Use and store your battery within the temperature limits stated by the manufacturer. Do not store in a closed location where sunlight may cause elevated temperatures, such as near a window.

You should protect batteries against being damaged; crushed, punctured or immersed in water

You should avoid leaving items continually on charge after the charge is complete.

As a general practice, you should unplug battery chargers and remove battery packs when not in use. Do not store batteries on their chargers.

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