



Safety instructions for the use and charging of small and medium size lithium ion powered devices

Draft

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New image needed!





The CFPA Europe develops and publishes common guidelines about fire safety, security, and natural hazards with the aim to achieve similar interpretation and to give examples of acceptable solutions, concepts, and models. The aim is to facilitate and support fire protection, security, and protection against natural hazards across Europe, and the whole world.

Today fire safety, security and protection against natural hazards form an integral part of a modern strategy for survival, sustainability, and competitiveness. Therefore, the market imposes new demands for quality.

These Guidelines are intended for all interested parties and the public. Interested parties includes plant owners, insurers, rescue services, consultants, safety companies and the like so that, in the course of their work, they may be able to help manage risk in society.

The Guidelines reflect best practice developed by the national members of CFPA Europe. Where these Guidelines and national requirements conflict, national requirements shall apply.

This Guideline has been compiled by the Guidelines Commission and is adopted by the members of CFPA Europe.

More information: www.cfpa-e.eu



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Key words:

1 Introduction

The Lithium ion batteries are more and more present in our lives, as a power source to small and medium electronic devices, and also as large scale energy storage systems. Although the batteries are safe elements, the utilization of a defective battery can cause a thermal runaway process triggering a domestic fire. This guideline present usage and recommendations for the users of small and medium electronic devices powered by lithium ion batteries.

2 Scope

Lithium batteries are nowadays an energy source of many small electronic devices e.g. cell phones, laptops, cameras, consoles, etc., as well as in medium size items such as electric bicycles, scooters and hover-boards. All these devices and items are regarded as so called "portable items". These items have to be distinguished by devices or items with removable batteries (for charging), or not removable batteries (charging fixed with the item).

Although these devices are safe devices (must always guarantee a minimum quality standards in design and fabrication), they are susceptible of overheating phenomena that can happen especially during the charging process, or for mechanical damage, that has affected the integrity of the cells.

This guideline is intended to the final users of small and medium size portable electronic devices, powered by lithium ion batteries, with the purpose of provide recommendations for a safe use.

This guideline does not include the batteries with a big capacity, such as car batteries, or the batteries used in storage banks of big scale energy. In addition, the primary (non-rechargeable) lithium metal batteries are outside the scope of this guideline.

3 Definitions

Lithium ion

It is a type of rechargeable battery, in which lithium ions move from the negative electrode (anode) to positive electrode (cathode) during the discharge, and back when charging.

Primary (non-rechargeable) lithium metal cells

These batteries have anodes of metal lithium that can be match with cathodes of different materials (MnO₂, CF_x, FeS₂, SOCL₂, etc.). Depending on the application and the chemistry reaction involved, the product format can be button or cylindrical battery. These batteries are non-rechargeable batteries.

Secondary (rechargeable) lithium metal cells

Its main characteristic is that this type of batteries are rechargeable. Depending of the manufacturing and components, it can endure to a thousand cycles of charge. The recharge is possible because the lithium is not present in metallic form, but as a part of compounds as the graphite or metallic oxide of lithium, being able to move from anode to cathode during the discharge, and from cathode to anode during the charge, in ionic status.

Thermal runaway

Energy release process in the form of heat, which happens when some battery cells break their physical integrity. In addition to the increase of temperature, it can be accompanied by electrolyte leakage, smoke emission, fire and/or explosion.

4 Hazards

When the batteries presents some damage, derived from inadequate manufacturing, bad use, or mechanic damage, among other causes, they can lead to fire or explosion process.

The amount of storage energy in a lithium ion cell is very high. Moreover, the failure of a battery gives place to a chain reaction called thermal runaway, which releases the energy contained in the battery in a short space of time. A failure of this type can produce temperatures over 500°C, accompanied by an explosion that can throw flaming material several meters away.

The following aspects should be considered as potential causes of a critical failure in a battery and should be avoided:

- Charging the battery using devices not recommended by the manufacturer. The battery charger must be able to stop the charging process before the maximum battery charge limit value is reached. Thus, the battery overload that leads to overheating is avoided.
- Mechanical damages to the battery (perforation, deformation, drop, etc.). This could break the physical integrity of the cells.
- Very high ambient temperature. For this reason, some electronic devices have an automatic shutdown system when reach a certain temperature. In addition, the batteries must be kept far away from directly heat sources, as heaters and open flames.
- Perform the charge process under freezing temperatures. This can lead to the appearance of metallic lithium in the anode, increasing the probability of failure.

5 Safety instructions for a safety use of battery powered devices

When using and/or recharging lithium ion batteries following safety instructions should be regarded:

- The batteries must have been designed and manufactured following a minimum standard of quality. It is important that the batteries and their chargers have been tested and certified by a third party.
- Always use the batteries recommended by the manufacturer of the device to be powered.
- Always use the charge system recommended by the manufacturer of the battery.
- Avoid the batteries overload. To ensure it, the devices of charge recommended by the manufacturer usually incorporate a disconnection system of the charge.
- Avoid any physical damage of the batteries. Inspect them to ensure there are no signs of deterioration (see chapter 6).
- Insert the batteries correctly in the device. Ensure a complete contact between the battery and the device terminals. Do not alter the polarity.
- Keep the batteries, or the devices that they power, within the limits of the ambient temperature stated by the manufacturer.
- Do not expose the batteries or the devices that they power, at the direct sun or heat sources (heaters, open flame, etc.).
- Do not make the charge process of the battery out of the temperature range recommended by the manufacturer.

- Do not disassemble the batteries and do not separate the cells that form it.
- Please note that if you are carrying devices equipped with lithium ion batteries on a plane, such devices cannot be checked in and must be carried in the cabin as carry-on baggage.

6 Safety instruction for fire protection in the homes

This section provides some tips to minimize personal and material damage in the event of a lithium-ion battery fire in the home:

- Do not make the charge process with the devices placed on easily combustible elements like pillows or sofas.
- Keep the immediate area clear of flammable objects when charging a battery; do not place e.g. scooters or e-bikes (pedelecs) in the near of flammable building insulation during charging.
- Do not leave lithium ion battery devices unattended, while it's charging, and don't leave it charging overnight. However, it is always advisable to install autonomous smoke detectors, placed in strategic places in the home, to detect smoke from a fire and give an early alarm to the occupants.
- Devices with medium-sized lithium ion batteries, such as scooters or e-bikes (pedelecs), shall not be charged on evacuation routes (for example next to the exit door of the house, or at the bottom of the stairwell), since in case of fire they can prevent safe evacuation.
- If a small lithium ion battery has started an overheating process but can still be handled safely, deposit it in a container filled with water that covers it completely. If handling is unsafe, use a metal lid to cover the appliance.
- If you carry out at home the process of charging equipment equipped with medium-sized batteries, such as scooters or e-bikes (pedelecs), it is advisable to have a fire extinguishing blanket. In the event that any of these appliances shows signs of incipient thermal runaway process, and whenever it is safe to approach the appliance, cover it with the blanket, separate as much as possible the combustible elements or furniture present (ideally, at least 2m), close the door of the room behind you, and notify the fire brigade.
- It is advisable to have a dry-chemical manual fire extinguisher to extinguish provided that the minimum safety conditions are met, the secondary fire sources that may appear from the lithium-ion battery original fire.

7 Damaged batteries

Using a defective battery can cause a thermal runaway process and later a fire. Therefore, is important to know how to identify a defective battery, and what to do in this case.

The following items are indicative of a defective battery:

- A size larger than normal, with expanded housing.
- A mechanical damage (puncture or deformation evidence caused by blows or falls).
- An excessive temperature released during the charge process or operating process.
- The battery is releasing smoke or the battery presents leakages.

The way to proceed in these cases are the following:

- Switch off the device that are powered by the battery.

- If possible, remove the battery of the device, using gloves and safety glasses, in case they are available. If the battery has an electrolyte leakage, the contact of the bare skin with the liquid must be avoided.
- Deposit the batteries (or the device, if the battery cannot be removed) inside a non-combustible and non-conductor element that can contain it (for example, a glass or porcelain tray), and maintain it separate of any combustible element.
- If a fire was declared, the fire can be extinguished applying ABC chemical powder, dirt or sand.

In case that the battery presents electrolyte leak and there´s an accidental contact with it, the following advices must be followed:

- If the contact has been with the bare skin, wash with abundant water the affected area. Remove the contaminated clothing.
- If the contact has been with the eyes, wash with water immediately, and keep washing for around 15 minutes. Ensure the correctly washing even under the eyelids.
- If the electrolyte has been inhaled, move the affected person to a place where he/she can breathe fresh air and monitor breathing. If the breathe stops, apply resuscitation maneuvers.
- In case of any excessive exposure, specialized medical attention should be given.

8 Disposal of lithium ion batteries

The lithium batteries are considered a dangerous waste, which must be properly collected, stored and recycled.

The used batteries should be deposited intact in specific containers to this type of waste. Normally the municipalities facilitate these collection points.

Batteries should never be deposited along with domestic waste.

The lithium batteries should not be mixed with other battery types, such as alkaline, cadmium or other types of rechargeable batteries.

European guidelines

Fire

- Guideline No 1 F - Internal fire protection control
- Guideline No 2 F - Panic & emergency exit devices
- Guideline No 3 F - Certification of thermographers
- Guideline No 4 F - Introduction to qualitative fire risk assessment
- Guideline No 5 F - Guidance signs, emergency lighting and general lighting
- Guideline No 6 F - Fire safety in care homes
- Guideline No 7 F - Safety distance between waste containers and buildings
- Guideline No 8 F - withdrawn*
- Guideline No 9 F - Fire safety in restaurants
- Guideline No 10 F - Smoke alarms in the home
- Guideline No 11 F - Recommended numbers of fire protection trained staff
- Guideline No 12 F - Fire safety basics for hot work operatives
- Guideline No 13 F - Fire protection documentation
- Guideline No 14 F - Fire protection in information technology facilities
- Guideline No 15 F - Fire safety in guest harbours and marinas
- Guideline No 16 F - Fire protection in offices
- Guideline No 17 F - Fire safety in farm buildings
- Guideline No 18 F - Fire protection on chemical manufacturing sites
- Guideline No 19 F - Fire safety engineering concerning evacuation from buildings
- Guideline No 20 F - Fire safety in camping sites
- Guideline No 21 F - Fire prevention on construction sites
- Guideline No 22 F - Wind turbines – Fire protection guideline
- Guideline No 23 F - Securing the operational readiness of fire control system
- Guideline No 24 F - Fire safe homes
- Guideline No 25 F - Emergency plan
- Guideline No 26 F - withdrawn*
- Guideline No 27 F - Fire safety in apartment buildings
- Guideline No 28 F - Fire safety in laboratories
- Guideline No 29 F - Protection of paintings: transports, exhibition and storage
- Guideline No 30 F - Managing fire safety in historic buildings
- Guideline No 31 F - Protection against self-ignition and explosions in handling and storage of silage and fodder in farms
- Guideline No 32 F - Treatment and storage of waste and combustible secondary raw materials
- Guideline No 33 F - Evacuation of people with disabilities
- Guideline No 34 F - Fire safety measures with emergency power supply
- Guideline No 35 F - Fire safety in warehouses
- Guideline No 36 F - Fire prevention in large tents
- Guideline No 37 F - Photovoltaic systems: recommendations on loss prevention
- Guideline No 38 F - Fire safety recommendations for short-term rental accommodations
- Guideline No 37 F - Fire protection in schools
- Guideline No 38 F - Fire safety recommendations for short-term rental accommodations
- Guideline No 39 F - Fire protection in schools
- Guideline No 40 F - Procedure to certify CFFPA-E Fire Safety Specialists in Building Design

Natural hazards

- Guideline No 1 N - Protection against flood

- Guideline No 2 N - Business resilience – An introduction to protecting your business
- Guideline No 3 N - Protection of buildings against wind damage
- Guideline No 4 N - Lighting protection
- Guideline No 5 N - Managing heavy snow loads on roofs
- Guideline No 6 N - Forest fires
- Guideline No 7 N - Demountable / Mobile flood protection systems

Security

- Guideline No 1 S - Arson document
- Guideline No 2 S - Protection of empty buildings
- Guideline No 3 S - Security systems for empty buildings
- Guideline No 4 S - Guidance on keyholder selections and duties
- Guideline No 5 S - Security guidelines for museums and showrooms
- Guideline No 6 S - Security guidelines emergency exit doors in non-residential premises
- Guideline No 7 S - Developing evacuation and salvage plans for works of art and heritage buildings
- Guideline No 8 S - Security in schools
- Guideline No 9 S - Recommendation for the control of metal theft
- Guideline No 10 S - Protection of business intelligence
- Guideline No 11 S - Cyber security for small and medium-sized enterprises



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