



# Li-ion powered fork-lifts

Lithium-ion batteries are increasingly being used to power forklifts in factories and warehouses, but Li-ion battery fires should not be treated like common fires as the burn characteristics and toxic by-products released are different from fires involving traditional lead-acid batteries.

One of the main challenges with Li-ion batteries lies in the fact that extinguishing them in case of a fire is very difficult. The chemistry and the energy content of the battery cause them to re-ignite after the flames have been extinguished. In large battery packs re-ignition may go on for hours causing extensive losses because of the smoke and gases produced, which are typically corrosive.

## How to reduce the risk

### Procurement:

- Use only well-known suppliers for Li-ion powered vehicles.
- Use only batteries and part numbers in accordance with the Original Equipment Manufacturer (OEM) instructions.



## Battery charging facilities:

- Charging stations for Li-ion operated vehicles should preferably be in a fire separated room (rated at least 60 minutes) to minimise smoke damage to production and storage.
- Charging rooms should be located at an outside wall, easily accessible from the outside.
- If a separate fire compartment cannot be provided and battery charging must take place within a larger space, the area devoted to battery charging should not exceed 50 m<sup>2</sup>, unless sprinkler protection is provided.
- Charging areas should be close to exits, where from evacuation of vehicles to the outside in the event of a fire is possible.
- The chargers should be fixed to a secure wall, but must never be directly fixed to combustible walls, such as sandwich panels with plastic insulation.
- A minimum clear area of 2 metres should be maintained around the battery charger and the equipment under charge. This area should not be used for storage.
- The area above the combination of vehicle and charger should be kept free of combustibles too. This includes cables, ceiling materials, etc.
- Cables and connectors should be protected from damage using load balancers (spring reels) to keep them from the floor.
- Signs should be provided indicating where li-ion charging areas are present in the building, to inform first responders about the hazard in case of a fire.

## Safety equipment at battery charging facilities:

- Battery charging areas should have automatic fire detection installed, preferably with smoke detection.
- Battery charging areas should have smoke & heat ventilation installed.
- Portable fire extinguishers should be available near the entrance.
- The extinguishers should be suitable for use on electrical fires.
- Rooms should be provided with automatic sprinkler protection (12.5mm/min)



## Maintenance:

- Make sure the vehicle, battery, and charger are inspected and maintained according to OEM instructions.
- As minimum, monthly inspections and annual maintenance applies.
- Inspections should focus on the condition of vehicles, batteries, chargers, cables, and connectors.
- Make sure damaged or malfunctioning batteries or battery packs are immediately moved to a safe location outside.
- Make sure damaged vehicles, chargers, cables, and connectors are taken out of use until repairs have been made. Batteries must be disconnected and if possible closed down in the battery management unit. Damaged batteries / vehicles should be removed and stored at a safe distance from the building.

## Training:

- Emergency responders should be trained in handling fires on Li-ion battery driven vehicles.
- The general staff should be informed of the toxic gasses generated by a fire in Li-ion batteries.

## Housekeeping of battery charging areas:

- Ensure that the minimum clear area of 2 metres is maintained around the battery charger and the equipment under charge.
- Storage should not be allowed in dedicated charging rooms.
- Ensure that the area above the charging stations should be kept clear of combustible materials, including cables and cable trays.
- Visual markings indicating the charging area, where storage is not allowed, is a good way to help maintain good housekeeping.



## In event of a fire:

Avoid inhalation of smoke from batteries. If possible, move burning vehicle/battery to the outside, or remove combustible materials near it.

Given the unpredictability of Li-ion fires regarding their intensity, the toxic and corrosive fumes produced, as well as the risk of re-ignition following extinguishing it is strongly recommended that you contact one of our risk engineers should you wish to deviate from the above recommendations.

The recommendations given above relate to battery charging on large equipment. However, even small portable equipment presents a fire risk when being charged or damaged.

Even though much of the above advice will be too restrictive for small device battery charging, the principles of keeping chargers away from combustible materials should be followed. Allowing batteries to be charged only in rooms equipped with automatic fire detection will also help to minimise the consequences of a fire involving the equipment. Regardless of the battery size, it is important that damaged and worn out batteries are disposed of in a safe way.

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