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Safe charging of forklift trucks with lithium-ion batteries

Maskin Leverantörerna

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Lithium-ion batteries have many advantages, they can store a lot of energy in a small volume, can be charged faster than e.g. lead acid batteries and have a long lifespan. Lithium-ion batteries are becoming increasingly common also as traction batteries for forklift trucks.

There are however risks associated with lithium-ion batteries that should be considered to ensure safe use.

This recommendation for the safe charging of forklift trucks with lithium-ion batteries has been developed by MaskinLeverantörerna (ML); the trade association for suppliers of mobile machines in Sweden. The document is intended for the forklift truck industry and is based on instructions from battery manufacturers and advice and recommendations from the Swedish Civil Contingencies Agency (MSB) and the Swedish National Electrical Safety Board.

The document serves as a general recommendation for the safe charging of forklift trucks with lithium-ion batteries. Always follow the battery or forklift truck manufacturer's instructions first and foremost to ensure correct handling and charging of the specific battery.

Check with insurance companies and local fire authorities if they have specific requirements or regulations for forklift trucks with lithium-ion batteries.

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Procedures for charging

- Always check that the battery and cables are not damaged before connecting them.
- Handle the charging glove and cable carefully, do not drop it on the floor and never pull hard on the cable.
- Always hang up the charging cable after use.
- A damaged charger/cable must not be used.

Checklist for safe charging of forklift trucks with lithium-ion batteries

Use the right charger

Only use a charger recommended by the supplier for the specific lithium-ion battery. An incorrect charger can lead to damage to the battery and/or the forklift truck and in worst case cause a fire.

Avoid extreme temperatures and environments

Lithium-ion batteries are best charged at normal room temperature. Avoid direct sunlight and high humidity. Check the permitted temperature range for charging the specific battery.

Inspect regularly

Regularly check the battery, charger or wiring and connections for signs of damage or abnormal wear. If any defect is detected, the battery/ charger shall not be used. In this case, contact the forklift truck supplier.

Emergency measures

Define and document in advance emergency measures to be taken in case of fire or smoke development in lithium-ion batteries. Ensure that all employees have received the information.

Fire protection measures

The charging point must be marked and labelled with a clear sign.

If possible, the location of the charging point for lithium-ion batteries should be so that emergency services can easily access the site in case of fire, i.e. as close to the entrance/exit as possible. This also increases the possibility of removing the forklift trucks from the building.

The charging point should be equipped with the possibility of electrical isolation in the event of fire, to allow safe disconnection of power before an extinguishing procedure is initiated.

Guidance on fire extinguishing

The Swedish Civil Contingencies Agency (MSB) has produced a guide for rescue operations where lithium-ion batteries are present. This document therefore does not deal in detail with extinguishing methods for fires involving lithium-ion batteries.

Click here to access the MSB guide (guide in Swedish)

Thermal runaway

Thermal runaway in a lithium-ion battery is a process where the battery becomes unstable and rapidly increases in temperature. This can happen when the battery is overheated, damaged or incorrectly charged. When the temperature rises to a certain point, the chemical reactions in the battery can accelerate uncontrollably, causing the battery cells to burn or explode.

Measures to be takes in case of thermal runaway

In the unlikely event of a thermal runaway in the battery, this may be manifested by a visible release of gas, intense smoke development or fire from the battery.

If this should occur while the **forklift truck is in operation**:

- Switch off the forklift truck immediately
- Evacuate the site
- Contact the emergency services

If this should occur **during charging**:

- Switch off or disconnect the charger if deemed possible
- Evacuate the site
- Contact the emergency services

Avoid breathing in the smoke and seek immediate medical attention in case of respiratory irritation.

Firefighting shall be carried out by rescue personnel with full personal protective equipment and breathing apparatus with air supply. Ensure that emergency responders are informed that the battery has lithium-ion chemistry.

Any indication of thermal runaway (gas, heat, vapours or smoke) requires some form of firefighting method. The absence of flames is not sufficient to determine that the thermal runaway has been stopped or extinguished.

Suitable extinguishing agents:

- Large quantities of water spray
- Dry chemical CO2 or foam
- Fire extinguisher designed for lithium-ion batteries; AVD (Aqueous Vermiculite Dispersion)

The cooling effect of water effectively prevents the fire from spreading to battery cells that have not yet reached the critical ignition temperature (thermal runaway).

After the fire has been extinguished, store the battery/forklift truck in a safe place, preferably outdoors for at least 24 hours. The temperature should be monitored regularly even after the fire has been extinguished to detect any new heat build-up.

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