
Lithium-ion battery loss control checklist – storage and warehousing



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Outlined below are characteristics to help identify hazards and controls associated with lithium-ion batteries in storage areas and warehouse occupancies. See applicable [FM Data Sheets](#) for additional information.

General controls

- Battery and charging equipment are listed or approved by a reputable third-party testing agency
- Charging is in accordance with the manufacturers' instructions
- Damaged or modified batteries are not used
- Lithium-ion batteries are not disposed of in the trash and instead are disposed of at a proper waste drop off site
- Policies and procedures are in place addressing the hazards, controls, storage and proper disposal of lithium-ion batteries
- Training is completed on the policies and procedures addressing lithium-ion battery hazards
- The local fire department is involved in on-site preplanning

Storage and warehousing

Incidental lithium-ion battery storage

- Stored in metal or cardboard containers (plastic containers require specific protection)
- Storage area is $\leq 200 \text{ ft.}^2$ or 18.6m^2
- Storage height is limited to 6 ft. or 2m
- Multiple storage areas are separated by aisles at least 10 ft. or 3m wide
- State of charge (SoC) is $\leq 60\%$

New or refurbished lithium-ion batteries are part of a finished product

Includes replacement batteries to be sold to the consumer—not vehicle modules or packs

- State of charge (SoC) is $\leq 60\%$ —provide sprinkler protection for the surrounding storage or the finished product without factoring in the battery, whichever is more demanding.
- State of charge (SoC) is $> 60\%$ —provide sprinkler protection for the surrounding storage or the finished product without factoring in the battery, whichever is more demanding; but include in-rack sprinklers

New or refurbished lithium-ion batteries are not part of a finished product

- Fire protection provided for the specific hazard
- Storage is limited to 15 ft. in height, unless adequate in-rack sprinkler protection is provided
- Storage above the batteries is prohibited unless adequate in-rack sprinklers are provided
- A 10 ft. or 3m space separation is provided between batteries and other combustibles
- In solid-piled arrangements, piles do not exceed a width of 15 ft. or 5m and a minimum aisle space of 10 ft. or 3m is provided

Returned, defective, off-specification, or damaged cells/modules/batteries

- Batteries are stored in an isolated location, either outside of the building or in a cut-off room

When stored outside of the building:

- Piles are limited to two pallets high with a footprint no larger than 900 ft.^2
- Piles are separated by 10 ft. or 3m
- Piles are stored at least 10 ft. or 3m away from noncombustible building walls without windows
- Piles are stored at least 20 ft. or 6m away from combustible building walls or walls with windows
- Piles are easily accessible by fire personnel with access to fire hydrants

When stored inside the building:

- Batteries are stored in a cut-off room
- Floor storage is limited to one pallet high
- Rack storage is provided with in-rack sprinklers
- Floor or palletized storage is protected with a minimum sprinkler density of $.3 \text{ gpm/ft}^2$ over entire area of cut-off room
- Cut-off room has direct access outside

Electric forklifts

Forklifts up to 50 kWh, including lithium-ion battery forklifts

- Forklifts are stored at least 50ft. or 15m from a sprinkler riser
- Forklift charging stations are not located within storage racks
- Physical barriers are provided near charging stations to prevent damage from forklift

Single panel charging station

- Forklift charging occurs at least 5ft. or 1.5m away from combustible material

Multi-panel charging station

- Forklift charging occurs in a cut-off room; or,
- Forklift charging occurs at least 5ft. or 1.5m away from combustible material; and,
- Fire protection is designed to the surrounding occupancy, or to deliver a density of at least $.3/2500$, with a hose stream of 250 gpm (gallons per minute) for 60 minutes, whichever is greater; and,
- Natural ventilation is provided at high points in exterior walls or roofs

For more specific guidance, refer to the following FM Data Sheets:

- FM Data Sheet 7-39, *Material Handling Vehicles*
- FM Data Sheet 7-112, *Lithium-Ion Battery Manufacturing and Storage*
- FM Data Sheet 10-1, *Pre-Incident and Emergency Response Planning*

