Lithium Battery Storage Risk Mitigation

Insurance Implications and Solutions

KULR Open House

October 23, 2024

Lithium Batteries
Why the Concern?

The popularity of lithium-ion batteries has risen significantly in recent years, serving as a primary source of power for smartphones, laptops, power tools, electric vehicles, and e-bikes.

Despite their many benefits, these batteries pose potential dangers, such as overheating and self-ignition fire, overpressure, and toxic or flammable gas venting.

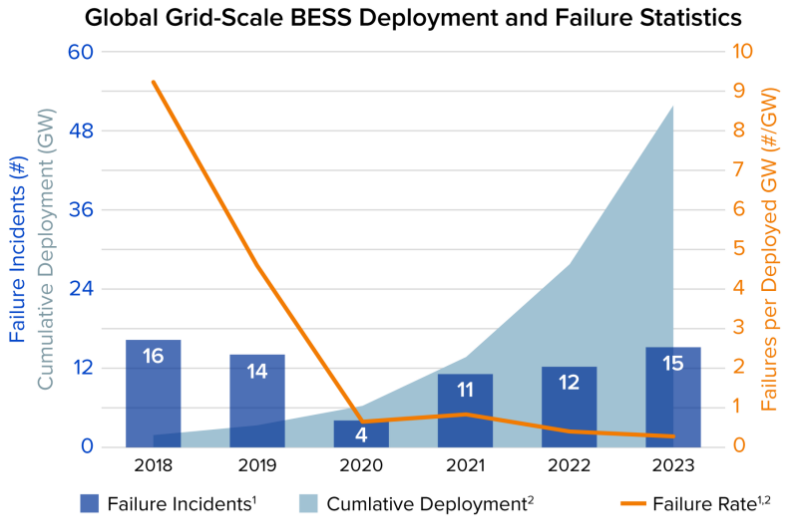
Overheating and self-ignition fire can happen when the battery is exposed to high temperatures, damaged, or overcharged, which can cause rapid heating and even lead to a fire.

Overpressure can cause the battery to rapidly disassemble and result in a hazardous explosion.

With the growing need for effective solutions to mitigate the risks of lithium-ion batteries, there is an increased demand for advanced thermal management and safety technologies.

Energy Storage Incidents

US Has Suffered Second Highest Number of Major Storage Fires



Sources: (1) EPRI Failure Incident Database, (2) Wood Mackenzie. Data as of 12/31/23.

More than a quarter of energy storage systems have fire detection and suppression defects: report

Evacuation orders lifted in Escondido after lithium-ion battery fire at SDG&E facility that also prompted school closures

With lithium-ion battery fires on the rise, San Diego Fire Rescue gets region's 1st response coordinator

Fire burns for five days at huge lithium-ion energy storage facility

Why are battery storage projects coming to Houston? Behind the new technology's rapid growth.

Texas battery boom

Lithium ion batteries, which are also used in electric vehicles, laptops, cell phones and many other home electronics, are at the heart of most grid-scale batteries. Lithium ion battery costs have plummeted since the mid-2010s, making its usage cost-effective for energy storage.

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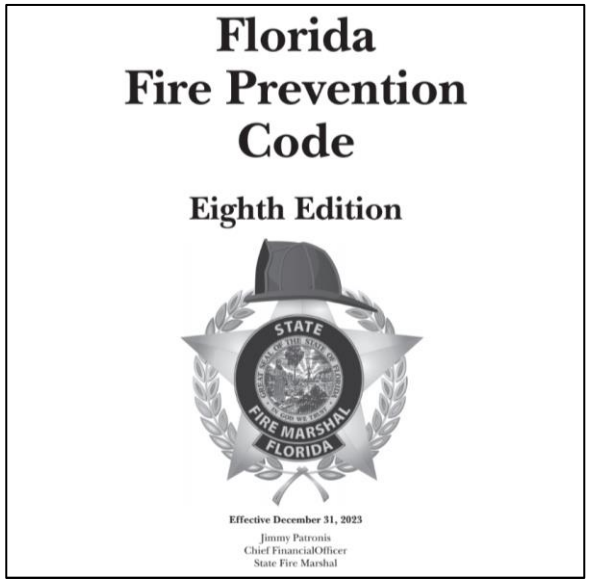
Battery Storage

Which Regulation Do I Follow?



National Fire Sprinkler Association's (NFSA) Engineering and Standards (E&S) committee

NFPA,ICC, IFC, IBC
Local Ordnances
What the AHJ tells me
Updates coming...

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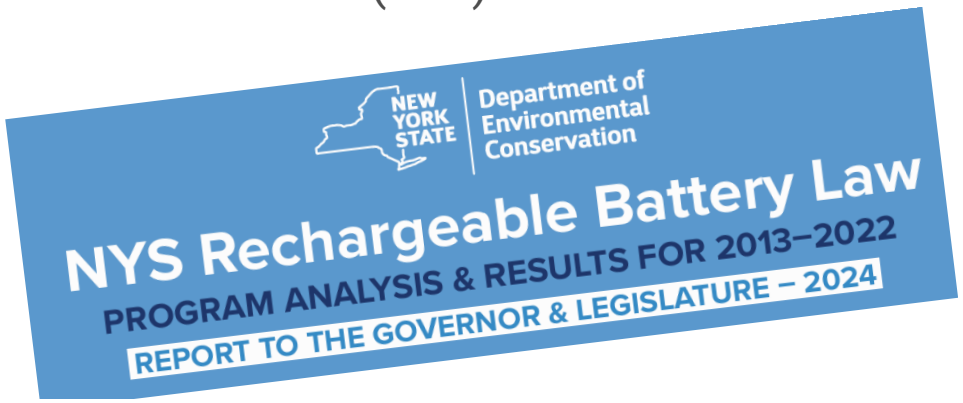


SAE INTERNATIONAL

SAE J3235 was developed by both battery industry and fire and emergency response experts to help raise the awareness of the hazards associated with lithium-ion batteries and the steps to take to develop a robust and safe storage plan.

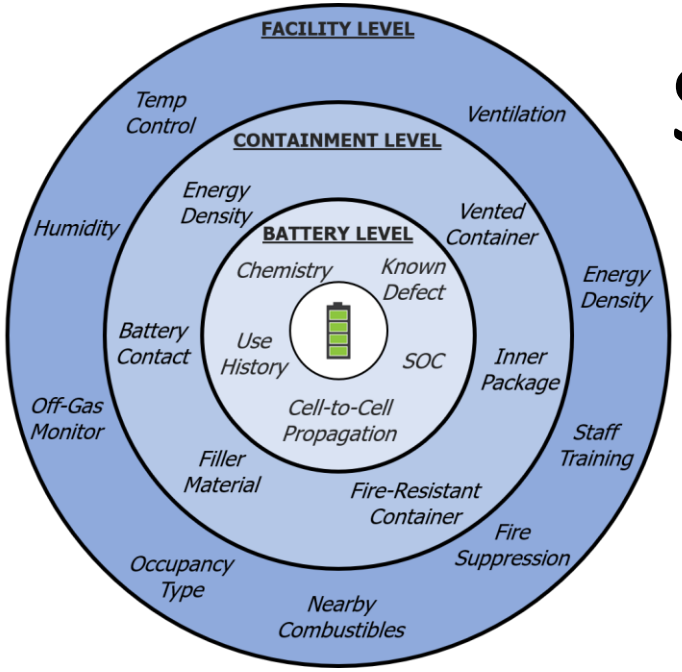
FM Global
Property Loss Prevention Data Sheets **5-33**

January 2017
Interim Revision January 2024

Florida rules process begins for lithium-ion battery storage to prevent fires

Exploding batteries have caused fires around the state and country

Safe Storage of Lithium Batteries



HSC developed a methodology to assess battery storage practices and enhance safety. An effective storage strategy can mitigate the hazards of a thermal runaway reaction. One must assess conditions at three levels: battery, containment, and facility. The goal of a safe storage program is to *contain and control fire/gas hazards associated with lithium-ion battery thermal runaway*.

No prescriptive regulations!

Requirements may come from:

- ✓Local Fire Departments
- ✓Industry Best Practices
- ✓Insurance Company

KULR SafeCase can mitigate risk, lower insurance costs, satisfy fire officials, avoid costly building modifications including sprinkler systems that may not be desirable (e.g. could damage high-cost electronics and stored goods).

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Insurance Implications

The insurance industry covering lithium battery storage is pretty concentrated, with several companies (i.e., Federated, FM Global, Travelers, & Chubb) writing policies.

Companies manufacturing, storing and handling lithium batteries are experiencing increased insurance premiums as a result of storage concerns and a plethora of incidents.

Insurance companies developing stringent standards including building fire walls, sprinkler systems and state of charge limits.

FM Global Lithium Battery Data Sheet

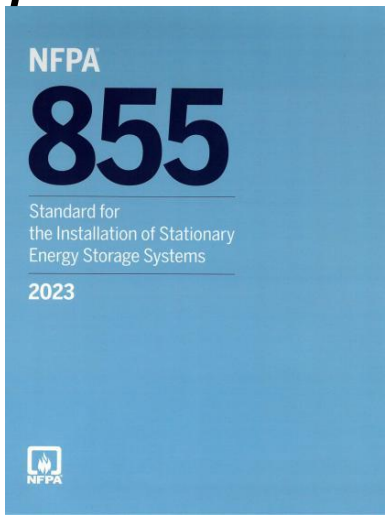
FM Global recently updated its Property Loss Prevention Datasheet 5-33 which provides guidance on the design, installation, and maintenance of lithium-ion battery systems. The datasheet covers various aspects of fire protection, electrical safety, and thermal management for these systems.

https://www.fmglobal.com/research-and-resources/fm-global-data-sheets.

Loss Prevention Recommendations are strict and will be extremely costly.

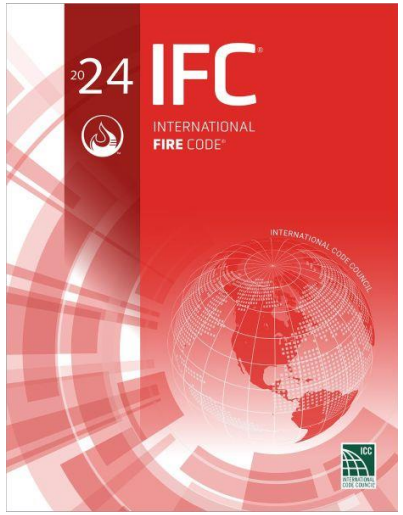
Data sheet could set the standard for other organizations and insurers.

Chapter 14 of NFPA 855



IFC / NFPA

- Developed by fire chiefs, industry, insurers, other stakeholders
- Adopted by states/cities, enforced by local fire depts.
- Inconsistently implemented across jurisdictions
- Lithium batteries not addressed until 2023/2024
- 2027 IFC is being developed currently.



2024 IFC Section 320

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IFC Indoor Storage Requirements

- ✓ Storage in fire area over 15ft^3 must obtain operational permit
  - ✓ Provisions for limited indoor storage
- ✓ Comprehensive fire safety plan
- ✓ Technical report on explosion and fire suppression systems
- ✓ 2-hour fire barrier separation from remainder of building, except if:
  1. Using approved pre-fabricated structure w/ 2-hr fire resistance; or
  2. Using approved packaging that will contain a thermal runaway; or
  3. Batteries are kept at no more than 30% SOC
- ✓ Automatic sprinkler & smoke/radiant energy detection
- ✓ Explosion control (if needed based on technical report)

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Alternative Means & Future Code

Ask your Fire Code Official about alternative means of compliance, for example:

- **Fire resistant packaging**
- **Propagation prevention battery pack design**
- **Battery thermal runaway testing**
- **SOC limits**

2024 Codes are just the start, likely changes to 2027 Code:

- **Adding a "battery" chapter that covers all battery types**
- **Exceptions for on-site charging/use of batteries**
- **Tighter outdoor storage provisions**
- **Requirements for battery-powered industrial equipment (i.e., forklifts, scrubbers, robots)**

Battery Storage and Transportation Solutions

KULR's SafeX product line, including SafeCASE and SafeSLEEVE, provides a comprehensive solution for the safe storage and transportation of batteries.

These products incorporate KULR's advanced patented Thermal Runaway Shield® (TRS) technology for efficient heat dissipation, which reduces the risks of battery overheating, self-ignition, and overpressure.

SafeCASE and SafeSLEEVE offer physical protection to batteries during transport, safeguarding against potential damage caused by shock or vibration, which can trigger internal damage and thermal events.

KULR can significantly reduce the risks associated with battery storage and transportation.

Versatile and easy to use, with customizable sizing to fit various battery configurations, making them an ideal solution for a range of applications.

U.S Department of Transportation (DOT) approved for ground transportation
Rated up to 2.5 kWh per SafeCASE and 0.3 kWh per SafeSLEEVE
Reusable
Mitigate thermal runaway
Sustainable storage and transportation
Safe nontoxic construction
Customizable
U.S. Patent No. US-11018397-B, US-11502352-B2, US-10727462-B2

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Next Steps

- These rules may/may not be implemented in your region
- Be prepared to get in compliance *ahead* of fire inspections
- Work with fire code officials
  - Consider “alternative means and methods”
  - Consider inviting fire dept to facility to collaborate on storage safety
  - *Remember*: this is all new to fire departments as well!
- Work with your insurance provider to negotiate rates based on risk

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Risk Assessment

If in doubt, It is recommended to conduct a facility storage safety risk assessment.

The absence of national regulations for companies that operates in multiple jurisdictions, make it difficult to institute a universal approach to safe battery storage because it is subject to variations imposed by the fire code officials and insurers in a particular municipality.

With the lack of explicit storage requirements, your companies are left to implement your own safe storage solutions in accordance with industry best practices, insurer requirements, or the guidance of local fire code officials.

HSC can assist!

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Questions and Contact

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