



TECHNICAL BULLETIN
CEA 4001-TB-003-LI-ION Batteries

CEA 4001 - Sprinkler systems - Planning and installation

Li-Ion Batteries

September 2022

This technical bulletin is intended to be used in combination with CEA 4001. It completes the CEA 4001 rule by providing specific requirement for Li-Ion Batteries storage.

Testing and research are ongoing. The provided design criteria for sprinkler protection reflects the current (2022) research and design status that are based on tests conducted on Li-Ion batteries.

Until further test and research, the guidelines in this TB should also be applicable to Li-polymer and Li-Fe-Phosphate.

Unless specified differently in this technical bulletin, all the provisions of CEA 4001 shall be fulfilled.

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1. Scope

Testing and research are ongoing. The below design criteria for sprinkler protection reflects the current (2019) research and design status that are based on tests conducted on Li-Ion batteries.

Until further test and research, the below guidelines should also be applicable to Li-polymer and Li-Fe-Phosphate

2. General guidelines

The below table shows where there is a need for specific sprinkler protection.

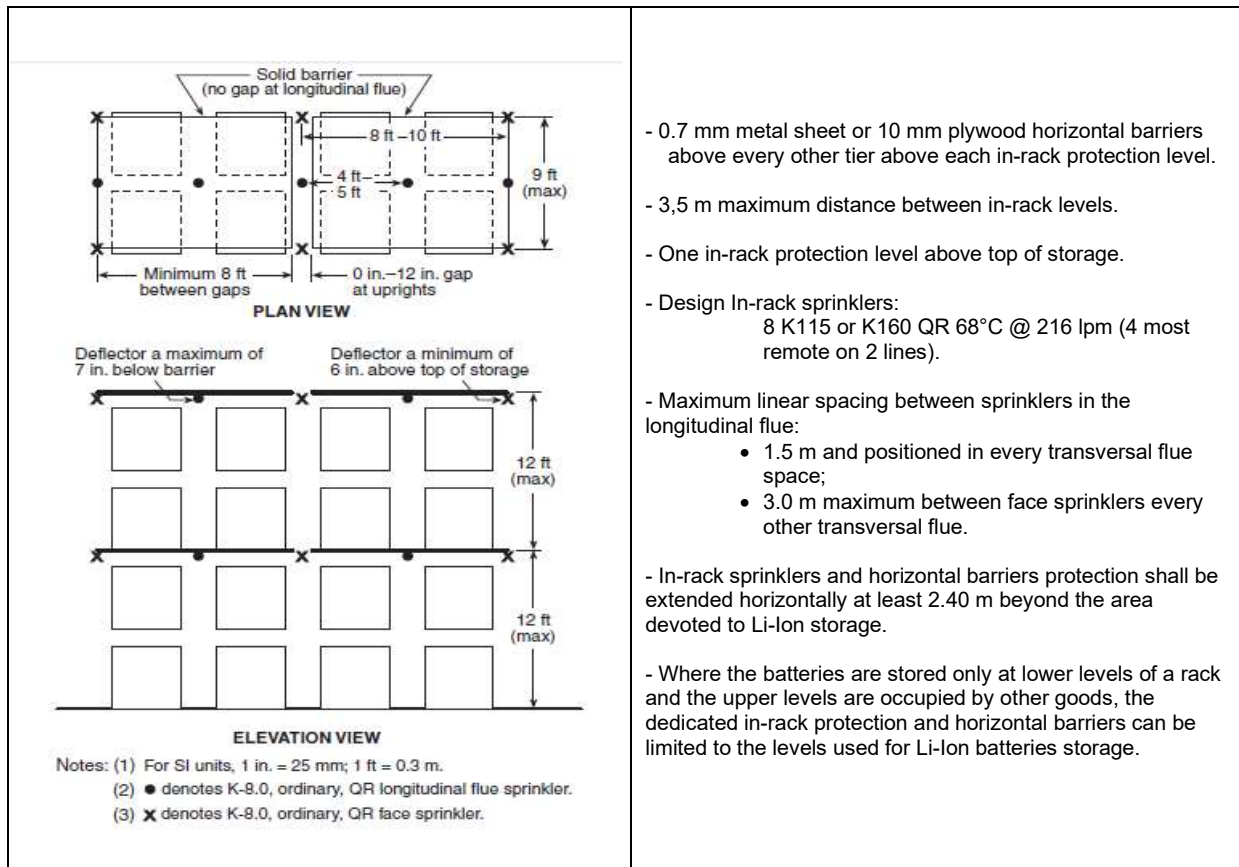
Table T 2.a

Configuration	Example / typical situation	Requirement
Only minor presence (no storage) of Li-Ion battery in the activity	Laptop in offices, electrical driven tool in a workshop, display of electrical equipment in retail...	No additional requirement: The sprinkler design for the activity is considered sufficient to cover this risk.
Storage of goods containing li-ion battery (limited to 1kWh per item)	Consumer goods such as electro technical, computers, drilling machines...	The classification of goods containing li-ion battery shall be HHS3 or according to the classification based on plastic content, whichever is greater.
Bulk storage of used or damaged Li-Ion batteries	More than 0,5m ³ Bulk storage in containers	Dedicated container (no other goods in the container) Specially designed container for batteries Stored in room separated by no less than EI 60 resistant walls/doors Limited to 1 level on ground (no piled storage) Ceiling protection with design no less than 12.5mm/min over 260m ² Note: If less than 0,5m ³ : no specific requirement)
Limited storage of Li-Ion batteries, e.g. in production areas	No more than 2m ³ (Including packaging) within an area of operation. Batteries must be contained in cardboard box. This could be in one single block or separated in several smaller units.	Protect as per HHS3. Where ceiling protection only is provided the design shall be no less than 12.5mm/min over 260m ² or ESFR or CMSA protection. Where in-rack protection is provided the design shall be as per HHS3 with no additional requirement.
Storage of Li-Ion batteries	More than 2m ³ (including packaging) within an area of operation or not contained in cardboard boxes This applies also to storage of used undamaged batteries	See specific design in §3 below

3. Sprinkler design of storage exceeding 2m³

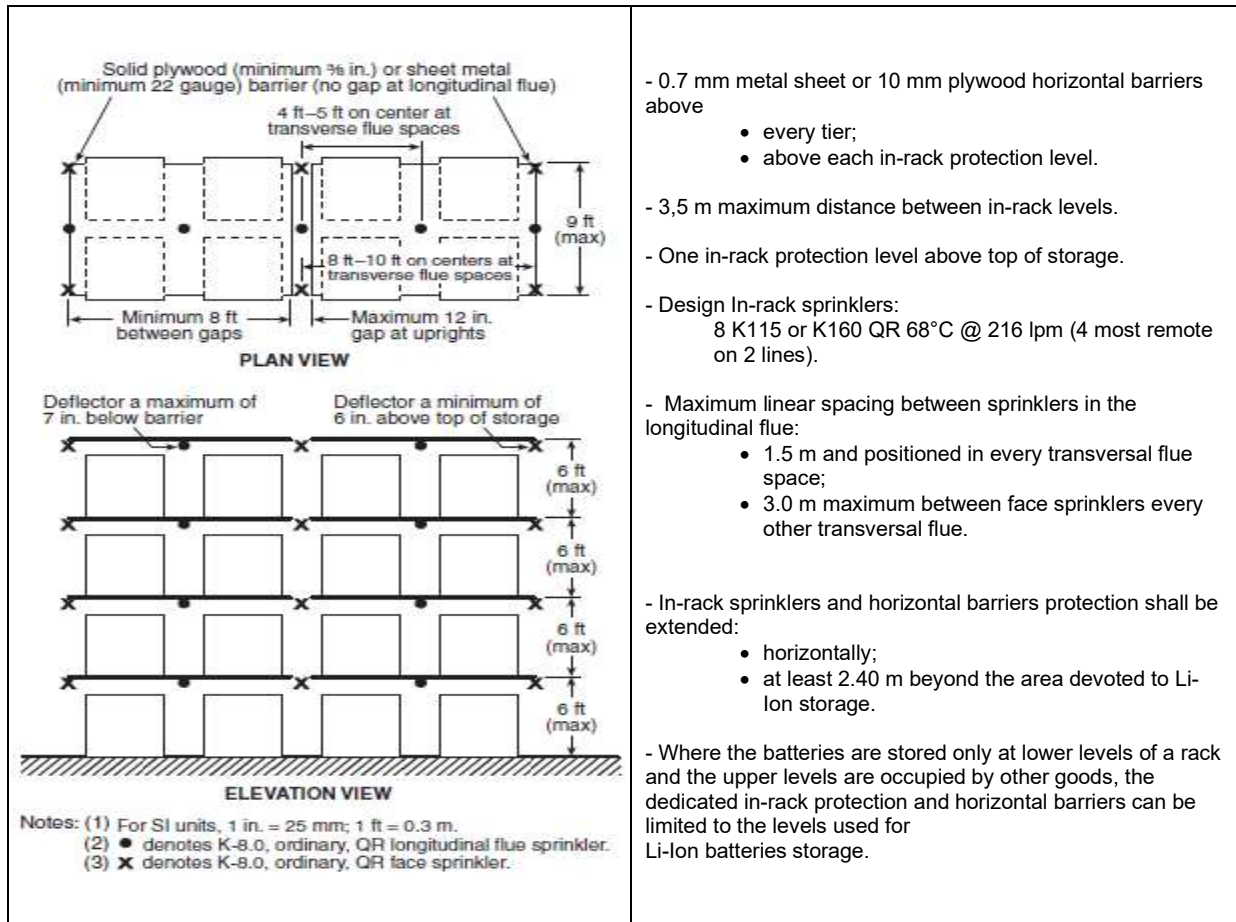
This design applies for storage exceeding 2m³ (including packaging) within an area of operation.
 important notice: the location and design of in-rack protection for Li-Ion batteries is specific to this risk and differs from the design of classical in-rack protection as defined in CEA 4001.

Storage configuration	Max ceiling height (m)	Max storage height (m)	Sprinkler design			Comments
			Type of sprinkler	Density (mm/min)	Area of operation (m ²)	
ST1	9	1 level on floor not exceeding 1,5m height	Spray sprinkler minimum K115, 68°C	12,5	260 (wet) 325 (dry)	
ST1	12,2	1 level on floor not exceeding 1,5m	Spray sprinkler minimum K160, 68°C	17,5	260 (wet)	Wet system only
ST1/ST2/ST3/S T4	12,2	4,6 (measured from floor to top of storage)	ESFR K 240 68°C or 74°C		12 spk @ 3,5 bar	Ceiling protection only. If mixed commodities, the maximum storage height remains 4,6m.
			ESFR K 320 68°C or 74°C		12 spk @2,4 bar	
			ESFR K 360 68°C or 74°C		12 spk @2,4 bar	
ST4	15	Ceiling height minus 1m (clearance)	Ceiling :Spray sprinkler minimum K115, 68°C In-rack : Spray sprinkler minimum K115, quick response , 68°C	12,5 ⁽¹⁾	260 (wet) (Ceiling sprinkler water demand and the IRAS demand shall be balanced at the point of connection)	Wet system only In-rack protection according to figure F 3a for cartoned batteries. In-rack protection according to figure F 3b for uncartoned batteries.
Note 1: It is acceptable to have an ESFR ceiling protection in combination with in-rack protection, providing that the design of the ESFR protection covers at least HHS3 classification for the height of the building.						



- 0.7 mm metal sheet or 10 mm plywood horizontal barriers above every other tier above each in-rack protection level.
- 3,5 m maximum distance between in-rack levels.
- One in-rack protection level above top of storage.
- Design In-rack sprinklers: 8 K115 or K160 QR 68°C @ 216 lpm (4 most remote on 2 lines).
- Maximum linear spacing between sprinklers in the longitudinal flue:
 - 1.5 m and positioned in every transversal flue space;
 - 3.0 m maximum between face sprinklers every other transversal flue.
- In-rack sprinklers and horizontal barriers protection shall be extended horizontally at least 2.40 m beyond the area devoted to Li-Ion storage.
- Where the batteries are stored only at lower levels of a rack and the upper levels are occupied by other goods, the dedicated in-rack protection and horizontal barriers can be limited to the levels used for Li-Ion batteries storage.

Figure F 3a: In-rack protection for cartoned batteries



- 0.7 mm metal sheet or 10 mm plywood horizontal barriers above
 - every tier;
 - above each in-rack protection level.
- 3,5 m maximum distance between in-rack levels.
- One in-rack protection level above top of storage.
- Design In-rack sprinklers:
 - 8 K115 or K160 QR 68°C @ 216 lpm (4 most remote on 2 lines).
- Maximum linear spacing between sprinklers in the longitudinal flue:
 - 1.5 m and positioned in every transversal flue space;
 - 3.0 m maximum between face sprinklers every other transversal flue.
- In-rack sprinklers and horizontal barriers protection shall be extended:
 - horizontally;
 - at least 2.40 m beyond the area devoted to Li-ion storage.
- Where the batteries are stored only at lower levels of a rack and the upper levels are occupied by other goods, the dedicated in-rack protection and horizontal barriers can be limited to the levels used for Li-ion batteries storage.

Figure F 3b: In-rack protection for uncartoned batteries