Tentative Interim Amendment

NFPA® 855

Standard for the Installation of Stationary Energy Storage Systems

2020 Edition

Reference: Section 4.12, A.4.12 and A.4.12.1
TIA 20-2
(SC 21-8-37 / TIA Log #1585)

Pursuant to Section 5 of the NFPA *Regulations Governing the Development of NFPA Standards*, the National Fire Protection Association has issued the following Tentative Interim Amendment to NFPA 855, *Standard for the Installation of Stationary Energy Storage Systems*, 2020 edition. The TIA was processed by the Technical Committee on Energy Storage Systems, and was issued by the Standards Council on August 26, 2021, with an effective date of September 15, 2021.

1. *Revise Section 4.12 to read as follows:*

4.12* Explosion Control. Where required elsewhere in this standard, explosion prevention or deflagration venting shall be provided in accordance with this section.

4.12.1* ESS installed within a room, building, ESS cabinet, or ESS walk-in unit shall be provided with one of the following:

(1) Explosion prevention systems designed, installed, operated, maintained, and tested in accordance with NFPA 69.

(2) Deflagration venting installed and maintained in accordance with NFPA 68.

4.12.~~2~~.1.1 Explosion prevention and deflagration venting shall not be required where approved by the AHJ based on large-scale ~~fire~~ testing in accordance with 4.1.5 and a deflagration hazard study that demonstrates that flammable gas concentrations in the room, building, ESS cabinet, or ESS walk-in unit cannot exceed 25 percent of the LFL ~~in locations where the gas is likely to accumulate~~.

4.12.1.2 Where approved, ESS cabinets that have been designed to ensure no hazardous pressure waves, debris, shrapnel, or enclosure pieces are ejected, as validated by installation level large-scale testing and engineering evaluation complying with 4.1.5 that includes the cabinet, shall be permitted in lieu of providing explosion control complying with NFPA 68 or NFPA 69.

2. *Revise Annexes A.4.12 and A.4.12.1 to read as follows:*

A.4.12 During failure conditions such as thermal runaway, fire, and abnormal faults, some ESS, in particular electrochemical batteries and capacitors, begin off-gassing flammable and toxic gases, which can include mixtures of CO, H_2, ethylene, methane, benzene, HF, HCl, and HCN. Among other things, these gases present an explosion hazard that needs to be mitigated. Explosion control is provided to mitigate this hazard.

Both the exhaust ventilation requirements of Section 4.9 and the explosion control requirements of Section 4.12 are designed to mitigate hazards associated with the release of flammable gases in battery rooms, ESS cabinets, and ESS walk-in units. The difference is that exhaust ventilation is intended to provide protection for flammable gases released during normal charging and discharging of battery systems since some electrochemical ESS technologies such as vented lead-acid batteries release hydrogen when charging.

In comparison, the Section 4.12 provisions are designed to provide protection for electrochemical ESS during an abnormal condition, such as thermal runaway, which can be instigated by physical damage, overcharging, short circuiting, and overheating of technologies such as lithium-ion batteries, which ~~incidentally~~ do not release detectable amounts of flammable gas during normal charging and discharging, but which can release significant quantities of flammable gas during a thermal event.

A.4.12.1 ~~This requirement targets rooms, buildings, and walk-in units, not ESS in cabinets installed indoors or outdoors or in open parking garages.~~This requirement recognizes that some cabinet designs with low internal volume, the application of NFPA 68 or NFPA 69 might not be practical. It is possible that a quantitative explosion analysis is necessary to show there is no threat to life and safety. As an example, the cabinet design might be installed such that any overpressure due to ignition of gases and vapors released from cells in thermal runaway within the enclosure are released to the exterior of the enclosure. There should be no uncontrolled release of overpressure of the enclosure. All debris, shrapnel, or pieces of the enclosure ejected from the system should be controlled. The UL 9540A unit level and installation level test identified in 4.1.5 will provide the test data referenced in this section, which is necessary for verification of the adequacy of the engineered deflagration safety of the cabinet.

NFPA 68 applies to the design, location, installation, maintenance, and use of devices and systems that vent the combustion gases and pressures resulting from a deflagration within an enclosure so that structural and mechanical damage is minimized, and provides criteria for design, installation, and maintenance of deflagration vents and associated components. NFPA 68 does not apply to detonations. Hydrogen accumulation in a confined space can lead to a detonation. For that reason, the combustion gases generated during the cell, module and installation level testing under UL 9540A must be utilized in applying a NFPA 68 solution. Where the likelihood for detonation exists, alternative solutions, such as those in NFPA 69.

NFPA 69 applies to the design, installation, operation, maintenance, and testing of systems for the prevention of explosions in enclosures that contain flammable concentrations of flammable gases, vapors, mists, dusts, or hybrid mixtures by means of the following methods:

(1) Control of oxidant concentration
(2) Control of combustible concentration
(3) Pre-deflagration detection and control of ignition sources
(4) Explosion suppression
(5) Active isolation
(6) Passive isolation
(7) Deflagration pressure contaminent
(8) Passive explosion suppression

Due to possible accumulation of flammable gases during abnormal conditions for lithium-ion batteries, combustible gas concentration reduction can be a viable mitigation strategy. Gas detection and appropriate interlocks can be used based on appropriate evaluation under a NFPA 69 deflagration hazard study. NFPA 69 allows concentration to exceed 25 percent LFL, but not more than 60 percent with reliable gas detection and exhaust interlocks as demonstrated by a safety integrity level (SIL 2) instrumented safety system rating.

Data on flammable gas composition and release rates, such as that included in UL 9540A large-scale fire testing, provide the information needed to design effective explosion control systems.

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