F122-21

IFC: 1201.1

Proponents: Michael O'Brian, representing FCAC (fcac@iccsafe.org)

2021 International Fire Code

Revise as follows:

1201.1 Scope. The provisions of this chapter shall apply to the installation, operation, maintenance, repair, retrofitting, testing, commissioning and decommissioning of energy systems used for generating or storing energy including but not limited to energy storage systems under the exclusive control of an electric utility or lawfully designated agency. It shall not apply to equipment associated with the generation, control, transformation, transmission, or distribution of energy installations that is under the exclusive control of an electric utility or lawfully designated agency.

Reason: This proposal clarifies that Chapter 12 applies to ESS at installations under the exclusive control of an electric utility, such as the ESS installation involved in an incident in Surprise, AZ. This is consistent with several requirements in Section 1207 that specifically reference ESS used at electric utility facilities.
This proposal is submitted by the ICC Fire Code Action Committee (FCAC). The FCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes with regard to fire and life safety in new and existing buildings and facilities as well as the protection of life and property in wildland urban interface areas. In 2020 and 2021 the Fire-CAC held multiple virtual meetings that were open to any interested party. In addition, there were numerous virtual specific working group meetings that were also open to any interested parties, to develop, discuss and debate the proposed changes. Related documentation and reports are posted on the FCAC website at: https://www.iccsafe.org/products-and-services/i-codes/code-development/cs/fire-code-action-committee-fcac/

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal will not increase the cost of construction. It just clarifies that Chapter 12 does cover electric utility ESS installations.

F123-21

IFC: 1201.1, NFPA Chapter 80 (New)

Proponents: sharon bonesteel, salt river project, representing salt river project (sharon.bonesteel@srpnet.com)

2021 International Fire Code

Revise as follows:

1201.1 Scope. The provisions of this chapter shall apply to the installation, operation, maintenance, repair, retrofitting, testing, commissioning and decommissioning of energy systems used for generating or storing energy. It shall not apply to equipment associated with the generation, control, transformation, transmission, or distribution of energy installations that is under the exclusive control of an electric utility or lawfully designated agency. Energy storage systems regulated by Section 1207 shall comply with this chapter as appropriate and NFPA 855.

Add new standard(s) as follows:

NFPA

National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169-7471

855-2020 Standard for the Installation of Stationary Energy Storage Systems

Reason: The NFPA 855 Standard for the Installation of Stationary Energy Storage Systems is a comprehensive standard that provides the minimum requirements for mitigating the hazards associated with ESS. Due to the nature of the fast changing ESS market, the NFPA 855 Standard, which is under continual maintenance process, will be able to address new technologies promptly. It is an appropriate standard to use in lieu of the requirements of Ch.12 of the IFC.

Bibliography: NFPA® 855 Standard for the Installation of Stationary Energy Storage Systems, 2020 Edition, prepared by the Technical Committee on Energy Storage Systems and acted on by the NFPA at its Association Technical Meeting held June 17-20,2019, in San Antonio, TX. It was issued by the Standards Council on August 5, 2019, with an effective date of August25, 2019. This edition of NFPA 855 was approved as an American National Standard on August 25, 2019.
The next edition will be submitted as the reference standard upon completion.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The use of NFPA® 855 as an equivalent standard to Ch.12 of the IFC will not increase or decrease the cost of construction.

Staff Analysis: A review of the standard proposed for inclusion in the code, NFPA 855-2020: Standard for the Installation of Stationary Energy Storage Systems, with regard to some of the key ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before March 20, 2021.

F126-21

IFC: 1201.3

Proponents: Gregory Benton, NYS DOS Division of Building Standards and Codes, representing NYS DOS Division of Building Standards and Codes (gregory.benton@dos.ny.gov); Emma Gonzalez-Laders, representing NYS DOS Division of Building Standards and Codes (emma.gonzalez-laders@dos.ny.gov)

2021 International Fire Code

Revise as follows:

1201.3 Mixed system installation. Where mixed systems are *approved*, the aggregate nameplate kWh energy of all energy storage systems in a *fire area* shall not exceed the maximum quantity specified for any of the energy systems in this chapter. Where required by the *fire code official*, a hazard mitigation analysis shall be provided and *approved* in accordance with Section 104.8.2 to evaluate any potential adverse interaction between the various energy systems and technologies.

Reason: The original wording of the code provision is confusing because it begins with "Where *approved*,..." and later in the same sentence states "shall not...", which could be mistakenly interpreted to mean the approval pertains to exceeding the aggregate energy storage limits rather than solely pertaining to allowing the existence of a mixed system in a *fire area*. By including the clarification of "where mixed systems are *approved*" it reduces the likelihood of this mistaken interpretation.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal solely clarifies wording in the code and will not affect cost.

F131-21

IFC: CHAPTER 12, SECTION 1206, 1206.1, 1206.5, 1206.6, 1206.13, 1206.13.1, 1206.14

Proponents: Michael O'Brian, representing FCAC (fcac@iccsafe.org)

2021 International Fire Code

CHAPTER 12
ENERGY SYSTEMS

SECTION 1206
STATIONARY FUEL CELL POWER SYSTEMS

Revise as follows:

1206.1 General. *Stationary fuel cell power systems* in new and existing occupancies shall comply with this section.

Exception: The temporary use of a fuel cell-powered electric vehicle to power a Group R-3 or R-4 building while parked shall comply with Section 1206.13 ~~1206.14~~.

1206.5 Residential use. *Stationary fuel cell power systems* shall not be installed in Group R-3 and R-4 buildings, or *dwelling units* associated with Group R-2 buildings unless they are specifically *listed* for residential use.

Exception: The temporary use of a fuel cell-powered electric vehicle to power a Group R-3 or R-4 building while parked shall comply with Section ~~1206.14~~ 1206.13.

1206.6 Indoor installations. *Stationary fuel cell power systems* installed in indoor locations shall comply with Sections 1206.6 through 1206.6.2. For purposes of this section, an indoor location includes a roof and 50 percent or greater enclosing walls.

Revise as follows:

~~**1206.13**~ **1206.6.3 Gas detection systems.** *Stationary fuel cell power systems* shall be provided with a gas detection system. Detection shall be provided in *approved* locations in the fuel cell power system enclosure, the exhaust system or the room that encloses the fuel cell power system. The system shall be designed to activate at a flammable gas concentration of not more than 25 percent of the lower flammable limit (LFL).

~~**1206.13.1**~ **1206.6.3.1 System activation.** The activation of the gas detection system shall automatically:

1. Close valves between the gas supply and the fuel cell power system.
2. Shut down the fuel cell power system.
3. Initiate local audible and visible alarms in *approved* locations.

~~**1206.14**~ **1206.13 Group R-3 and R-4 fuel cell vehicle energy storage system use.** The temporary use of the *dwelling unit owner* or occupant's fuel cell-powered electric vehicle to power a Group R-3 or R-4 dwelling while parked in an attached or detached garage or outside shall comply with the vehicle manufacturer's instructions and NFPA 70.

Reason: This proposal corrects an error made when the new fuel cell language was added to the 2018 edition of the IFC. The intent was to provide core requirements and guidance that is correlated to the existing standards which had been inexplicably left out of the IFC when added to the IMC and IFGC. With combination systems becoming more popular, (battery storage and fuel cell), it was important to add the language to the IFC to ensure comprehensive design and installation approaches matching what was done with NFPA 855 for ESS.
Unfortunately, an error occurred in the formatting of the new language when the detection requirement was taken from NFPA 853. That requirement applies to “Indoor installations” in NFPA 853 and the reason statement points to NFPA 853, but where added in the IFC it is being applied to indoor and outdoor installations which causes practical difficulties.

This proposal simply relocates the language to the “Indoor installation” requirements to correct the misapplication.

Original proposal adding the language:

F111-16

105.7.9 (New), 202 (New), 602.1, 612 (New), Chapter 80

Proponent : *Michael O'Brian representing the Fire Code Action Committee (FCAC@iccsafe.org)*

Reason: *Fuel cell power systems are being used in ever increasing numbers to meet facility energy needs. Stationary fuel cell pow er systems generate power through an electrochemical process that combines hydrogen and oxygen to produce electricity. The hydrogen comes from a direct hydrogen source or from any hydrocarbon fuel such as natural gas, gasoline, diesel, or methanol if the fuel cell pow er system includes integral reforming. The oxygen comes from air around the fuel cell. A new section is being proposed in the IFC which provides a comprehensive set of requirements to mitigate potential hazards associated with the installation and use of stationary fuel cell power systems.*

Three referenced documents form the basis for these requirements:

ANSI/CSA FC 1 standard is used to investigate and list the stationary fuel cells covered by this section. The construction and performance requirements in that standard address a variety of hazards, including mechanical, electrical, thermal, malfunction, erroneous human intervention and environmental.

NFPA 853, the Standard for the Installation of Stationary Fuel Cell Power Systems includes requirements for the design, construction, and installation of stationary fuel cell power systems.

NFPA 2, the Hydrogen Technologies Code covers the production, storage, transfer, and use of hydrogen in all occupancies and on all premises. Chapter 12 of this code includes requirements for the design, construction, and installation of stationary fuel cell power systems which are extracted from NFPA 853.

Comments on portions of the proposal are as follows:

612.3 *– Gas detection system requirements include detection locations from NFPA 853 and activation criteria that are consistent with IFC requirements.*

NFPA 853-2020 edition

(No change from 2015 edition)

Chapter 8 Fire Protection

8.1 Fire Protection and Detection.

8.1.5 Indoor Installation.

8.1.5.4* *Combustible gas detector(s) shall be installed in the fuel cell power system enclosure, the exhaust system, or the room that encloses the fuel cell power system installation in accordance with the detector manufacturer's instructions and local regulation.*

A.8.1.5.4 *A fuel cell power system that includes an internal combustible gas detector meets this requirement if it is supported by a separate safety analysis.*

8.1.5.5* *A combustible gas detector that meets the requirements of 8.1.5.4 shall be provided for all indoor or separately enclosed fuel gas compressors (fuel gas boosters).*

A.8.1.5.5 *Fuel gas boosters (within the fuel cell enclosure containing fuel) containing members are addressed in ANSI/CSA FC 1, Fuel cell technologies — Part 3-100: Stationary fuel cell power systems — Safety, as part of the leak detection and mitigation strategy.*

8.1.5.6 *When gaseous or liquefied hydrogen is piped into the room or area from outside, hydrogen detector(s) shall be installed in accordance with 8.1.5.7.*

8.1.5.7 *The following criteria for combustible gas detection systems, including detection specific to hydrogen, shall be met:*

(1) The location of the detection device(s) shall be based on leakage sources and fuel type.

(2) The combustible gas detection system shall be arranged to alarm at 25 percent of the lower flammable limit (LFL) and be interlocked to shut down the power system fuel supply at 60 percent LFL.

(3) The LFL used shall be the lowest flammability limit of the gas or gas mixture.

Chapter 9 Fuel Cell Power Systems 50 kW or Less

9.1 Chapter Scope*. This chapter identifies additional requirements or modifications to Chapters 1 through 8 as they relate directly to fuel cell power systems 50 kW or less.*

***9.5 Fire Protection**. The requirements of Chapter 8 shall not apply to 50 kW or smaller systems except as modified in 9.5.1 and 9.5.2.*

9.5.1 Combustible gas detection shall be installed in accordance with 8.1.5.4 through 8.1.5.6 except where the fuel gas system is listed for indoor use and the fuel is odorized natural gas or LP-Gas.

This proposal is submitted by the ICC Fire Code Action Committee (FCAC). The FCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes with regard to fire and life safety in new and existing buildings and facilities as well as the protection of life and property in wildland urban interface areas. In 2020 and 2021 the Fire-CAC held multiple virtual meetings that were open to any interested party. In addition, there were numerous virtual specific working group meetings that were also open to any interested parties, to develop, discuss and debate the proposed changes. Related documentation and reports are posted on the FCAC website at: https://www.iccsafe.org/products-and-services/i-codes/code-development/cs/fire-code-action-committee-fcac/

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This section was not intended to apply to outdoor installations so would not have been applicable. In cases where this was being enforced this may decrease the cost of construction.

F132-21

IFC: 1207.1.1 (New), TABLE 1207.1.1, 1207.1.2 (New)

Proponents: Michael O'Brian, representing FCAC (fcac@iccsafe.org)

2021 International Fire Code

Add new text as follows:

1207.1.1 Utilities and Industrial applications. This section shall not apply to capacitors and capacitor equipment for electric utilities and industrial facilities, used in applications such as flexible ac transmission (FACTS) devices, filter capacitor banks, power factor correction, and standalone capacitor banks for voltage correction and stabilization.

Revise as follows:

TABLE 1207.1.1 ENERGY STORAGE SYSTEM (ESS) THRESHOLD QUANTITIES

TECHNOLOGY	**ENERGY CAPACITY[a]**
Capacitor ESS	3 kWh
Flow batteries[b]	20 kWh
Lead-acid batteries, all types	70 kWh[c]
Lithium-ion batteries	20 kWh
Sodium nickel chloride batteries ~~Nickel Metal Hydride (Ni-MH)~~	70 kWh
Nickel-cadmium batteries (Ni-Cd), Nickel Metal Hydride (Ni-MH), and Nickel Zinc (Ni-Zn) batteries	70 kWh
Non-electrochemical ESS[d]	70 kWh
Other battery technologies	10 kWh
Other electrochemical ESS technologies	3 kWh
Zinc manganese dioxide batteries (Zn-MnO2)	70 kWh

For SI: 1 kilowatt hour = 3.6 megajoules.

a. Energy capacity is the total energy capable of being stored (nameplate rating), not the usable energy rating. For units rated in amp-hours, kWh shall equal rated voltage times amp-hour rating divided by 1,000.

b. Shall include vanadium, zinc-bromine, polysulfide-bromide and other flowing electrolyte-type technologies.

c. Fifty gallons of lead-acid battery electrolyte shall be considered equivalent to 70 kWh.

~~d. Section 1207 shall not apply to capacitors and capacitor equipment for electric utilities and industrial facilities used in applications such as flexible ac transmission (FACTS), filter capacitor banks, power factor correction, and stand-alone capacitor banks for voltage correction and stabilization.~~

d. Covers nonelectrochemical technologies such as flywheel and thermal ESS

Add new text as follows:

1207.1.2 Mobile ESS. Mobile ESS deployed at an electric utility substation or generation facility for 90 days or less shall not add to the threshold values in Table 1207.1.1. , for the stationary ESS installation if both of the following conditions apply:

1. The mobile ESS complies with Section 1207.10.
2. The mobile ESS is only being used during periods in which the facility's stationary ESS is being tested, repaired, retrofitted or replaced.

Reason: The proposed new Section 1207.1.1 is consistent with NFPA 855 Section 10.1.4. The changes to Table 1207.1.1 are consistent with NFPA 855 Table 1.3. Data has been provided previously to address addition of nickel zinc (Ni-Zn), zinc manganese dioxide (Zn-MnO2) and sodium nickel chloride batteries to the table. The table now also covers non-electrochemical ESS, consistent with how it is treated in NFPA 855.

This proposal is submitted by the ICC Fire Code Action Committee (FCAC). The FCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes with regard to fire and life safety in new and existing buildings and facilities as well as the protection of life and property in wildland urban interface areas. In 2020 and 2021 the Fire-CAC held multiple virtual meetings that were open to any interested party. In addition, there were numerous virtual specific working group meetings that were also open to any interested parties, to develop, discuss and debate the proposed changes. Related documentation and reports are posted on the FCAC website at: https://www.iccsafe.org/products-and-services/i-codes/code-development/cs/fire-code-action-committee-fcac/

Cost Impact: The code change proposal will not increase or decrease the cost of construction

This has the potential to lower costs since it recognizes new electrochemical ESS technologies, which are no longer classified under the more stringent "other" technology provisions.

F133-21

IFC: 404.1, 1207.1.3

Proponents: Emma Gonzalez-Laders, NYS DOS Division of Building Standards and Codes, representing NYS DOS Division of Building Standards and Codes (emma.gonzalez-laders@dos.ny.gov); Gregory Benton, representing NYS DOS Division of Building Standards and Codes (gregory.benton@dos.ny.gov); Chad Sievers, representing NYS Dept. of State (chad.sievers@dos.ny.gov); Jeffrey Hinderliter, City of Oswego, representing City of Oswego (jhinderliter@oswegony.org)

2021 International Fire Code

Revise as follows:

404.1 General. Where required by Section 403 or by other sections of this code, fire safety, evacuation and lockdown plans shall comply with Sections 404.2 through 404.4.1.

1207.1.3 Construction documents. The following information shall be provided with the permit application:

1. Location and layout diagram of the room or area in which the ESS is to be installed.
2. Details on the hourly *fire-resistance ratings* of assemblies enclosing the ESS.
3. The quantities and types of ESS to be installed.
4. Manufacturer's specifications, ratings and listings of each ESS.
5. Description of energy (battery) management systems and their operation.
6. Location and content of required signage.
7. Details on fire suppression, smoke or fire detection, thermal management, ventilation, exhaust and *deflagration* venting systems, if provided.
8. Support arrangement associated with the installation, including any required seismic restraint.
9. A commissioning plan complying with Section 1207.2.1.
10. A decommissioning plan complying with Section 1207.2.3.
11. A fire safety and evacuation plan in accordance with Section 404.

Reason: The actions taken in the initial minutes of an emergency are critical. A call for help to emergency services that provides full and accurate information helps the dispatcher send the right responders and equipment.[1] When it comes to energy storage systems (ESS), as a relatively new technology, emergency responders have limited knowledge and experience developing mitigation plans and anticipating the hazards they might encounter when responding to an emergency.

The document titled Energy Storage Safety Strategic Plan, prepared by the US Department of Energy in December of 2014, recognized that *"first responders must be included in the discussion to ensure that all areas of potential failure are identified and the best mitigation strategies are developed, spanning the chemistries and materials choices through components, module layouts and deployment."* The document emphasized the need for *"deliberate and concerted effort to engage the first responder community early in the design and siting of energy storage systems so that proper mitigation techniques can be developed and systems* [can be] *designed to improve the overall safety and ability to quickly and safely resolve the incident. This must include the development of techniques to extinguish any fires if they were to occur and respond to the variety of non-fire incidents that may require fire department response, developing site specific training for first responders, improved systems design, and the development of incident response plans. All of these must be based on the scientific understanding of the systems, materials and processes."* The report also highlighted the importance of ensuring that those mechanisms be included as part of the requirements "*in codes, standards and regulations."*[2]

In spite of this clear guidance issued by a reliable source, first responders arrive at the scene of an emergency without this critical information. In March of 2018, after first responders worked for hours to extinguish a deadly electric vehicle fire near Mountain View, California, the vehicle manufacturer dispatched a team of engineers to assist in the removal of the battery pack.[3] As it pertains to buildings, first responders should be able to reasonably anticipate the types of hazards to be encountered prior to being dispatched. Having to wait for a manufacturer or other facility personnel to arrive and provide critical information to successfully address the hazards could result in loss of life, injuries, and loss of property.A report from the UL Firefighter Safety Research Institute included similar recommendations. Prepared after the 2018 fire and explosion at an ESS facility in Sunrise, Arizona, that resulted in injuries to four firefighters, the investigative report was the first of its kind and was issued as part of the Study of Firefighter Line of Duty Injuries and Near Misses. The report included *"recommendations on how to improve codes, standards, and emergency response training to better protect first responders, maintenance personnel and nearby communities."* [4] The report indicated that an Emergency Response Plan was neither required, nor provided to fire service personnel prior to the incident and that the report provided on arrival did not include adequate guidance to mitigate the typical potential hazards to be found at an ESS facility: thermal runaway, fire, and explosion. The burden of preparing the emergency response plan during design and permitting and making it available to the fire code official prior to an incident is minor when compared to the potential to injuries to first responders.

Much of the work and information required for the preparation of an ERP is basically already required under in Item #7 on the same list and code section (*"details on fire suppression, smoke or fire detection, thermal management, ventilation, exhaust and deflagration venting systems, if provided"*). Many of the technical aspects required in Item #7 will inform the creation of the emergency response plan.

[1] https://www.ready.gov/business/implementation/emergency

[2] https://www.sandia.gov/ess-ssl/docs/other/DOE_OE_Safety_Strategic_Plan_Dec_2014_final.pdf

[3] https://www.cnet.com/roadshow/news/tesla-model-x-autopilot-crash-fire/ and https://electrek.co/2018/03/23/tesla-fire-battery-pack-model-x-crash/

[4] https://ulfirefightersafety.org/posts/four-firefighters-injured-in-lithium-ion-battery-energy-storage-system-explosion.html

Bibliography: *Emergency Response Plan.* Ready Campaign. FEMA. www.ready.gov/business/implementation/emergency. Accessed 12/2/2020.
Energy Storage Safety Strategic Plan. US Department of Energy. December, 2014. www.sandia.gov/ess-ssl/docs/other/DOE_OE_Safety_Strategic_Plan_Dec_2014_final.pdf. Accessed 12/2/2020.

Hyatt, Kyle. *Tesla Model X Fatal Crash and Fire Under Investigation.* CNET. 03/28/2018. www.cnet.com/roadshow/news/tesla-model-x-autopilot-crash-fire/. Accessed 12/2/2020.

Lambert, Fred. *Tesla Assists in Removing Partially Destroyed Battery Pack After Tragic Fatal Crash Resulted in a Fire. Electrek*. www.electrek.co/2018/03/23/tesla-fire-battery-pack-model-x-crash/Four Firefighters Injured in Lithium-Ion Battery. Accessed 12/2/2020.

McKinnon, Mark B., DeCrane, Sean, and Kerber, Stephen . *Energy Storage System Explosion - Arizona*. UL Firefighter Safety Research Institute. www.ulfirefightersafety.org/posts/four-firefighters-injured-in-lithium-ion-battery-energy-storage-system-explosion.html. Accessed 12/2/2020.

Emergency Response Planning Checklist. Akita Box. www.home.akitabox.com/emergency-response-planning-checklist-pdf. Accessed 12/2/2020.

Cost Impact: The code change proposal will increase the cost of construction
Any responsible development will likely include some level of hazard mitigation and incident pre-planing at some stage of the project process, regardless. This proposal simply would require that all that information be gathered into a standard Emergency Response Plan (ERP) during design and permitting and be subject to the approval of the fire code official.

Sample checklists for the development of a general Emergency Response Plan can be found online free of charge.[1] Completing the checklist and customizing a plan based on the presence of a lithium-ion battery ESS on the premises will likely require one to three hours depending on the preparer's level of familiarity with and the complexities of the system being used. Where a battery type other than lithium-ion is being proposed, less information is readily available and likely more time will be required. As mentioned in the Reason Statement, some of the research and documentation needed to prepare an ERP will be readily available, since much of the technical information that is already required in Item #7 of the same list and section will form the basis for the creation of the ERP.

Once a plan is developed, the designer or the supplier of the system can use it as the basis for future projects, therefore, the time required to prepare it for subsequent projects will decrease. Likewise, a plan developed for another facility with the same technology and a similar scope can inform the development of a plan for a new facility, also reducing the time required to develop the new plan.

The cost of inaction, when considering the risks to first responders and property losses, far outweighs the cost of pre-planning.

[1] https://home.akitabox.com/emergency-response-planning-checklist-pdf

F134-21

IFC: 1207.1.3.1 (New)

Proponents: Michael O'Brian, representing FCAC (fcac@iccsafe.org)

2021 International Fire Code

Add new text as follows:

1207.1.3.1 Utilities applicability. Plans and specifications associated with ESS owned and operated by electric utilities as a component of the electric grid that are considered critical infrastructure documents in accordance with the provisions of the North American Electric Reliability Corporation and other applicable governmental laws and regulations shall be made available to the fire code official for viewing based on the requirements of the applicable governmental laws and regulations.

Reason: This proposed change is consistent with NFPA 855, Section 4.1.2.1.2 and recognizes that there are federally enforced NAERC restrictions that regulate distribution of certain sensitive electric utility plans and documents.
This proposal is submitted by the ICC Fire Code Action Committee (FCAC). The FCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes with regard to fire and life safety in new and existing buildings and facilities as well as the protection of life and property in wildland urban interface areas. In 2020 and 2021 the Fire-CAC held multiple virtual meetings that were open to any interested party. In addition, there were numerous virtual specific working group meetings that were also open to any interested parties, to develop, discuss and debate the proposed changes. Related documentation and reports are posted on the FCAC website at: https://www.iccsafe.org/products-and-services/i-codes/code-development/cs/fire-code-action-committee-fcac/

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposal only addresses the manner in which documentation is provided to the code official.

F135-21

IFC: 1207.1.4, 1207.1.4.1, 1207.1.4.2

Proponents: Michael O'Brian, representing FCAC (fcac@iccsafe.org)

2021 International Fire Code

Revise as follows:

1207.1.4 Hazard mitigation analysis. A failure modes and effects analysis (FMEA) or other*approved* hazard mitigation analysis shall be provided in accordance with Section 104.8.2 under any of the following conditions:

1. Where ESS technologies not specifically identified in Table 1207.1.1 are provided.
2. More than one ESS technology is provided in a ~~room or enclosed~~ single fire area where there is a potential for adverse interaction between technologies.
3. Where allowed as a basis for increasing maximum allowable quantities. See Section 1207.5.2.
4. Where required by the fire code official to address a potential hazard with an ESS installation that is not addressed by existing requirements.

1207.1.4.1 Fault condition. The hazard mitigation analysis shall evaluate the consequences of the following failure modes. Only single failure modes shall be considered.

1. A thermal runaway condition in a single electrochemical ESS ~~rack, module or~~ unit.
2. A mechanical failure of a non-electrochemical ESS unit.
3. ~~2.~~ Failure of any battery (energy) management system or fire protection system within the ESS equipment that is not covered by the product listing failure mode effects analysis (FMEA).
4. ~~3.~~ Failure of any required ~~ventilation or exhaust system~~ protection system external to the ESS including but not limited to ventilation (HVAC), exhaust ventilation, smoke detection, fire detection, gas detection or fire suppression system.
5. ~~4. Voltage surges on the primary electric supply.~~
6. ~~5. Short circuits on the load side of the ESS.~~
7. ~~6. Failure of the smoke detection, fire detection, fire suppression or gas detection system.~~
8. ~~7. Required spill neutralization not being provided or failure of a required secondary containment system.~~

1207.1.4.2 Analysis approval. The*fire code official* is authorized to approve the hazardous mitigation analysis provided that the consequences of the hazard mitigation analysis demonstrate:

1. Fires will be contained within unoccupied ESS rooms or areas for the minimum duration of the fire-resistance-rated separations identified in Section 1207.7.4.
2. Fires involving the ESS will allow occupants or the general public to evacuate to a safe location. ~~in occupied work centers will be detected in time to allow occupants within the room or area to safely evacuate.~~
3. ~~Toxic and highly toxic gases released during fires will not reach concentrations in excess of the IDLH level in the building or adjacent *means of egress* routes during the time deemed necessary to evacuate occupants from any affected area.~~
4. ~~Flammable gases released from ESS during charging, discharging and normal operation will not exceed 25 percent of their lower flammability limit (LFL).~~
5. ~~Flammable gases released from ESS during fire, overcharging and other abnormal conditions will be controlled through the use of ventilation of the gases, preventing accumulation, or by *deflagration* venting.~~

Reason: This proposal addresses the following:
1207.1.4 – Editorially corrected the reference to fire area.

1207.1.4.1

- Item 2 addresses potential mechanical ESS failure modes for nonelectrochemical ESS, such as loss of speed controls on flywheel ESS.
- Item 3 added failure of fire protection systems within the ESS enclosure, that was not covered by the UL 9540 listing FMEA, such as an off-gas air sampling systems.
- Item 4 combined ventilation and protection systems, formerly item (7), and added required HVAC equipment needed to keep the ESS in a safe temperature range. It also made these changes:.
- Voltage surges (item 5) and short circuits (item 6) protection are covered by the ESMS or BMS equipment requirements.

- When it comes to the FMEA, there was limited value in considering lack of spill neutralization materials or failure of secondary containment under single fault failure modes, so item 8 is being deleted. .

1207.1.4.2 – A major outcome of the HMA analysis is to allows occupants or the general public (for outdoor installations) to evacuate to a safe area. Item 3 is deleted because the IDLH level does not need to be stated and is covered by getting individuals to a safe area. Item 4 is being deleted because it is a performance requirement during normal operating conditions. Item 5 is being deleted because it is not an outcome, but rather ONE method of achieving the desired results.

This proposal is submitted by the ICC Fire Code Action Committee (FCAC). The FCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes with regard to fire and life safety in new and existing buildings and facilities as well as the protection of life and property in wildland urban interface areas. In 2020 and 2021 the Fire-CAC held multiple virtual meetings that were open to any interested party. In addition, there were numerous virtual specific working group meetings that were also open to any interested parties, to develop, discuss and debate the proposed changes. Related documentation and reports are posted on the FCAC website at: https://www.iccsafe.org/products-and-services/i-codes/code-development/cs/fire-code-action-committee-fcac/

Cost Impact: The code change proposal will increase the cost of construction
The cost impact was shown as possibly increasing however this may vary. The revised hazard mitgation analysis (HMA) requirements may not impact the outcome or could change the protection to be provided.

F136-21

IFC: CHAPTER 12, SECTION 1207, 1207.1, 1207.1.5

Proponents: Robert J Davidson, Davidson Code Concepts, LLC, representing Tesla, USA (rjd@davidsoncodeconcepts.com)

2021 International Fire Code

CHAPTER 12
ENERGY SYSTEMS

SECTION 1207
ELECTRICAL ENERGY STORAGE SYSTEMS (ESS)

1207.1 General. The provisions in this section are applicable to stationary and mobile electrical energy storage systems (ESS).
Exception: ESS in Group R-3 and R-4 occupancies shall comply with Section 1207.11.

Revise as follows:

1207.1.5 Large-scale fire test. Where required elsewhere in Section 1206, large-scale fire testing shall be conducted on a representative ESS in accordance with UL 9540A. The testing shall be conducted or witnessed and reported by an *approved* testing laboratory and show that a fire involving one ESS will not propagate to an adjacent ESS, and where installed within buildings, enclosed areas and walk-in units will be contained within the room, enclosed area or walk-in unit for ~~a~~ the duration ~~equal to the *fire-resistance rating* of the room separation specified in Section 1207.7.4~~ of the test. The test report shall be provided to the *fire code official* for review and approval in accordance with Section 104.8.2.

Reason: The purpose of this change is to correct a technical problem.
When the struck language was added to the fire code it was believed that this factor could be tested for and have the results contained within the large scale burn test report based on how long a fire-resistance-rated wall lasted. However, when working with UL on the development of UL 9540A as the test standard we were informed that this factor, fire-resistance rating as understood by the codes based upon E119 or ANSI/UL 263 testing could not be tested for in the large scale burn tests because there is no way to utilize a test furnace and the heat generation is entirely different.

Because of how the indoor tests in UL 9540A are tested you do know if the two simulated walls in the Unit Level Test survive testing, an important factor that is part of the distance to wall criteria, and with the Installation Level Test there is a room with ceiling and suppression that again provides knowledge of whether a room would survive. The problem is it cannot be reported in terms of length of fire-resistance rating.

The change in the language will provide data on duration for sharing with the code official, it just won't be in fire-resistant rating. Bottom line, the phrase deleted cannot be tested for, therefor it should be deleted/modified.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
Since this does not change the construction methods required, nor does it eliminate the need to conduct a large scale test, there is no impact on costs of construction.

F137-21

IFC: 1207.1.6.1

Proponents: Gregory Benton, NYS DOS Division of Building Standards and Codes, representing NYS DOS Division of Building Standards and Codes (gregory.benton@dos.ny.gov); Emma Gonzalez-Laders, representing NYS DOS Division of Building Standards and Codes (emma.gonzalez-laders@dos.ny.gov)

2021 International Fire Code

Revise as follows:

1207.1.6.1 Fire mitigation personnel. Where, in the opinion of the *fire code official*, it is essential for public safety that trained personnel be on-site to respond to possible ignition or re-ignition of a damaged ESS, the system owner, agent or lessee shall ~~immediately~~ dispatch within 15 minutes one or more fire mitigation personnel to the premise, as required and *approved*, at their expense. These personnel shall remain on duty continuously after the fire department leaves the premise until the damaged energy storage equipment is removed from the premises, or earlier if the *fire code official* indicates the public safety hazard has been abated.

Reason: The word "immediately" is unspecific and therefore unenforceable. The selection of 15 minutes was based on the New York City Fire Department's New Fire Department Rule 3 RCNY 608-01 "Outdoor Stationary Storage Battery Systems", which was adopted on October 1, 2019. In RCNY 608-01 the Fire Department requires a technical representative from the battery manufacturer with knowledge of the battery system be made available within 15 minutes of the Fire Department's request.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The specification of a maximum dispatch time will have a negligible affect on cost.

F138-21

IFC: 1207.2.1

Proponents: Michael O'Brian, representing FCAC (fcac@iccsafe.org)

2021 International Fire Code

Revise as follows:

1207.2.1 Commissioning. Commissioning of newly installed ESS and existing ESS that have been retrofitted, replaced or previously decommissioned and are returning to service shall be conducted prior to the ESS being placed in service in accordance with a commissioning plan that has been *approved* prior to initiating commissioning. The commissioning plan shall include the following:

1. A narrative description of the activities that will be accomplished during each phase of commissioning, including the personnel intended to accomplish each of the activities.
2. A listing of the specific ESS and associated components, controls and safety-related devices to be tested, a description of the tests to be performed and the functions to be tested.
3. Conditions under which all testing will be performed, which are representative of the conditions during normal operation of the system.
4. Documentation of the owner's project requirements and the basis of design necessary to understand the installation and operation of the ESS.
5. Verification that required equipment and systems are installed in accordance with the *approved* plans and specifications.
6. Integrated testing for all fire and safety systems.
7. Testing for any required thermal management, ventilation or exhaust systems associated with the ESS installation.
8. Preparation and delivery of operation and maintenance documentation.
9. Training of facility operating and maintenance staff.
10. Identification and documentation of the requirements for maintaining system performance to meet the original design intent during the operation phase.
11. Identification and documentation of personnel who are qualified to service, maintain and decommission the ESS, and respond to incidents involving the ESS, including documentation that such service has been contracted for.
12. A decommissioning plan for removing the ESS from service, and from the facility in which it is located. The plan shall include details on providing a safe, orderly shutdown of energy storage and safety systems with notification to the code officials prior to the actual decommissioning of the system. The decommissioning plan shall include contingencies for removing an intact operational ESS from service, and for removing an ESS from service that has been damaged by a fire or other event.

~~**Exception**~~ **Exceptions:** Commissioning shall not be required for lead-acid and nickel-cadmium battery systems at facilities under the exclusive control of communications utilities that comply with NFPA 76 and operate at less than 50 VAC and 60 VDC. A decommissioning plan shall be provided and maintained where required by the fire code official.

1. Lead-acid and nickel-cadmium battery systems less than 50 V ac, 60 V dc that are in telecommunications facilities for installations of communications equipment under the exclusive control of communications utilities and located outdoors or in building spaces or walk-in units used exclusively for such installations that are in compliance with NFPA 76 shall be permitted to have a commissioning plan in compliance with recognized industry practices in lieu of complying with Section 1207.2.1.
2. Lead-acid and nickel-cadmium battery systems that are used for dc power for control of substations and control or safe shutdown of generating stations under the exclusive control of the electric utilities, and located in building spaces or walk-in units used exclusively for such installations shall be permitted to have a commissioning plan in compliance with applicable governmental laws and regulations in lieu of developing a commissioning plan in accordance with Section 1207.2.1.

Reason: This proposed change is consistent with NFPA 855, Sections 8.1.1, 6.1.1.2, and 8.1.2 and allows options for lead acid and Ni-cad battery system ESS commissioning for telecommunications and electric utility installations.
This proposal is submitted by the ICC Fire Code Action Committee (FCAC). The FCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes with regard to fire and life safety in new and existing buildings and facilities as well as the protection of life and property in wildland urban interface areas. In 2020 and 2021 the Fire-CAC held multiple virtual meetings that were open to any interested party. In addition, there were numerous virtual specific working group meetings that were also open to any interested parties, to develop, discuss and debate the proposed changes. Related documentation and reports are posted on the FCAC website at: https://www.iccsafe.org/products-and-services/i-codes/code-development/cs/fire-code-action-committee-fcac/

Cost Impact: The code change proposal will not increase or decrease the cost of construction

It merely provides industry options for commissioning ESS.

Staff Analysis: A review of the standard proposed for inclusion in the code, IEEE C2-2017, National Electrical Safety Code(R) (NESC(R)), with regard to some of the key ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before March 20, 2021.

F140-21

IFC: 1207.3.1, UL Chapter 80 (New)

Proponents: Michael O'Brian, representing FCAC (fcac@iccsafe.org)

2021 International Fire Code

Revise as follows:

1207.3.1 Energy storage system listings. ESS shall be *listed* in accordance with UL 9540.

Exceptions: ~~**Exception:** Lead-acid and nickel-cadmium battery systems installed in facilities under the exclusive control of communications utilities, and operating at less than 50 VAC and 60 VDC in accordance with NFPA 76, are not required to be listed.~~

1. Lead-acid and nickel-cadmium battery systems less than 50 V ac, 60 V dc in telecommunications facilities for installations of communications equipment under the exclusive control of communications utilities located outdoors or in building spaces used exclusively for such installations that are in compliance with NFPA 76.
2. Lead-acid and nickel-cadmium battery systems that are used for dc power for control of substations and control or safe shutdown of generating stations under the exclusive control of the electric utility, and located outdoors or in building spaces used exclusively for such installations.
3. Lead-acid battery systems in uninterruptable power supplies listed and labeled in accordance with UL 1778 and utilized for standby power applications.

Add new standard(s) as follows:

UL

Underwriters Laboratories LLC
333 Pfingsten Road
Northbrook, IL 60062

1778-2014 - with revisions through October 2017 Uninterruptible Power Systems

Reason: This proposed change is consistent with NFPA 855, Sections 4.2.1.1 through 4.2.1.3 and allows certain battery systems in telecommunication, electric utility and UPS applications to not be listed to UL 9540.
This proposal is submitted by the ICC Fire Code Action Committee (FCAC). The FCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes with regard to fire and life safety in new and existing buildings and facilities as well as the protection of life and property in wildland urban interface areas. In 2020 and 2021 the Fire-CAC held multiple virtual meetings that were open to any interested party. In addition, there were numerous virtual specific working group meetings that were also open to any interested parties, to develop, discuss and debate the proposed changes. Related documentation and reports are posted on the FCAC website at: https://www.iccsafe.org/products-and-services/i-codes/code-development/cs/fire-code-action-committee-fcac/

Cost Impact: The code change proposal will not increase or decrease the cost of construction
It introduces applications in which certain ESS technologies are not required to be listed.

Staff Analysis: A review of the following standards proposed for inclusion in the code, with regard to some of the key ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before March 20, 2021.

- IEEE C2-2017, National Electrical Safety Code(R) (NESC(R))
- UL 1778-2014 - Uninterruptible Power Systems with revisions through October 2017

F141-21

IFC: 1207.3.7.1, UL Chapter 80 (New)

Proponents: Michael O'Brian, representing FCAC (fcac@iccsafe.org)

2021 International Fire Code

Revise as follows:

1207.3.7.1 Retrofitting lead acid and nickel cadmium. Changing out or retrofitting of lead-acid and nickel-cadmium batteries with other lead-acid and nickel-cadmium batteries in the following applications shall be considered repairs where there is no increase in system size or energy capacity greater than 10 percent of the original design

1. At facilities under the exclusive control of communications utilities that comply with NFPA 76 and operate at less than 50 VAC and 60 VDC.
2. Battery systems ~~designed in accordance with IEEE C2,~~ used for dc power for control of substations and control or safe shutdown of generating stations under the exclusive control of the electric utility, and located outdoors or in building spaces used exclusively for such installations.
3. Batteries in uninterruptible power supplies listed and labeled in accordance with UL 1778 and used for standby power applications only.

Add new standard(s) as follows:

UL

Underwriters Laboratories LLC
333 Pfingsten Road
Northbrook, IL 60062

1778-2014 Uninterruptible Power Systems - with revisions through October 2017

Reason: This proposed change is consistent with NFPA 855, Sections 4.2.3.2 through 4.2.3.4 and recognizes exceptions for changing out batteries for telecommunications, electric utility and UPS systems without additional commissioning or pulling a permit.

This proposal is submitted by the ICC Fire Code Action Committee (FCAC). The FCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes with regard to fire and life safety in new and existing buildings and facilities as well as the protection of life and property in wildland urban interface areas. In 2020 and 2021 the Fire-CAC held multiple virtual meetings that were open to any interested party. In addition, there were numerous virtual specific working group meetings that were also open to any interested parties, to develop, discuss and debate the proposed changes. Related documentation and reports are posted on the FCAC website at: https://www.iccsafe.org/products-and-services/i-codes/code-development/cs/fire-code-action-committee-fcac/

Cost Impact: The code change proposal will not increase or decrease the cost of construction
It may decrease costs by not requiring additional commissioning or pulling a permit.

Staff Analysis: A review of the following standards proposed for inclusion in the code, with regard to some of the key ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before March 20, 2021.

- IEEE C2-2017, National Electrical Safety Code(R) (NESC(R))
- UL 1778-2014 - Uninterruptible Power Systems with revisions through October 2017

F142-21

IFC: TABLE 1207.5

Proponents: Michael O'Brian, representing FCAC (fcac@iccsafe.org)

2021 International Fire Code

Revise as follows:

TABLE 1207.5 MAXIMUM ALLOWABLE QUANTITIES OF ELECTROCHEMICAL ESS

TECHNOLOGY	MAXIMUM ALLOWABLE QUANTITIES [a]
STORAGE BATTERIES	
Flow batteries[b]	600 kWh
Lead-acid, all types	Unlimited
Lithium-ion	600 kWh
Sodium nickel chloride ~~Nickel metal hydride (Ni-MH)~~	~~Unlimited~~ 600kWh
Nickel-cadmium (Ni-Cd), Nickel metal hydride (NI-MH) and nickel zinc (Ni-Zn)	Unlimited
Zinc Manganese dioxide (Zn-MnO2)	Unlimited
Other battery technologies	200 kWh
CAPACITORS	
All types	20 kWh
OTHER ELECTROCHEMICAL ESS	
All types	20 kWh

For SI: 1 kilowatt hour = 3.6 megajoules.

a. For electrochemical ESS units rated in amp-hours, kWh shall equal rated voltage times the amp-hour rating divided by 1,000.

b. Shall include vanadium, zinc-bromine, polysulfide-bromide and other flowing electrolyte-type technologies.

Reason: This proposed change is consistent with NFPA 855, Table 4.8, it adds nickel zinc technology, zinc manganese dioxide and sodium nickel chloride into the table based on testing performed and the data provide to the NFPA 855 technical committee. It also relocated the nickel metal hydride batteries reference with no technical change.
This proposal is submitted by the ICC Fire Code Action Committee (FCAC). The FCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes with regard to fire and life safety in new and existing buildings and facilities as well as the protection of life and property in wildland urban interface areas. In 2020 and 2021 the Fire-CAC held multiple virtual meetings that were open to any interested party. In addition, there were numerous virtual specific working group meetings that were also open to any interested parties, to develop, discuss and debate the proposed changes. Related documentation and reports are posted on the FCAC website at: https://www.iccsafe.org/products-and-services/i-codes/code-development/cs/fire-code-action-committee-fcac/

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal will not increase the cost of construction. It just introduces two new battery technologies.

F143-21

IFC: 1207.5.1, UL Chapter 80 (New)

Proponents: Michael O'Brian, representing FCAC (fcac@iccsafe.org)

2021 International Fire Code

Revise as follows:

1207.5.1 Size and separation. Electrochemical ESS shall be segregated into groups not exceeding 50 kWh (180 megajoules). Each group shall be separated a minimum of 3 feet (914 mm) from other groups and from walls in the storage room or area. The storage arrangements shall comply with Chapter 10.

Exceptions:

1. Lead-acid and nickel-cadmium battery systems in facilities under the exclusive control of communications utilities and operating at less than 50 VAC and 60 VDC in accordance with NFPA 76.
2. Lead-acid and nickel cadmium systems that are used for dc power for control of substations and control or safe shutdown of generating stations under the exclusive control of the electric utility, and located outdoors or in building spaces used exclusively for such installations.
3. Lead-acid battery systems in uninterruptable power supplies listed and labeled in accordance with UL 1778, utilized for standby power applications, and limited to not more than 10% of the floor area on the floor on which the ESS is located.
2. 4. The *fire code official* is authorized to approve larger capacities or smaller separation distances based on large-scale fire testing complying with Section 1207.1.5.

Add new standard(s) as follows:

UL

Underwriters Laboratories LLC
333 Pfingsten Road
Northbrook, IL 60062

1778-2014: Uninterruptible Power Systems with revisions through October 2017

Reason: This proposed change is consistent with NFPA 855, Sections 4.6.6 and 4.6.7 and includes exceptions for certain battery technologies in electric utility and UPS applications .
This proposal is submitted by the ICC Fire Code Action Committee (FCAC). The FCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes with regard to fire and life safety in new and existing buildings and facilities as well as the protection of life and property in wildland urban interface areas. In 2020 and 2021 the Fire-CAC held multiple virtual meetings that were open to any interested party. In addition, there were numerous virtual specific working group meetings that were also open to any interested parties, to develop, discuss and debate the proposed changes. Related documentation and reports are posted on the FCAC website at: https://www.iccsafe.org/products-and-services/i-codes/code-development/cs/fire-code-action-committee-fcac/

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal will not increase the cost of construction. It introduces applications in which certain ESS technologies are not required to meet size and separation requirements.

Staff Analysis: A review of the following standards proposed for inclusion in the code, with regard to some of the key ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before March 20, 2021.

- IEEE C2-2017, National Electrical Safety Code(R) (NESC(R))
- UL 1778-2014 - Uninterruptible Power Systems with revisions through October 2017

F144-21

IFC: 1207.5.3, UL Chapter 80 (New)

Proponents: Michael O'Brian, representing FCAC (fcac@iccsafe.org)

2021 International Fire Code

Revise as follows:

1207.5.3 Elevation. Electrochemical ESS shall not be located in the following areas:

1. Where the floor is located more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access.
2. Where the floor is located below the lowest *level of exit discharge*.

Exceptions:

1. Lead-acid and nickel-cadmium battery systems less than 50 VAC and 60 VDC installed in facilities under the exclusive control of communications utilities in accordance with NFPA 76.
2. Lead-acid and nickel cadmium systems that are used for dc power for control of substations and control and safe shutdown of generating stations under the exclusive control of the electric utility, and located outdoors or in building spaces used exclusively for such installations.
3. Lead-acid battery systems in uninterruptable power supplies listed and labeled in accordance with UL 1778, utilized for standby power applications, which is limited to not more than 10% of the floor area on the floor on which the ESS is located.
4. ~~2.~~ Where *approved*, installations shall be permitted in underground vaults complying with NFPA 70, Article 450, Part III.
5. ~~3.~~ Where *approved* by the *fire code official,* installations shall be permitted on higher and lower floors.

Add new standard(s) as follows:

UL

Underwriters Laboratories LLC
333 Pfingsten Road
Northbrook, IL 60062

1778-2014 Uninterruptible Power Systems

Reason: This proposed change is consistent with NFPA 855, Section 4.3.9.3 and allows exceptions to elevation requirements for certain battery technologies in electric utility and UPS systems.
This proposal is submitted by the ICC Fire Code Action Committee (FCAC). The FCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes with regard to fire and life safety in new and existing buildings and facilities as well as the protection of life and property in wildland urban interface areas. In 2020 and 2021 the Fire-CAC held multiple virtual meetings that were open to any interested party. In addition, there were numerous virtual specific working group meetings that were also open to any interested parties, to develop, discuss and debate the proposed changes. Related documentation and reports are posted on the FCAC website at: https://www.iccsafe.org/products-and-services/i-codes/code-development/cs/fire-code-action-committee-fcac/

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal will not increase the cost of construction. It is actually a relaxation of requirements.

Staff Analysis: A review of the following standards proposed for inclusion in the code, with regard to some of the key ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before March 20, 2021.

- IEEE C2-2017, National Electrical Safety Code(R) (NESC(R))
- UL 1778-2014 - Uninterruptible Power Systems with revisions through October 2017

F145-21

IFC: 1207.5.4, 1207.5.4.1

Proponents: Michael O'Brian, representing FCAC (fcac@iccsafe.org)

2021 International Fire Code

Revise as follows:

1207.5.4 Fire detection. An *approved* automatic smoke detection system or radiant energy-sensing fire detection system complying with Section 907.2 shall be installed in rooms, indoor areas and walk-in units containing electrochemical ESS. An *approved* radiant energy-sensing fire detection system shall be installed to protect open parking garage and rooftop installations. Alarm signals from detection systems shall be transmitted to a central station, proprietary or remote station service in accordance with NFPA 72, or where *approved* to a constantly attended location.

Exception: Normally unoccupied, remote stand-alone telecommunications structures with a gross floor area of less than 1500 ft ^{2} (139 m^2) utilizing lead-acid or nickel cadmium batteries shall not be required to have a fire detection system installed.

1207.5.4.1 System status. Lead-acid and nickel-cadmium battery systems that are used for dc power for control of substations and control or safe shutdown of generating stations under the exclusive control of the electric utility, and located outdoors or in building spaces used exclusively for such installations shall be allowed to use the process control system to monitor the smoke or radiant energy–sensing fire detectors required in Section 1207.5.4.

~~Where required by the fire code official, visible annunciation shall be provided on cabinet exteriors or in other approved locations to indicate that potentially hazardous conditions associated with the ESS exist.~~

Reason: This proposed change is consistent with NFPA 855, Sections 4.10.2 and 4.10.3. It allows small remote telecommunication facilities, such as mountaintop repeaters, to not require a fire detection system. It also revises the fire detection system requirements for certain electric utility installations to use process control systems to monitor the smoke or fire detectors.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
It is actually a relaxation of requirements.

Staff Analysis: A review of the standard proposed for inclusion in the code, IEEE C2-2017, National Electrical Safety Code(R) (NESC(R)), with regard to some of the key ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before March 20, 2021.

F146-21

IFC: 1207.5.5, UL Chapter 80 (New)

Proponents: Michael O'Brian, representing FCAC (fcac@iccsafe.org)

2021 International Fire Code

Revise as follows:

1207.5.5 Fire suppression systems. Rooms and areas within buildings and walk-in units containing electrochemical ESS shall be protected by an automatic fire suppression system designed and installed in accordance with one of the following:

1. ~~An~~ Automatic sprinkler systems, ~~system~~ designed and installed in accordance with Section 903.3.1.1, for ESS units (groups) with a maximum stored energy capacity of 50 kWh, as described in Section 1207.5.1, shall be designed with a minimum density of 0.3 gpm/ft^2 (1.1 l/min) based ~~on the fire area~~ over the area of the room or 2500 ft^2 (232 m^2) design area, whichever is smaller, unless a lower density is approved based upon large-scale fire testing in accordance with Section 1207.1.5.
2. ~~Where *approved*, an *automatic* *Automatic* *sprinkler* *system*~~ *systems* designed and installed in accordance with Section 903.3.1.1 for ~~with a sprinkler hazard classification~~ ESS units (groups) exceeding 50 kWh shall use a density based on large-scale fire testing complying with Section 1207.1.5.
3. The following alternative automatic fire-extinguishing systems designed and installed in accordance with Section 904, provided that the installation is *approved* by the *fire code official* based on large-scale fire testing complying with Section 1207.1.5:

   3.1. NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems*.

   3.2. NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*.

   3.3. NFPA 750, *Standard on Water Mist Fire Protection Systems*.

   3.4. NFPA 2001, *Standard on Clean Agent Fire-Extinguishing Systems*.

   3.5. NFPA 2010, *Standard for Fixed Aerosol Fire-Extinguishing Systems*.

~~Exception~~ Exceptions:

1. Fire suppression systems for lead-acid and nickel-cadmium battery systems at facilities under the exclusive control of communications utilities that operate at less than 50 VAC and 60 VDC shall be provided where required by NFPA 76.
2. Lead-acid and nickel cadmium systems that are used for dc power for control of substations and control or safe shutdown of generating stations under the exclusive control of the electric utility, and located outdoors or in building spaces used exclusively for such installations shall not be required to have a fire suppression system installed.
3. Lead-acid battery systems in uninterruptable power supplies listed and labeled in accordance with UL 1778, utilized for standby power applications, which is limited to not more than 10% of the floor area on the floor on which the ESS is located shall not be required to have a fire suppression system.

Add new standard(s) as follows:

UL

Underwriters Laboratories LLC
333 Pfingsten Road
Northbrook, IL 60062

1778-2014: Uninterruptible Power Systems with revisions through October 2017

Reason: This proposed change is consistent with NFPA 855, TIA Log #1486, and Sections 4.11.6 and 4.11.5. The new sprinkler density requirements were based, in part, on testing conducted by FM. The two exemptions for not requiring fire suppression for certain lead-acid and Ni-Cad battery systems used in electric utility and UPS applications were consistent with requirements in place prior to the 2018 IFC.
This proposal is submitted by the ICC Fire Code Action Committee (FCAC). The FCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes with regard to fire and life safety in new and existing buildings and facilities as well as the protection of life and property in wildland urban interface areas. In 2020 and 2021 the Fire-CAC held multiple virtual meetings that were open to any interested party. In addition, there were numerous virtual specific working group meetings that were also open to any interested parties, to develop, discuss and debate the proposed changes. Related documentation and reports are posted on the FCAC website at: https://www.iccsafe.org/products-and-services/i-codes/code-development/cs/fire-code-action-committee-fcac/

Cost Impact: The code change proposal will increase the cost of construction
This proposal may result in an increase in the cost of construction. Large scale UL 9540A fire testing may dictate larger sprinkler densities be

provided. However, the two exceptions have the potential to reduce the cost of construction.

Staff Analysis: A review of the following standards proposed for inclusion in the code, with regard to some of the key ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before March 20, 2021.

- IEEE C2-2017, National Electrical Safety Code(R) (NESC(R))
- UL 1778-2014 - Uninterruptible Power Systems with revisions through October 2017

F147-21

IFC: TABLE 1207.6

Proponents: Michael O'Brian, representing FCAC (fcac@iccsafe.org)

2021 International Fire Code

Revise as follows:

TABLE 1207.6 ELECTROCHEMICAL ESS TECHNOLOGY-SPECIFIC REQUIREMENTS

COMPLIANCE REQUIRED[b]		BATTERY TECHNOLOGY						OTHER ESS AND BATTERY TECHNOLOGIES[b]	CAPACITOR ESS[b]
Feature	**Section**	Lead-acid	Nickel cadmium (Ni-Cd), ~~and~~ nickel metal hydride (Ni-MH) and nickel zinc (Ni-Zn)	Zinc Manganese dioxide (Zn MnO2)	Lithium-ion	Flow	Sodium nickel chloride		
Exhaust ventilation	1207.6.1	Yes	Yes	Yes	No	Yes	No	Yes	Yes
Explosion control	1207.6.3	Yes[a]	Yes[a]	Yes	Yes	No	Yes	Yes	Yes
Safety caps	1207.6.4	Yes	Yes	No	No	No	No	Yes	Yes
Spill control and neutralization	1207.6.2	Yes[c]	Yes[c]	Yes[f]	No	Yes	No	Yes	Yes
Thermal runaway	1207.6.5	Yes[d]	Yes	Yes[e]	Yes[e]	No	Yes	Yes[e]	Yes

a. Not required for lead-acid and nickel-cadmium batteries at facilities under the exclusive control of communications utilities that comply with NFPA 76 and operate at less than 50 VAC and 60 VDC.

b. Protection shall be provided unless documentation acceptable to the fire code official is provided in accordance with Section 104.8.2 that provides justification why the protection is not necessary based on the technology used.

c. Applicable to vented-type (i.e., flooded) nickel-cadmium and lead-acid batteries.

d. Not required for vented-type (i.e., flooded) lead-acid batteries.

e. The thermal runaway protection is permitted to be part of a battery management system that has been evaluated with the battery as part of the evaluation to UL 1973.

f. Not required for batteries with jelled electrolyte.

Reason: Data had been provided to address addition of nickel zinc (Ni-Zn), zinc manganese dioxide (ZnMnO2), and sodium nickel chloride batteries to the table. This revision for nickel chloride batteries is consistent with NFPA 855 Table 9.2.
This proposal is submitted by the ICC Fire Code Action Committee (FCAC). The FCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes with regard to fire and life safety in new and existing buildings and facilities as well as the protection of life and property in wildland urban interface areas. In 2020 and 2021 the Fire-CAC held multiple virtual meetings that were open to any interested party. In addition, there were numerous virtual specific working group meetings that were also open to any interested parties, to develop, discuss and debate the proposed changes. Related documentation and reports are posted on the FCAC website at: https://www.iccsafe.org/products-and-services/i-codes/code-development/cs/fire-code-action-committee-fcac/

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This has the potential to lower costs since it recognizes new electrochemical ESS technologies, which are no longer classified under the more stringent ”other” technology provisions.

F148-21

IFC: TABLE 1207.6

Proponents: Richard Kluge, Ericsson Inc., representing Alliance for Telecommunications Industry Solutions (ATIS) (richard.kluge@ericsson.com)

2021 International Fire Code

Revise as follows:

TABLE 1207.6 ELECTROCHEMICAL ESS TECHNOLOGY-SPECIFIC REQUIREMENTS

COMPLIANCE REQUIRED[b]		BATTERY TECHNOLOGY				OTHER ESS AND BATTERY TECHNOLOGIES[b]	CAPACITOR ESS[b]
Feature	Section	Lead-acid	Ni-Cd and Ni-MH	Lithium-ion	Flow		
Exhaust ventilation	1207.6.1	Yes	Yes	No	Yes	Yes	Yes
Explosion control	1207.6.3	Yes[a]	Yes[a]	Yes	No	Yes	Yes
Safety caps	1207.6.4	Yes	Yes	No	No	Yes	Yes
Spill control and neutralization	1207.6.2	Yes[c]	Yes[c]	No	Yes	Yes	Yes
Thermal runaway	1207.6.5	Yes[d]	Yes[d]	Yes[e]	No	Yes[e]	Yes

a. Not required for lead-acid and nickel-cadmium batteries at facilities under the exclusive control of communications utilities that comply with NFPA 76 and operate at less than 50 VAC and 60 VDC.

b. Protection shall be provided unless documentation acceptable to the fire code official is provided in accordance with Section 104.8.2 that provides justification why the protection is not necessary based on the technology used.

c. Applicable to vented-type (i.e., flooded) nickel-cadmium and lead-acid batteries.

d. Not required for vented-type (i.e., flooded) ~~lead-acid~~ batteries.

e. The thermal runaway protection is permitted to be part of a battery management system that has been evaluated with the battery as part of the evaluation to UL 1973.

Reason: Flooded nickel-cadmium batteries do not require thermal-runaway control for safe operation. In fact, they are as abuse tolerant as flooded lead-acid batteries, if not more so. Prior editions of the IFC did not require thermal runaway control for flooded nickel-cadmium batteries.

From the 2018 Edition: **1206.2.12.2 (3)** "Thermal runaway control shall be provided for valve-regulated sealed nickel-cadmium storage batteries in accordance with section 1206.2.10.7."
Note this specifically exempts flooded nickel-cadmium batteries which are neither sealed nor valve-regulated. The language in prior IFC editions was similar and never required thermal runaway control for flooded nickel-cadmium batteries.

The change to include thermal runaway control for flooded nickel-cadmium batteries may have inadvertently been made when this part of the energy storage section was updated and put into tabular format in the 2021 edition as there was no justification recorded for the change. A Public Input to correct a similar mistake found in the 2018 edition of NFPA 855 was recently accepted at the technical committee level. See attached pdf file of first revision 114 of NFPA 855 - in particular, edit to note e.

Nickel-metal-hydride batteries are not made in a flooded or vented configuration, so even though they are included in the same column as nickel-cadmium, the footnote exempting them from thermal runaway control would not apply.

Cost Impact: The code change proposal will decrease the cost of construction
Not requiring thermal runaway control for nickel-cadmium batteries will result in a slightly lower cost for these installations as simpler charge controllers without temperature compensation can be utilized.

F151-21

IFC: 1207.6.3, UL Chapter 80 (New)

Proponents: Michael O'Brian, representing FCAC (fcac@iccsafe.org)

2021 International Fire Code

Revise as follows:

1207.6.3 Explosion control. Where required by Table 1207.6 or elsewhere in this code, explosion control complying with Section 911 shall be provided for rooms, areas, ESS cabinets or ESS walk-in units containing electrochemical ESS technologies.

Exceptions:

1. Where *approved*, explosion control is permitted to be waived by the *fire code official* based on large-scale fire testing complying with Section 1207.1.5 that demonstrates that flammable gases are not liberated from electrochemical ESS cells or modules ~~where tested in accordance with UL 9540A~~.
2. Where *approved*, explosion control is permitted to be waived by the *fire code official* based on documentation provided in accordance with Section 104.7 that demonstrates that the electrochemical ESS technology to be used does not have the potential to release flammable gas concentrations in excess of 25 percent of the LFL anywhere in the room, area, walk-in unit or structure under thermal runaway or other fault conditions.
3. Where approved, ESS cabinets that have no debris, shrapnel, or enclosure pieces ejected during large scale fire testing complying with Section 1207.1.5 shall be permitted in lieu of providing explosion control complying with Section 911.
4. Explosion control is not required for lead-acid and nickel cadmium battery systems less than 50 V ac, 60 V dc in telecommunication facilities under the exclusive control of communications utilities located in building spaces or walk-in units used exclusively for such installations.
5. Explosion control is not required for lead-acid and nickel cadmium systems used for dc power for control of substations and control or safe shutdown of generating stations under the exclusive control of the electric utility located in building spaces or walk-in units used exclusively for such installations.
6. Explosion control is not required for lead-acid battery systems in uninterruptable power supplies listed and labeled in accordance with UL 1778, utilized for standby power applications, and housed in a single cabinet in a single fire area in buildings or walk-in units.

Add new standard(s) as follows:

UL

Underwriters Laboratories LLC
333 Pfingsten Road
Northbrook, IL 60062

1778-2014	Uninterruptible Power Supply Systems with revisions through October 2017

Reason: This proposal accomplishes the following:
1. ESS Cabinets - Several large ESS cabinets containing lithium ion batteries are now being manufactured. This corrects an oversight for these units not requiring explosion control. In lieu of providing explosion control in accordance with Section 911 (e.g. NFPA 68 or 69) these ESS cabinets can be designed so that “no debris, shrapnel, or enclosure pieces are ejected” during large scale fire testing complying, which is terminology used in the unit level test acceptance criteria in UL 9540A. See item (3)

2. The reference to UL 9540A is being removed from exception 1 since it is covered by the reference to 1207.5.1.

3. Allows exemptions (4), (5), and (6) for lead-acid and Ni-Cad ESS at telecom, electric utility and UPS installations that are consistent with NFPA 855.

This proposal is submitted by the ICC Fire Code Action Committee (FCAC). The FCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes with regard to fire and life safety in new and existing buildings and facilities as well as the protection of life and property in wildland urban interface areas. In 2020 and 2021 the Fire-CAC held multiple virtual meetings that were open to any interested party. In addition, there were numerous virtual specific working group meetings that were also open to any interested parties, to develop, discuss and debate the proposed changes. Related documentation and reports are posted on the FCAC website at: https://www.iccsafe.org/products-and-services/i-codes/code-development/cs/fire-code-action-committee-fcac/

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposal has the potential to increase the cost of construction It requires explosion control in ESS cabinets which was overlooked during the

last code cycle. It can decrease the cost of construction for installations covered by (4), (5) and (6).

Staff Analysis: A review of the following standards proposed for inclusion in the code, with regard to some of the key ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before March 20, 2021.

- IEEE C2-2017, National Electrical Safety Code(R) (NESC(R))
- UL 1778-2014 - Uninterruptible Power Systems with revisions through October 2017

F152-21

IFC: 1207.10.1, 1207.10.2

Proponents: Michael O'Brian, representing FCAC (fcac@iccsafe.org)

2021 International Fire Code

Revise as follows:

1207.10.1 Charging and storage. For the purpose of Section 1207.10, charging and storage covers the operation where mobile ESS are charged and stored so they are ready for deployment to another site, and where they are charged and stored after a deployment.
Exception: Mobile ESS used to temporarily provide power to lead-acid and nickel cadmium systems that are ~~designed in accordance with IEEE C2,~~ used for dc power for control of substations and control or safe shutdown of generating stations under the exclusive control of the electric utility, and located outdoors or in building spaces used exclusively for such installations.

1207.10.2 Deployment. For the purpose of Section 1207.10, deployment covers operations where mobile ESS are located at a site other than the charging and storage site and are being used to provide power.
Exception: Mobile ESS used to temporarily provide power to lead-acid and nickel cadmium systems that are ~~designed in accordance with IEEE C2,~~ used for dc power for control of substations and control or safe shutdown of generating stations under the exclusive control of the electric utility, and located outdoors or in building spaces used exclusively for such installations.

Reason: This proposed change allows exemptions for lead-acid and Ni-Cad battery systems used in electric utility applications, and is consistent with NFPA 855, Sections 4.5.1.1 and 4.5.2.1.
This proposal is submitted by the ICC Fire Code Action Committee (FCAC). The FCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes with regard to fire and life safety in new and existing buildings and facilities as well as the protection of life and property in wildland urban interface areas. In 2020 and 2021 the Fire-CAC held multiple virtual meetings that were open to any interested party. In addition, there were numerous virtual specific working group meetings that were also open to any interested parties, to develop, discuss and debate the proposed changes. Related documentation and reports are posted on the FCAC website at: https://www.iccsafe.org/products-and-services/i-codes/code-development/cs/fire-code-action-committee-fcac/

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This is a relaxtion of requirements for mobile ESS providing temporary power with lead-acid and nickel cadmium systems so will reduce cost of compliance.

Staff Analysis: A review of the standard proposed for inclusion in the code, IEEE C2-2017, National Electrical Safety Code(R) (NESC(R)), with regard to some of the key ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before March 20, 2021.

F153-21

IFC: 1207.1, 1207.11, 1207.11.1, 1207.11.2, 1207.11.2.1, 1207.11.3, 1207.11.4, 1207.11.5, 1207.11.6, 1207.11.7, 1207.11.8, 1207.11.9, 1207.11.10

Proponents: Michael O'Brian, representing FCAC (fcac@iccsafe.org)

2021 International Fire Code

Revise as follows:

1207.1 General. The provisions in this section are applicable to stationary and mobile electrical energy storage systems (ESS).
Exception: ESS in Group R-3 and R-4 occupancies shall only be required to comply with Section 1207.11 except where Section 1207.11.4 requires compliance with Sections 1207.1 through 1207.9.

1207.11 ESS in Group R-3 and R-4 occupancies. ESS in Group R-3 and R-4 occupancies shall be ~~installed and maintained~~ in accordance with Sections 1207.11.1 through 1207.11.9. ~~The temporary use of an *owner* or occupant's electric-powered vehicle as an ESS shall be in accordance with Section 1207.11.10.~~

Exceptions:

1. ESS listed and labeled in accordance with UL 9540 and marked “For use in residential dwelling units”, where installed in accordance with the manufacturer’s instructions and NFPA 70.
2. ESS rated less than 1 kWh (3.6 megajoules).

1207.11.1 Equipment listings. ESS shall be *listed* and *labeled* in accordance with UL 9540. ~~ESS *listed* and *labeled* solely for utility or commercial use shall not be used for residential applications.~~

~~**Exceptions:**~~

1. ~~Where *approved*, repurposed unlisted battery systems from electric vehicles are allowed to be installed outdoors or in detached dedicated cabinets located not less than 5 feet (1524 mm) from exterior walls, property lines and public ways.~~
2. ~~ESS less than 1 kWh (3.6 megajoules).~~

1207.11.2 Installation. ESS shall be installed in accordance with the manufacturer's instructions and their listing.

1207.11.2.1 Spacing. Individual ESS units shall be separated from each other by at least 3 feet (914 mm) ~~of spacing unless~~ except where smaller separation distances are documented to be adequate based on large-scale fire testing complying with Section 1207.1.5.

1207.11.3 Location. ESS shall be installed only in the following locations:

1. Detached garages and detached accessory structures.
2. Attached garages separated from the *dwelling unit* living space and *sleeping units* in accordance with Section 406.3.2 of the *International Building Code*.
3. Outdoors or on the exterior side of exterior walls located a minimum of 3 feet (914 mm) from doors and windows directly entering the dwelling unit.
4. Enclosed Utility closets, basements, ~~and~~ storage or utility spaces within *dwelling units* and *sleeping units* with finished or noncombustible walls and ceilings. Walls and ceilings of unfinished wood-framed construction shall be provided with not less than 5/8 in. Type X gypsum wallboard.

ESS shall not be installed in sleeping rooms, or closets or spaces opening directly into sleeping rooms.

1207.11.4 Energy ratings. Individual ESS units shall have a maximum rating of 20 kWh. The aggregate rating of the ESS ~~structure~~ shall not exceed:

1. 40 kWh within utility closets, basements, and storage or utility spaces.
2. 80 kWh in attached or detached garages and detached accessory structures.
3. 80 kWh on exterior walls.
4. 80 kWh outdoors on the ground.

ESS installations exceeding the permitted individual or aggregate ratings shall be installed in accordance with Section 1207.1 through 1207.9.

1207.11.5 Electrical installation. ESS shall be installed in accordance with NFPA 70. Inverters shall be *listed* and *labeled* in accordance with UL

1741 or provided as part of the UL 9540 listing. Systems connected to the utility grid shall use inverters *listed* for utility interaction.

1207.11.6 Fire detection. Rooms and areas within *dwellings units*, *sleeping units*, *basements* and attached garages in which ESS are installed shall be protected by smoke alarms in accordance with Section 907.2.11. A *heat detector listed* and interconnected to the smoke alarms shall be installed in locations within *dwelling units*, *sleeping units* and attached garages where smoke alarms cannot be installed based on their listing.

1207.11.7 Protection from impact. ~~Stationary storage battery systems~~ ESS installed in a location subject to vehicle damage shall be protected by *approved* barriers. ~~Appliances in garages shall also be installed in accordance with Section 304.3 of the *International Mechanical Code.*~~

1207.11.8 Ventilation. Indoor installations of ESS that include batteries that produce hydrogen or other flammable gases during charging shall be provided with exhaust ventilation in accordance with Section 304.5 of the *International Mechanical Code* ~~1207.6.1~~.

Delete without substitution:

~~**1207.11.9 Toxic and highly toxic gas.** ESS that have the potential to release toxic or highly toxic gas during charging, discharging and normal use conditions shall not be installed within Group R-3 or R-4 occupancies.~~

Revise as follows:

~~**1207.11.10**~~ **1207.11.9 Electric vehicle use.** The temporary use of an *owner* or occupant's electric-powered vehicle to power a *dwelling unit* or *sleeping unit* while parked in an attached or detached garage or outdoors ~~outside~~ shall comply with the vehicle manufacturer's instructions and NFPA 70.

Reason: Significant changes were made when the ESS requirements were updated in the 2021 International Residential Code. Those changes are also being introduced into the next edition of the NFPA 855 Stationary Energy Storage system standard. This update includes requirements that are essentially identical to the 2021 IRC, with the following two exceptions.

1. In section 1207.11.1 an exception was removed that allowed, where approved, repurposed unlisted battery systems from electric vehicles are allowed to be installed outdoors or in detached dedicated cabinets located not less than 5 feet (1524 mm) from exterior walls, property lines and public ways. This type of installation is not common, and there are concerns with the overall safety of these unlisted systems. This was also not allowed in NFPA 855.
2. There has been considerable discussion about whether ESS should be allowed in certain rooms and spaces within the dwelling unit. Item 4 to Section 1207.11.3 provides more requirements for protection of walls and ceilings where located in utility closets, basements and storage or utility spaces.

The footnote to 1207.1 was revised to clarify that ESS in Group R-3 and R-4 occupancies only have to comply with section 1207.11, except when larger systems that exceed the energy capacity limits of Section 1207.11.4. Those larger system must comply with the requirements that apply to commercial ESS installations, which is also in the 2021 IRC.

This proposal is submitted by the ICC Fire Code Action Committee (FCAC). The FCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance assigned International Codes with regard to fire and life safety in new and existing buildings and facilities as well as the protection of life and property in wildland urban interface areas. In 2020 and 2021 the Fire-CAC held multiple virtual meetings that were open to any interested party. In addition, there were numerous virtual specific working group meetings that were also open to any interested parties, to develop, discuss and debate the proposed changes. Related documentation and reports are posted on the FCAC website at: https://www.iccsafe.org/products-and-services/i-codes/code-development/cs/fire-code-action-committee-fcac/

Cost Impact: The code change proposal will increase the cost of construction
This proposal has the potential to increase the cost of construction due to the eliminations of exceptions and possible limitations on locations of ESS.

F154-21

IFC: 1207.11.6

Proponents: Larry Sherwood, on behalf of Sustainable Energy Action Committee, representing Interstate Renewable Energy Council (Larry@irecusa.org); Kevin Reinertson, Riverside County Fire Dept., representing California Fire Chiefs Association FPO (kevin.reinertson@fire.ca.gov); Benjamin Davis, CA Solar & Storage Association, representing CA Solar & Storage Association (ben@calssa.org); Joseph H. Cain, P.E., Solar Energy Industries Association (SEIA), representing SEIA (JoeCainPE@gmail.com)

2021 International Fire Code

Revise as follows:

1207.11.6 Fire detection. ESS installed in group R-3 and R-4 occupancies shall comply with the following:

1. Rooms and areas within *dwellings units*, *sleeping units* and attached garages in which ESS are installed shall be protected by smoke alarms in accordance with Section 907.2.11 ~~907.2.10~~.
2. A listed heat alarm ~~heat detector listed and interconnected to the smoke alarms~~ shall be installed in locations ~~within *dwelling units*, *sleeping units* and attached garages~~ where smoke alarms cannot be installed based on their listing.

Reason: The purpose of this proposal is to:

1. Divide the single paragraph into distinct parts for clarity, separating the charging language from the provisions to provide single-station or multi-station smoke alarms per the code.
2. Correct the section pointer to section 907.2.10 to the revised location in the 2021 IFC, 907.2.11.
3. Clarify the intent is to provide both heat detection and alarm annunciation in the ESS location through the use of listed heat alarms.

The term heat detector was replaced because the heat detectors do not include a local annunciator. A heat detector is only required to detect a heat event, and safety officials want an audible alarm.

The term interconnected is removed from this section as the requirements for interconnection are provided in section 907.2.11 of the code.

This proposal was prepared by the Sustainable Energy Action Committee (SEAC), a forum for all stakeholders (including, but not limited to, AHJs, designers, engineers, contractors, first responders, manufacturers, suppliers, utilities, and testing labs) to collaboratively identify and find solutions for issues that affect the installation and use of solar energy systems, energy storage systems, demand response, and energy efficiency. The purpose is to facilitate the deployment and use of affordable, clean and renewable energy in a safe, efficient, and sustainable manner.

All recommendations from SEAC are approved by diverse stakeholders through a consensus process.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal clarifies existing code language.

Staff Analysis: Note that the reference to Section 907.2.10 has been corrected by errata to Section 907.2.11 for the first printing of the 2021 IFC.

F155-21

IFC: 1207.11.7, 1207.11.7.1 (New), FIGURE 1207.11.7.1 (New), 1207.11.7.2 (New), 1207.11.7.3 (New)

Proponents: Larry Sherwood, on behalf of Sustainable Energy Action Committee, representing Interstate Renewable Energy Council (Larry@irecusa.org); Kevin Reinertson, Riverside County Fire Dept., representing California Fire Chiefs Association FPO (kevin.reinertson@fire.ca.gov); Benjamin Davis, CA Solar & Storage Association, representing CA Solar & Storage Association (ben@calssa.org); Joseph H. Cain, P.E., Solar Energy Industries Association (SEIA), representing SEIA (JoeCainPE@gmail.com)

2021 International Fire Code

Revise as follows:

1207.11.7 Protection from impact. ~~Stationary storage battery systems~~ ESS installed in a location subject to vehicle damage in accordance with ~~shall~~ Section 1207.11.7.1 or 1207.11.7.2 shall be provided with impact protection in accordance with Section 1207.11.7.3. ~~be protected by *approved* barriers. Appliances in garages shall also be installed in accordance with Section 304.3 of the *International Mechanical Code.*~~

Add new text as follows:

1207.11.7.1 Garages. Where an ESS is installed in the normal driving path of vehicle travel within a garage, impact protection complying with Section 1207.11.3 shall be provided . The normal driving path is a space between the garage vehicle opening and the interior face of the back wall to a height of 48 in. (1219 mm)above the finished floor. The width of the normal driving path shall be equal to the width of the garage door opening. Impact protection shall also be provided for an ESS installed at either of the following locations (See Figure 1207.11.7.1):

1. On the interior face of the back wall and located within 36” to the left or to the right of the normal driving path.
2. On the interior face of a side wall and located within 24 inches from the back wall and 36 inches of the normal driving path.

Exception: Where the clear height of the vehicle garage opening is 7 ft 6 in, (2286 mm) or less, ESS installed not less than 36 inches (914 mm) above finished floor are not subject to vehicle impact protection requirements.

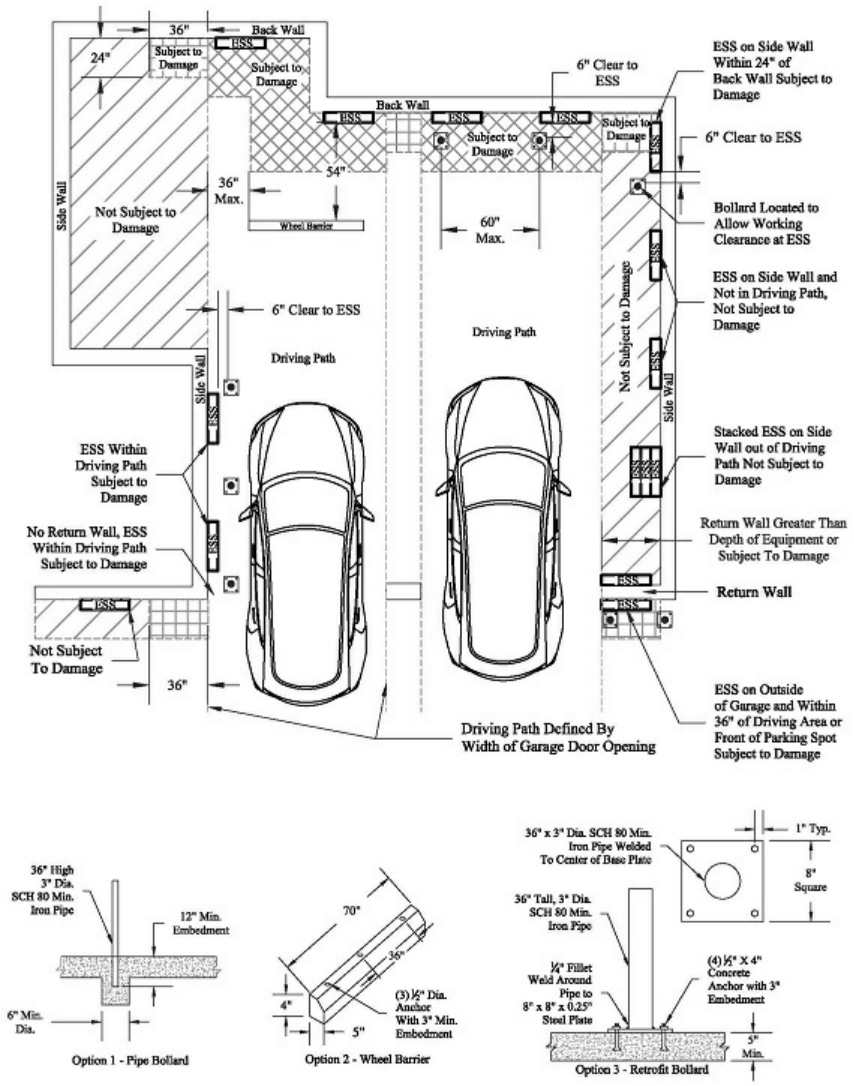

FIGURE 1207.11.7.1 ESS VEHICLE IMPACT PROTECTION

1207.11.7.2 Other locations subject to vehicle impact. Where an ESS is installed in a location other than as defined in Section 1207.11.7.1, and is subject to vehicle damage, impact protection shall be provided in accordance with Section 1207.11.7.3.

1207.11.7.3 Impact Protection Options. Where ESS is required to be protected from impact in accordance with Section 1207.11.7.1 or 1207.11.7.2 such protection shall comply with one of the following:

1. Bollards constructed in accordance with one of the following:
   - 1.1 Minimum 48 inches (1219 mm) in length by 3 inches (76mm) in diameter schedule 80 steel pipe embedded in a concrete pier not less than 12 inches (304 mm) deep and 6 inches (152 mm) in diameter, with at least 36 inches (914 mm) of pipe exposed, filled with concrete, and spaced at a maximum interval of 5 feet (1524 mm). Each bollard shall be located not less than 6 inches (152 mm) from an ESS.
   - 1.2 Minimum 36 inches (914 mm) in height by 3 inches (76 mm) in diameter schedule 80 steel pipe fully welded to a minimum 8 inches (203 mm) by ¼ inch (6.4 mm) thick steel plate and bolted to a concrete floor by means of 4 - ½ inch (13 mm) concrete anchors with 3 inch (76 mm) minimum embedment. Spacing shall be not greater than 60 inches. (1524 mm), and each bollard shall be located not less than 6 inches (152 mm) from the ESS.
   - 1.3 Pre-manufactured steel pipe bollards shall be filled with concrete and anchored in accordance with the manufacturer's installation instructions, with spacing not greater than a 60 inches. (1524 mm). Each bollard shall be located not less than 6 inches (152mm) from the ESS.

2. Wheel barriers constructed in accordance with one of the following:
   2.1. 4 inches(102 mm) in height by 5 inches (127 mm) in width by 70 inches (1778 mm) in length wheel barrier made of concrete or polymer, anchored to the concrete floor not less than every 36 inches (914 mm) and located not less than 54 inches (1372 mm) from the ESS.. Minimum 3) - ½ inch (13 mm) diameter concrete anchors with 3 inch (76 mm) embedment per barrier shall be used. Spacing between barriers shall be no greater than 36 inches. (914 mm).

   2.2. Pre-manufactured wheel barriers shall be anchored in accordance with the manufacturers installation instructions.

3. Approved method designed to resist a 2000 lbf (8899 Newtons) impact in the direction of travel at 24 inches (608 mm) above grade.

Reason: Summary
First, a minor editorial change is n**e**eded to replace stationary storage battery system with ESS . This should have been part of a global change last cycle.

Second, the last sentence referring to appliances has been removed. Section 304.3 is related to the elevation of ignition sources not vehicle impact protection. The concern about raising ignition sources has historically been applied to fuel-fired appliances such as water heaters. These types of appliances are the only equipment able to be listed as flammable vapor ignition resistant. Even when a water heater has not been evaluated to ANSI Z21.10, only the actual ignition source needs to be elevated above 18", not the entire water heater. It's important to note that NFPA 70 does not consider the area below 18" a classified location in above-grade residential garages.

The third and most substantial change addresses the need for a clearly defined area in which a residential garage ESS installation would trigger the "Subject to Vehicle Damage" requirement found in 1207.11.7. The existing language has led to widely varying interpretations and enforcement of impact protection.

- **N**ew language (1207.11.1) has been added to define this area and set the expectation that the barriers are intended to deflect, resist, or visually deter an impact. This language mirrors the existing Section 312.3 in the IFC.
- A minimum installation height of 48" within the likely impact area has been added to allow elevation of the ESS as a permissible mitigation option. An exception to this 48" minimum has been included to recognize that a reduced garage opening height would thereby limit vehicle height and allow a lower placement of equipment before additional protection is needed. This exception is inspired by existing IMC Commentary:

"The height of the vehicle entry opening of the garage or carport can be used as a guide in determining how tall of a vehicle could be driven into the garage or carport"

- A new Figure 1207.11.7.1 has been added to illustrate the zones in which a typical residential garage ESS installation would trigger the need for impact protection. This figure is based on existing IMC commentary related to the installation of fuel-fired appliances that may pose a fire hazard when damaged. The IMC commentary Figure 304.6 (2) has been modified to reflect common ESS installation locations and takes a similar approach to mitigating the risk of impact.
- New language (1207.11.7.2) has been added to address other than garage locations that may also have vehicle access such as residential driveways, and also allows some flexibility to the AHJ and installer for larger, non-typical, or custom residential garages where the normal path of vehicle travel falls outside of the area defined in 1207.11.7.1.

Finally, the prescriptive barrier and post designs per IBC 1607.10 or IFC 312.2 may be appropriate for an energy storage system in a public access parking lot, garage, or other throughway. We are therefore not proposing any changes to 1207.4.5. However, the forces assumed in these sections are not representative of the impact scenarios expected in a private residential garage reserved for permanent occupants.
For example, the calculation in IBC 1607.8.3 results in approx. 12K lb-force applied to the anchorage, which causes readily available bollard to concrete connections to fail. This effectively eliminates the possibility of retrofitting a floor mounted bollard as a solution. Additionally, the posts described in IFC 312.2 can not be reasonably installed in an existing residential garage, and although uncommon especially those with tensioned concrete slabs. This leaves AHJs and installers with no guidelines for a retrofit bollard designed to deter vehicle operators from carelessly striking the ESS units. While IFC Section 312.3 does allow an alternative approach, designers, installers, and code officials will benefit from more explicit guidance within Section 1207.11. In new construction posts designed in accordance with Section 312 may be feasible, however it is unlikely that a homebuilder would be able to anticipate the installation of an ESS in a specific location in a garage. The proposed options for impact protection were inspired by existing IMC commentary figure 304.6(2). These options have been modified to provide a consistent amount of force resistance across the available choices, something teh IMC commentary does not do. These options more reasonably reflect the expected impact scenario described in the commentary text:

"The barriers shown in the commentary figure will not eliminate all possibility of a motor vehicle contacting the appliances but will offer a reasonable warning to a driver who is slowly navigating near the appliances"

And:

"Although this section does not specifically require the impact protection provided to stop any type of vehicle at any speed, the intent is for the impact protection to cause the driver to want to stop vehicle movement out of concern for damage that could be occurring. The choice of the type,

structural capacity and the location of barriers is the responsibility of the designer."

Between limiting the locations that ESS Batteries can be installed, and defining the requirements when impact protection is required, the result will be an improved level of protection from the risk of vehicle impacts, and damage mitigation if incidents do occur.

Technical Justification

An engineering review of the impact protection guidance found across the I-Codes and ASCE 7-16 was completed. Specifically Section 312 of both the prior and existing IFC, Section 4.5.3 of ASCE 7-16, and commentary language and figures associated with Section 304.6 of the IMC.

It is important to recognize that the prescription of the IFC Section 312 for bollards in public driving areas does not lead to a bollard that will resist 12k lbs. as prior editions of the code suggested.. In actual testing ((Harrison (SwRI), Evaluation of collision protection provided by vehicle impact bollards and propane cylinder exchange cabinets 2013)) the static resistance was between 900 lbs. at 36" (2.7k lbs. reaction) and 11k lbs. at 36" (33k lbs. reaction).

ASCE 7-16 specifies vehicle barrier systems must resist 6k lbs. load at between 18" and 27" (9k to 13.5k lbs. reaction) There are no commonly available retrofittable bollards that can do this in an average residential garage without adding thickness to the concrete.

The IMC commentary figure when back calculated sets a bar of physical resistance which seems more appropriate to this risk and allows for solutions that are more practical to apply. For example, the bollard shown in IMC commentary Figure 304.6(2) will take an impact of about 625 lbs. load applied at 24", resulting in a 1250 lb reaction force at the post to base plate connection. Likely outcomes based on this force include:

- No damage at 0.5 mph impact from an average passenger car.
- Bollard would deflect permanently a few inches at a 2 mph collision speed
- Anchor bolts would shear off or blowout at a 5 mph collision speed.

The limitation is mostly the concrete to base plate connection. The IRC requires a 2500-3000 psi mix for garages, and garages are often of stronger mix, especially in freeze prone areas. The average garage concrete slab will fall within these specifications: 2500 - 4000 psi concrete with 5" min thickness. Using 1/2" epoxy anchors this equates to roughly a 2mph impact that could be sustained without significant damage to the bollard. This is aligned with a standard Uline 4.5" bollard with 1/8" wall thickness and a 8x8x3/8" base plate. More strength requires a larger base plate, as the limitation is the connection to the concrete.

The bolt down bollard specified in this proposal will take a 2000 lb impact, 24" off the ground with no damage, given 3000 psi concrete. More than 6" of permanent deflection would require a very significant force, and then only touching the face of the ESS. This seems a reasonable level of protection, and clearance distance.

This proposal was prepared by the Sustainable Energy Action Committee (SEAC), a forum for all stakeholders (including, but not limited to, AHJs, designers, engineers, contractors, first responders, manufacturers, suppliers, utilities, and testing labs) to collaboratively identify and find solutions for issues that affect the installation and use of solar energy systems, energy storage systems, demand response, and energy efficiency. The purpose is to facilitate the deployment and use of affordable, clean and renewable energy in a safe, efficient, and sustainable manner.

All recommendations from SEAC are approved by diverse stakeholders through a consensus process.

Bibliography:
Harrison, O. (2013). Evaluation of Collision Protection provided by vehicle impact bollards and propane cylinder exchange cabinets (Rep. No. 18.19083.01.107.FR1). Southwest Research Institute.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal clarifies and gives more technical rigor to the requirements.