

2021 IBC

No requirements

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Table 1105.4 Incidental Uses in Existing Group I-2 Occupancies

Room or Area	Separation and/or Protection
Stationary storage battery systems having a liquid electrolyte capacity of more than 50 gallons for flooded lead-acid, nickel cadmium or VRLA, or more than 1,000 pounds for lithium-ion and lithium metal polymer used for facility standby power, emergency power or uninterruptable power supplies	2 hours

Section 1207 – Electrical Energy Storage Systems (ESS)

This section applies to lithium-ion batteries exceeding energy capacity of > 20 kWh.

Requires automatic detection, sprinkler suppression, and explosion control.

Section 3203 – High-Piled Combustible Storage - Commodity Classification

Lithium-ion is classified as high hazard.

Chapter 59 - Flammable Solids

Chapter 60 – Pyrophoric Materials

REVIEWED AND DETERMINED TO BE UNCLASSIFIED.
THIS REVIEW DOES NOT CONSTITUTE CLEARANCE
FOR PUBLIC RELEASE.
DERIVATIVE CLASSIFIER: Jessica Covington, SRNS FFE
(NAME/PERSONAL IDENTIFIER AND POSITION TITLE)
DATE: 7/26/2023

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(G32-21 As Submitted, Consent Agenda)

CHAPTER 3 OCCUPANCY CLASSIFICATION AND USE

304.1 Business Group B. Business Group B occupancy includes, among others, the use of a building or structure, or a portion thereof, for office, professional or service-type transactions, including storage of records and accounts. Business occupancies shall include, but not be limited to, the following:

...
Laboratories: testing and research
Lithium-ion or lithium metal battery testing, research and development
...

306.2 Moderate-hazard factory industrial, Group F-1. Factory industrial uses that are not classified as Factory Industrial F-2 Low Hazard shall be classified as F-1 Moderate Hazard and shall include, but not be limited to, the following:

...
Energy storage systems (ESS) in dedicated use buildings
Energy storage systems (ESS) and equipment containing lithium-ion or lithium metal batteries
...
Lithium-ion batteries
...
Vehicles powered by lithium-ion or lithium metal batteries
...

311.2 Moderate-hazard storage, Group S-1. Storage Group S-1 occupancies are buildings occupied for storage uses that are not classified as Group S-2, including, but not limited to, storage of the following:

...
Lithium-ion or lithium Metal batteries
...
Motor vehicle repair garages complying with the maximum allowable quantities of hazardous materials specified in Table 307.1(1) (see Section 406.8)
...
Vehicle repair garages for vehicles powered by lithium-ion or lithium metal batteries

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(F66-21 As Submitted, Consent Agenda)

CHAPTER 9

FIRE PROTECTION AND LIFE SAFETY SYSTEMS SECTION 903 AUTOMATIC SPRINKLER SYSTEMS.

903.1 General. Automatic sprinkler systems shall comply with this section.

903.2.2 Group B. An automatic sprinkler system shall be provided for Group B occupancies as follows:

903.2.2.2 Laboratories; research and development or testing. An automatic sprinkler system shall be installed throughout the fire areas utilized for the research and development or testing of lithium-ion or lithium metal batteries.

903.2.4 Group F-1. An automatic sprinkler system shall be provided throughout all buildings containing a Group F-1 occupancy where one of the following conditions exists:

4. A Group F-1 occupancy used to manufacture lithium-ion or lithium metal batteries.
5. A Group F-1 occupancy used to manufacture vehicles, energy storage systems or equipment containing lithium-ion or lithium metal batteries where the batteries are installed as part of the manufacturing process.

903.2.7 Group M. An automatic sprinkler system shall be provided throughout buildings containing a Group M occupancy where one of the following conditions exists:

903.2.7.3 Lithium-ion or lithium metal battery storage. An automatic sprinkler system shall be provided in a room or space within a Group M occupancy where required for the storage of lithium-ion or lithium metal batteries by Section 322 or Chapter 32 of this code.

903.2.9 Group S-1. An automatic sprinkler system shall be provided throughout all buildings containing a Group S-1 occupancy where one of the following conditions exists:

5. A Group S-1 fire area used for the storage of lithium-ion or lithium metal powered vehicles where the fire area exceeds 500 square feet (46.4 m²)

903.2.9.1 Repair garages. An automatic sprinkler system shall be provided throughout all buildings used as repair garages in accordance with Section 406.8 of the International Building Code, as shown:

5. A Group S-1 fire area used for the repair of vehicles powered by lithium-ion or lithium metal batteries that exceeds 500 square feet (46.4 m²).

(F71-21 as modified by Davidson-1, Consent Agenda)

903.3.1.1 NFPA 13 sprinkler systems. Where the provisions of this code require that a building or portion thereof be equipped throughout with an automatic sprinkler system in accordance with this section, sprinklers shall be installed throughout in accordance with NFPA 13 except as provided in Sections 903.3.1.1.1 and 903.3.1.1.2.

903.3.1.1.3 Lithium-ion or lithium metal batteries. Where automatic sprinkler systems are required by this code for areas containing lithium-ion or lithium metal batteries, the design of the system shall be based upon a series of fire tests conducted or witnessed and reported by an approved testing laboratory involving test scenarios that address the range of variables associated with the intended arrangement of the hazards to be protected.

(F88-21 As Submitted, Consent Agenda)

CHAPTER 9
FIRE PROTECTION AND LIFE SAFETY SYSTEMS SECTION 907 FIRE
ALARM AND DETECTION SYSTEMS.

907.1 General. This section covers the application, installation, performance and maintenance of fire alarm systems and their components in new and existing buildings and structures. The requirements of Section 907.2 are applicable to new buildings and structures. The requirements of Section 907.9 are applicable to existing buildings and structures.

907.2.2 Group B. A manual fire alarm system, which activates the occupant notification system in accordance with Section 907.5, shall be installed in Group B occupancies where one of the following conditions exists:

907.2.2.2 Laboratories; research and development or testing. A fire alarm system activated by an air sampling-type smoke detection system or a radiant energy-sensing detection system shall be installed throughout the entire fire area utilized for the research and development or testing of lithium-ion or lithium metal batteries.

907.2.4 Group F. A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group F occupancies where both of the following conditions exist:

907.2.4.1 Manufacturing involving lithium-ion or lithium metal batteries. A fire alarm system activated by an air sampling-type smoke detection system or a radiant energy-sensing detection system shall be installed throughout the entire fire area where lithium-ion or lithium metal batteries are manufactured; and where the manufacturer of vehicles, energy storage systems or equipment containing lithium-ion or lithium metal batteries where the batteries are installed as part of the manufacturing process.

907.2.7 Group M. Fire alarm systems shall be required in Group M occupancies in accordance with Sections 907.2.7.1 and 907.2.7.2:

907.2.7.2 Storage of lithium-ion or lithium metal batteries. A fire alarm system activated by an air sampling-type smoke detection system or a radiant energy-sensing detection system shall be installed in a room or space within a Group M occupancy where required for the storage of lithium-ion or lithium metal batteries by Section 322.

907.2.10 Group S. A fire alarm system shall be in a Group S occupancy as required by the following sections:

907.2.10.2 Storage of lithium-ion or lithium metal batteries. A fire alarm system activated by an air sampling-type smoke detection system or a radiant energy-sensing detection system shall be installed throughout the entire fire area where required for the storage of lithium-ion batteries or lithium metal batteries By Section 322 of this code.

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(F21-21 as modified by Davidson-3 and Scott-2, Consent Agenda)

105.6.25 Lithium batteries. An operational permit is required for an accumulation of more than 15 cubic feet (0.42 m³) of lithium-ion and lithium metal batteries, where required by Section 322.1.

301.2 Permits. Permits shall be required as set forth in Section 105.5 for the activities or uses regulated by Sections 306, 307, 308, 315, 320 and 322.

SECTION 322 STORAGE OF LITHIUM-ION AND LITHIUM METAL BATTERIES

322.1 General. The storage of lithium-ion and lithium metal batteries shall comply with Section 322.

Exceptions:

1. New or refurbished batteries installed in the equipment, devices, or vehicles they are designed to power.
2. New or refurbished batteries packed for use with the equipment, devices, or vehicles they are designed to power.
3. Batteries in original retail packaging that are rated at 300 watt-hours or less for lithium-ion batteries or contain 25 grams or less of lithium metal for lithium metal batteries.
4. Temporary storage of batteries or battery components during the battery manufacturing process prior to completion of final quality control checks.
5. Temporary storage of batteries during the vehicle manufacturing or repair process.

322.2 Permits. Permits shall be required for an accumulation of more than 15 cubic feet (0.42 m³) of lithium-ion and lithium metal batteries, other than batteries listed in the exceptions to Section 322.1, as set forth in Section 105.6.25

322.3 Fire safety plan. A fire safety plan shall be provided in accordance with Section 403.10.6. In addition, the fire safety plan shall include emergency response actions to be taken upon detection of a fire or possible fire involving lithium-ion or lithium metal battery storage.

322.4 Storage requirements. Lithium-ion and lithium metal batteries shall be stored in accordance with Section 322.4.1, 322.4.2, or 322.4.3, as applicable.

322.4.1 Limited indoor storage in containers. Not more than 15 cubic feet (0.42 m³) of lithium-ion or lithium metal batteries shall be permitted to be stored in containers in accordance with all of the following.

1. Containers shall be open-top and constructed of noncombustible materials or shall be approved for battery collection.

2. Individual containers and groups of containers shall not exceed a capacity of 7.5 cubic feet (0.21 m³).
3. A second container or group of containers shall be separated by not less than 3 feet (914 mm) of open space, or 10 feet (3,048 mm) of space that contains combustible materials.
4. Containers shall be located not less than 5 feet (1,524 mm) from exits or exit access doors.

322.4.2 Indoor storage areas. Indoor storage areas for lithium-ion and lithium metal batteries, other than those complying with Section 322.4.1, shall comply with Sections 322.4.2.1 through 322.4.2.6.

322.4.2.1 Technical opinion and report. A technical opinion and report complying with Section 104.8.2 shall be prepared to evaluate the fire and explosion risks associated with the indoor storage area and to make recommendations for fire and explosion protection. The report shall be submitted to the fire code official and shall require the fire code official's approval prior to issuance of a permit. In addition to the requirements of Section 104.8.2, the technical opinion and report shall specifically evaluate the following:

1. The potential for deflagration of flammable gases released during a thermal runaway event.
2. The basis of design for an automatic sprinkler system or other approved fire suppression system. Such design basis shall reference relevant full-scale fire testing or another approved method of demonstrating sufficiency of the recommended design

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[A] 104.8.2 Technical assistance. *To determine the acceptability of technologies, processes, products, facilities, materials and uses attending the design, operation or use of a building or premises subject to inspection by the fire code official, the fire code official is authorized to require the owner or owner's authorized agent to provide, without charge to the jurisdiction, a technical opinion and report. The opinion and report shall be prepared by a qualified engineer, specialist, laboratory or fire safety specialty organization acceptable to the fire code official and shall analyze the fire safety properties of the design, operation or use of the building or premises and the facilities and appurtenances situated thereon, to recommend necessary changes. The fire code official is authorized to require design submittals to be prepared by, and bear the stamp of, a registered design professional.*

322.4.2.2 Construction requirements. Where indoor storage areas for lithium-ion and lithium metal batteries are located in a building with other uses, battery storage areas shall be separated from the remainder of the building by 2-hour rated fire barriers or horizontal assemblies. Fire barriers shall be constructed in accordance with Section 707 of the International Building Code, and horizontal assemblies shall be constructed in accordance with Section 711 of the International Building Code.

Exceptions:

1. Where battery storage is contained in one or more approved prefabricated portable structures providing a complete 2-hour fire resistance rated enclosure, fire barriers and horizontal assemblies are not required.

2. Where battery storage is limited to new batteries in packaging that has been demonstrated to and approved by the fire code official as sufficient to isolate a fire in packaging to the package interior, fire barriers and horizontal assemblies are not required.

322.4.2.3 Fire protection systems. Indoor storage areas for lithium-ion and lithium metal batteries shall be protected by an automatic sprinkler system complying with Section 903.3.1.1 or an approved alternative fire suppression system. The system design shall be based on recommendations in the approved technical opinion and report required by Section 322.4.2.1.

322.4.2.4 Fire alarm systems. Indoor storage areas for lithium-ion and lithium metal batteries shall be provided with an approved automatic fire detection and alarm system complying with Section 907. The fire detection system shall use air-aspirating smoke detection, radiant energy-sensing fire detection, or both.

322.4.2.5 Explosion control. Where the approved technical opinion and report required by Section 321.4.2.1 recommends explosion control, explosion control complying with Section 911 shall be provided.

322.4.2.6 Reduced requirements for storage of partially charged batteries. Indoor storage areas for lithium-ion and lithium metal batteries with a demonstrated state of charge not exceeding 30 percent shall not be required to comply with Sections 322.4.2.1, 322.4.2.2, or 322.4.2.5, provided that procedures for limiting and verifying that the state of charge will not exceed 30 percent have been approved.

322.4.3 Outdoor Storage. Outdoor storage of lithium-ion or lithium metal batteries shall comply with Sections 321.4.3.1 through 321.4.3.3.

322.4.3.1 Distance from storage to exposures. Outdoor storage of lithium-ion or lithium metal batteries, including storage beneath weather protection in accordance with Section 414.6.1 of the International Building Code, shall comply with one of the following.

1. Battery storage shall be located not less than 20 feet (6,096 mm) from any building, lot line, public street, public alley, public way or means of egress.
2. Battery storage shall be located not less than 3 feet (914mm) from any building, lot line, public street, public alley, public way or means of egress, where the battery storage is separated by a 2-hour fire-resistance rated assembly without openings or penetrations and extending 5 feet (1,524 mm) above and to the sides of the battery storage area.
3. Battery storage shall be located not less than 3 feet (914 mm) from any building, lot line, public street, public alley, public way or means of egress, where batteries are contained in approved prefabricated portable structures providing a complete 2-hour fire-resistance rated enclosure.

322.4.3.2 Storage area size limits and separation. Outdoor storage areas for lithium-ion or lithium metal batteries, including storage beneath weather-protection in accordance with Section 414.6.1 of the International Building Code, shall not exceed 900 sq. ft (83.6 m²). The height of battery storage in such areas shall not exceed 10 feet (3,048 mm). Multiple battery storage areas shall be separated from each other by not less than 10 feet (3,048 mm) of open space.

322.4.3.3 Fire detection. Outdoor storage areas for lithium-ion or lithium metal batteries, regardless of whether such areas are open, under weather protection or in a prefabricated portable structure, shall be provided with an approved automatic fire detection and alarm system complying with Section 907. The fire detection system shall use radiant energy-sensing fire detection.

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[F] 414.6 Outdoor storage, dispensing and use. *The outdoor storage, dispensing and use of hazardous materials shall be in accordance with the International Fire Code.*

[F] 414.6.1 Weather protection. *Where weather protection is provided for sheltering outdoor hazardous material storage or use areas, such areas shall be considered outdoor storage or use where the weather protection structure complies with Sections 414.6.1.1 through 414.6.1.3.*

[F] 414.6.1.1 Walls. *Walls shall not obstruct more than one side of the structure.*

Exception: *Walls shall be permitted to obstruct portions of multiple sides of the structure, provided that the obstructed area is not greater than 25 percent of the structure's perimeter.*

[F] 414.6.1.2 Separation distance. *The distance from the structure to buildings, lot lines, public ways or means of egress to a public way shall be not less than the distance required for an outside hazardous material storage or use area without weather protection.*

[F] 414.6.1.3 Noncombustible construction. *The overhead structure shall be of approved noncombustible construction with a maximum area of 1,500 square feet (140 m²).*

Exception: *The maximum area is permitted to be increased as provided by Section 506.*

403.10.6 Buildings with lithium-ion or lithium metal battery storage. An approved fire safety plan in accordance with Section 404 shall be prepared and maintained for buildings with lithium-ion or lithium metal battery storage.

(Correlation Committee will correlate this with results of F28-21)

(F25-21 As modified by PC-1, OGCV Approved)**POWERED MICROMOBILITY DEVICES.**

Motorized bicycles, motorized scooters and other personal mobility devices powered by a lithium-ion or lithium metal battery. The term does not include motor vehicles that are required to be registered with the Department of Motor Vehicles for the state or jurisdiction

**SECTION 323
POWERED MICROMOBILITY DEVICES****323.1 General.**

Lithium-ion and lithium metal battery powered micromobility devices shall be operated and maintained in accordance with this section.

Exceptions:

1. Storage, repair and charging in residential occupancies of battery powered mobility devices , provided that such devices are for personal use by its owner.
2. Charging of a single powered mobility device in any occupancy by its owner.

323.1.1 Prohibited locations.

The use of a residential occupancy as a business for the charging of commercially owned powered mobility devices as part of a rental or sales service shall not be permitted.

323.2 Battery chargers and equipment.

Powered micromobility devices shall be charged in accordance with their listing and the manufacturer's instructions using only the original equipment manufacturer-supplied charging equipment or charging equipment in accordance with the listing and manufacturer's instructions.

323.3 Listing.

Powered micromobility devices shall be listed and labeled in accordance with UL 2272 or UL 2849, as applicable.

323.4 Battery charging areas.

Where approved, powered micromobility devices shall permitted to be charged in a room or area that complies with all of the following:

1. Only listed devices utilizing listed charging equipment shall be permitted to be charged.
2. Is provided with sufficient electrical receptacles to allow the charging equipment for each device to be directly connected to a receptacle. Extension cords and relocatable power taps shall not be used.
3. Storage of combustible materials, combustible waste or hazardous materials shall not be permitted.
4. The charging operation shall not be conducted in or obstruct any required means of egress.
5. Removable storage batteries shall not be stacked or charged in an enclosed cabinet unless the cabinet is specially designed and approved for such purpose.

6. A minimum distance of 18 inches (457.2 mm) shall be maintained between each removable storage battery during charging operations unless each battery is isolated from neighboring batteries by an approved fire-resistant material.

7. A minimum of 18 inches (457.2 mm) shall be maintained between the locations of the batteries on each powered micromobility devices during charging operations.

8. The indoor room or area shall be protected by a fire alarm system utilizing air-aspirating smoke detectors or radiant energy-sensing fire detection.

323.5 Fire safety plan.

A fire safety plan shall be provided in accordance with Section 403.10.6. In addition, the fire safety plan shall include emergency response actions to be taken upon detection of a fire or possible fire involving lithium-ion or lithium metal battery storage.

CHAPTER 80**REFERENCED STANDARDS**

UL Underwriters Laboratories LLC
333 Pfingsten Road
Northbrook, IL 60062

UL 2272-2016 Electrical Systems for Personal E-Mobility Devices

UL 2849-2020 Electrical Systems for eBikes

(F28-21 As modified by Davidson-2 OGCV Approved)**403.10.6 Lithium-ion and lithium metal batteries.**

An approved fire safety and evacuation plan in accordance with Section 404 shall be prepared and maintained for occupancies that involve activities for the research and development, testing, manufacturing, handling, storage of lithium-ion batteries or lithium metal batteries or the repair or servicing of vehicles powered by lithium-ion batteries or lithium metal batteries.

Exceptions. A fire safety and evacuation plan is not required for the storage or merchandizing of any of the following:

1. New or refurbished batteries installed for use in the equipment or vehicles they are designed to power
2. New or refurbished batteries packed for use with the equipment or vehicles they are designed to power for merchandizing purposes;
3. New or refurbished lithium-ion batteries rated at no more than 300 Watt-hours and lithium metal batteries containing no more than 25 grams of lithium metal in their original retail packaging;
4. The storage, repair and charging activities in detached one- and two-family dwellings and

townhouses, provided that such devices are for personal use.

5. The storage, repair and charging activities associated with personal use in sleeping units and dwelling units of Group R-1 and R-2 occupancies.

403.10.6.1 Mitigation planning.

The approved fire safety and evacuation plan shall include thermal runaway event mitigation measures addressing activities undertaken to prevent thermal runaway, early detection of a thermal runaway event and mitigations measures to be undertaken to limit the size and impact of the event on occupants and the facility.

(F121-21 As Submitted, Consent Agenda)

SECTION 1107

ENERGY STORAGE SYSTEMS

1107.1 Lithium-ion technology energy storage systems. The owner of an energy storage system (ESS) utilizing lithium-ion battery technology having capacities exceeding the values in Table 1207.1.1 and that was installed prior to the jurisdiction's adoption of the 2018 or later edition of the International Fire Code shall provide the fire code official a failure modes and effects analysis (FMEA) or other approved hazard mitigation analysis in accordance with Section 104.8.2 for review and approval.

Exception: Detached one- and two-family dwellings and townhouses.

1107.1.1 Early detection. In addition to the requirements of Section 1207.1.4.1 and 1207.1.4.2, the analysis shall include an assessment of the ability of the installed protection systems to provide for early detection and notification of a thermal runaway event in relation to the ability of emergency responders to safely mitigate the size and impact of a thermal runaway event.

1107.1.2 Corrective action plan. Where hazards are identified by the analysis, a plan that includes a timetable for corrective action shall be submitted to the fire code official for review and approval. The plan shall include actions and system improvements necessary for eliminating or mitigating any identified hazards, including listed methods for early detection and notification of a thermal runaway event.

Chapter 12

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. Energy storage systems regulated by Section 1207 shall comply with this chapter as appropriate and NFPA 855.

Added lithium-ion to Chapter 32 in the 2021 International Fire Code

CHAPTER 32
HIGH-PILED COMBUSTIBLE STORAGESECTION 3203 COMMODITY
CLASSIFICATION

3203.6 High-hazard commodities. High-hazard commodities are products presenting special fire hazards beyond those of Class I, II, III or IV. Group A plastics not otherwise classified are included in this class.

TABLE
3203.8
EXAMPLES OF COMMODITY CLASSIFICATION

Batteries	Lithium-ion	High-hazard
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HIGH-PILED COMBUSTIBLE STORAGE. Storage of combustible materials in closely packed piles or combustible materials on pallets, in racks or on shelves where the top of storage is greater than 12 feet (3,658 mm) in height. Where required by the *fire code official*, *high-piled combustible storage* also includes certain high-hazard commodities, such as rubber tires, Group A plastics, *flammable liquids*, idle pallets and similar commodities, where the top of storage is greater than 6 feet (1,829 mm) in height.

HIGH-PILED STORAGE AREA. An area within a building which is designated, intended, proposed or actually used for *high-piled combustible storage*, including operating aisles.

Code citations curtesy of:

Robert J Davidson – Code Consultant, 311 Camperdown Court, Easley, SC 29642