

7x24 Exchange NW Chapter

Code Update: 2021 Fire Code Changes for Electrical Energy Storage Systems

June 21, 2022

Presented by Leonard A. Ruff, AIA, NCARB

Cascade Mission Critical, LLC



CASCADE MISSION CRITICAL, LLC

Data Center Consulting

- Legal Notice

This presentation is intended to provide a general, high level overview of recent code changes in the 2021 code cycle related to data center design and construction and is not to be construed as an exhaustive explanation of all code revisions. Cascade Mission Critical, LLC assumes no liability for the information given herein or action taken upon the summaries presented. Local codes may vary by jurisdiction. Before proceeding with any project impacted by the referenced codes, users must consult with their respective design or code professionals for any interpretations of the codes and impacts on any project.



- What is the ICC?

- The International Code Council publishes model codes for authorities all across the country and internationally for use by local jurisdictions to create a safe building environment.

- What Codes are Published?

- IBC: International Building Code
- IFC: International Fire Code
- IMC: International Mechanical Code
- IECC: International Energy Conservation Code
- IRC: International Residential Code
- IEBC: International Existing Building Code
- Plus many others.



- How often are the Codes Updated?

- 3 year Review and Modification Schedule for ICC Codes
- Other Codes may have different update schedules

- How do the Codes get put into place?

- Each State adopts a model family of codes by law, with amendments if deemed necessary.
- Once adopted by the State then local jurisdictions, i.e., counties or municipalities, can adopt the State Code, with amendments if deemed necessary.
- In Washington, you get the Washington Building Code, King County Building Code, Seattle Building Code, etc.
- **Critical** to understand both regional and local code requirements, as they can vary from the model codes and by individual jurisdiction, even in the same state.
- 2021 Codes are expected to be adopted by Washington 2023.



Chapter 12: Energy Systems

• Electrical Energy Storage Systems (ESS)-Now Section 1207

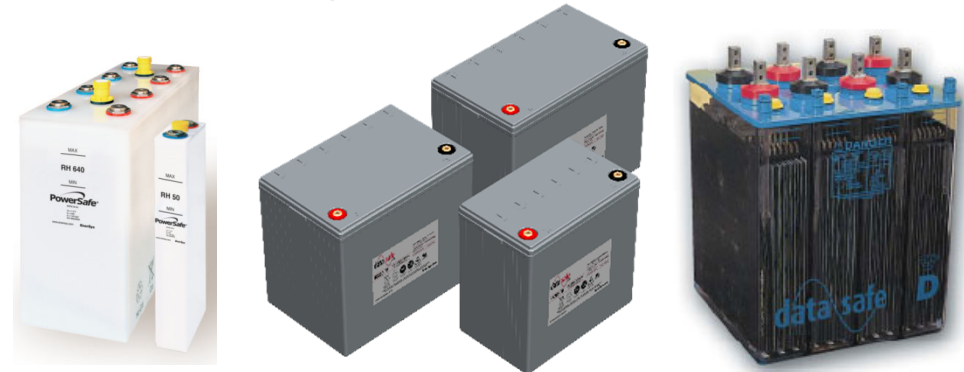
- New Requirements for Construction Documents
- Detailed Requirements for Commissioning and Decommissioning
- Changes to UL Listing Requirements
- Changes to Sizing and Separation of Battery Units
- Changes to Building Requirements for areas containing ESS
- Standby power required for mechanical ventilation of ESS
- Expanded requirements for Outdoor Installations
- New requirements for Special Installations
- New requirements for Mobile ESS
- New requirements for ESS in Residential Occupancies



• Table 1207.1.1: Energy Storage System (ESS) Threshold Quantities

Technology	Maximum Allowable Quantity
Capacitor ESS	3 kWh
Flow Batteries	20 kWh
Lead Acid Batteries	70 kWh
Lithium-Ion Batteries	20 kWh
Nickel Cadmium Batteries	70 kWh
Other Battery Technologies	10 kWh
Other Electrochemical ESS technologies	3 kWh

- Defines Threshold Quantities for different materials
- Amounts greater than those listed are subject to the applicable parts of Section 1207
- Note that amounts have not changed, but new line items for Capacitor ESS and other ESS technologies added



Images Courtesy of EnerSys

- Understanding Code defined “Energy Capacity” vs. “Design Capacity”

- Code requires the Energy Capacity to be used as the total available energy in the ESS. For batteries, this is calculated by the module rated amp-hours times the voltage, divided by 1,000. This value will be much greater than the Design Energy Capacity that cuts off at a low voltage set point.

- **Impacts**

- Total battery energy must be verified early in the design process with the proposed manufacturers for the battery type and installation.
- A detailed code analysis of each installation should be performed to ensure code compliance for initial and ultimate installations.



- Separation Requirements

- For Rooms exceeding threshold amounts of ESS per Table 1207.1.1, Compliance with IBC Section 509 is no longer required

- Impacts

- Battery Rooms are no longer classified as “Incidental Use Areas”, therefore the 10% floor area limitation is not mandated.
- Battery Rooms or the areas containing the batteries must now be separated by a 2-Hour fire barrier from other areas, instead of 1-Hour fire barrier under previous code.



- **Construction Documents**

- Must submit a Commissioning Plan as well as a Decommissioning Plan
- Code now lists very detailed requirements for Commissioning Plans, Decommissioning Plans, Testing and Reports, and Operations and Maintenance procedures

- **Impacts**

- Many owners have not created specific Decommissioning Plans
- Check with battery vendors to see if sample Decom plans area available
- Start development of Decom plans to be ready for next submittal



- Listing

- All ESS shall be listed in accordance with UL 9540, except for lead acid and nickel-cadmium battery systems installed under exclusive control of communications utilities and operating less than 50 VAC and 60 VDC.
- Listing exception for lead acid batteries has been deleted

- Impacts

- Installations of VRLA battery systems must now comply with UL 9540.
- Status of UL 9540 listing for VRLA systems is not widely available
- Building codes and fire codes may require UL9540, but the UL standard itself is not in agreement:
 - *From UL 9540 1.5: Systems using lead acid or Ni-cad batteries that fall within the scope of UL 1778 and only serve an uninterruptible power system (UPS) application are outside the scope of this standard.*



• Table 1207.5: Maximum Allowable Quantities of Electrochemical ESS

Technology	Maximum Allowable Quantities
Storage Batteries	
Flow Batteries	600 kWh
Lead Acid, All Types	Unlimited
Lithium-Ion	600 kWh
Nickel Metal Hydride	Unlimited
Nickel Cadmium	Unlimited
Other Battery Technologies	200 kWh
Capacitors	
All Types	20 kWh
Other Electrochemical ESS	
All Types	20 kWh

- Defines Maximum Quantities for different materials
- Use of amounts greater than listed must comply with 1207.5.2: Generally means a Hazard Mitigation Analysis along with full scale UL 9540a fire testing will be required.
- Listing of Group H Occupancy deleted. Now rooms or areas exceeding the amounts listed must be separated by other areas by a 2-hour fire barrier. Group H Occupancy is no longer required.
- Also note that the IBC 509 Incidental Use area limitation is no longer required.



- **Size and Separation**

- Electrochemical ESS shall be segregated into groups not exceeding 50 kWh.
- Each group shall be separated from other groups and walls by 3 feet.
- Lead Acid batteries are no longer exempted from this requirement.
- Fire Code Official may approve larger groups and smaller spacing if UL 9540a large scale fire test is submitted.

- **Impacts**

- VRLA battery manufacturers have not yet completed UL 9540a large scale fire testing. Some may be in progress.
- If use of VRLA batteries is desired, the rooms or areas will need to account for the limits on grouping and minimum spacing requirements.
- **Note that some jurisdictions will explicitly not accept a UL 9540a test as justification for increasing the group size or decreasing the spacing requirements!!**



- Electrochemical ESS Technology Specific Requirements

Compliance Required		Battery Technology				Other ESS and Battery Technologies	Capacitor ESS
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	Yes	Yes	No	Yes	Yes
Safety Caps	1207.6.4	Yes	Yes	No	No	Yes	Yes
Spill Control and Neutralization	1207.6.2	Yes	Yes	No	Yes	Yes	Yes
Thermal Runaway	1207.6.5	Yes	Yes	Yes	No	Yes	Yes



- ESS Technology Specific Requirements

- Need to carefully evaluate what has changed for the specific ESS to be used
- Mechanical ventilation must now be provided with a minimum of 2 hours standby power
- Explosion control is a new requirement-see exceptions

- Impacts

- Explosion control may be waived by Fire Code Official if:
 - Large scale fire testing (UL 9540a) shows that batteries do not liberate flammable gases, or
 - A Hazardous Mitigation Analysis documents that the ESS does not have the potential to release flammable gas concentrations in excess of 25% of the LFL anywhere in the room or area.
 - Design issues must be addressed early in the process with the local Fire Code Official.



- Fire Resistance Rated Separations

- Rooms or areas containing ESS shall include fire resistance rated separations as follows:
 - In dedicated use buildings, separated from administrative and support personnel areas
 - In non dedicated use buildings, separated from all other areas in the building
- Separation shall be provided by 2-hour fire barriers in accordance with Section 707 of the IBC.

- Impacts

- Good News: Incidental Use Area designation with 10% area limitation no longer applies.
- No so Bad News: Separation goes up from 1-hour to 2-hour. Readily achievable with standard gypsum wall construction.



- **New Detailed Requirements for other Types of ESS Installations**

- **1207.8: Outdoor Installations**
 - Remote outdoor installations, installations near exposures
 - Exterior wall installations
- **1207.9: Special Installations**
 - Roof top and open parking garages
- **1207.10: Mobile ESS Equipment and Operations**
 - Charging and Storage
 - Deployed Mobile ESS
- **1207.11: ESS in Residential Occupancies**
 - Covers R-3 and R-4 Occupancies



Questions?

Presented by Leonard A. Ruff, AIA, NCARB

Cascade Mission Critical, LLC

leonard.ruff@casademissioncritical.com

206-294-1288



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