

Eaton's Lithium ion UPS battery Q&A

This document will serve as a guide for Eaton salespersons, sales support personnel, engineering clients, and end users who have questions regarding the lithium battery cabinets used with Eaton UPS systems.

General FAQs

1) Which vendors do we offer?

- a. Samsung cabinets containing 128 or 136 battery cells (16 or 17 battery modules).
- b. LG Chem cabinets populated with a single string or a double string of battery modules.

2) Which Eaton UPS products can use lithium ion batteries?

- a. The 9395/9395P/9395C and all 93PM products are approved for lithium batteries.
 - i. *NOTE the 93PM with Samsung batteries uses only the Samsung 128 model, not the 136 version.*

3) What are the major differences between each manufacturer's product

- a. Capacity (kWh) 32.6 for Samsung 128S, 34.6 for the 136S and 28 for a double string from LG
- b. LG offers 2 strings, 14 kWh each, in a single cabinet, allowing for single string configurations which works nicely with UPS products rated less than 100 kW
- c. Samsung has been evaluated to Seismic Zone 3 for the original (white) cabinet, and Zone 4 for the UL9540A (Black) cabinet.
- d. LG has been evaluated to Seismic Zone 4
- e. Samsung requires a 3 phase 400-480Vac power source, 'Ups protected' for the BMS. UL9540A (Black) cabinets should be selected with a 1-phase 120/240VAC protected power source for use with a 208VAC UPS.
- f. LG Chem requires 1x 120-240Vac single phase 'UPS protected' power source for the BMS

4) Are we looking at additional vendors for lithium ion products?

- a. Yes, and evaluations are underway

5) Are they safe?

- a. We are comfortable and confident that all the vendors' products we offer are safe, when used with our UPS, installed per the manufacturer's recommendations, and when their environmental requirements are observed
- b. The battery management system (BMS) is one component which ensures the safe operation of the battery, by monitoring temperature, voltage balance, etc., and it has the ability to disconnect the battery string if conditions warrant. The other component is the design of the battery cells and battery modules.
 - i. All of our vendors comply with UL1642 (Battery cell safety); UL1973 (Battery module/cabinet safety). The BMS complies with UL1973 which pulls in UL991 and UL1998 (Software safety) as appropriate

6) How is thermal runaway detected and mitigated?

- a. The BMS and battery module construction handles the detection and mitigation and meets code requirements. The BMS can disconnect the string via shunt tripping the cabinet breaker.

7) How long do we expect the batteries to last in a UPS application?

- a. Both vendors expect 10-15-year float service life like we utilize in our UPS equipment. Both vendors offer a 3-year defect warranty and a Performance warranty of 10 years.

8) What is the vendor's warranty?

- a. Each vendor's warranty document is slightly differently worded, but, they each provide: 3 years full parts warranty, and a 10 year "Performance Warranty" on the lithium battery's ability to provide rated capacity.
- b. Administration of the vendor's warranty will be identical to what we now do for VRLA

9) What is a performance warranty?

- a. The vendor warrants that when the battery is installed per vendor's instructions, operated within vendors environmental guidelines, and charged by the UPS as specified, the battery system will provide at least 78-80% of its initial capacity at the 10-year mark. If the battery or string fails to provide that capacity, it will be replaced at no charge. Labor is not covered, but a labor charge can be added to a battery system quote.
- b. The battery must be operated within the environmental specifications and cycle life limits set by the battery vendor. Data recordkeeping is the responsibility of the user (like VRLA). If the evidence indicates that the battery has been misused:
 - i. Samsung may cancel the 10-year warranty
 - ii. LG Chem decrements the warranty coverage time length, depending on the degree of misuse (temperature and/or cycle count)

10) Can we supply copies of each vendor's warranty document?

- a. Yes. For now, access this through the DCCG group in Raleigh only with quotations or sales.

11) How are the batteries shipped? Can they be air shipped?

- a. We will ship battery cabinet systems by ground. Individual replacement batteries may be air shipped.
- b. Refrigerated ground shipment is not required for either vendor
- c. Shipments must be in accordance with UN38.3 requirements. All shippers must be trained on Class 9 shipment of hazardous goods. These requirements involve specific packaging, labeling of said packaging, and accompanying paperwork. Trucker and the truck must be certified with proper signage.
- d. Batteries for air shipment must not exceed 30% state of charge (SoC). We will ship all lithium batteries at 30% SoC, whether ground or air shipment.
- e. It will require about 4 hours of charge time to bring the newly replaced battery up to full charge
- f. Battery cabinet systems are shipped disassembled. All assembly and start-up/commissioning activities are included in our pricing.

12) What are lead times?

- a. 4 to 6 weeks from stock (systems must be kitted prior to shipment)

13) Can they be recycled?

- a. Yes, using the same processes and vendors that we offer on our <http://www.Eaton.com/batteryrecycle> website
- b. Alternatively, some battery vendors, and some 3rd parties will recommend that, rather than recycling, the used batteries should be shipped to them, where they will be refurbished and reused in a 'second life application', where they may be in service for an additional 5-6 years before finally reaching their end of life. While few of these organizations exist today, it is likely that many battery re-use entities will enter the market over the initial 10-year life of a UPS lithium ion battery.

14) How long can lithium ion batteries be stored without recharging?

- a. If the battery modules are connected together, i.e. installed in a cabinet, the storage times are 6 months at 25 degrees C. This is due to parasitic losses from the BMS.
- b. If the battery modules are NOT connected together (either power or communication connections), then the storage times are 1 year at 25 degrees C.
 - i. Note Samsung requires a 'voltage check' of the batteries every 180 days during storage.

Installation FAQs

1) Which codes apply for lithium ion battery installations?

- a. *It is important to note that Eaton should not be the official source for these answers. Legal liabilities preclude our ability to act as the authority on any of this information. Clients are responsible for interpretation and compliance to the appropriate local codes. However, we do want to provide general information on what clients should be aware of*

prior to the sale of lithium ion battery systems. Both national and local codes could apply, and various codes may exceed or supersede our generic interpretations. We have included a section in this document which describes which entity; the UPS vendor, or the site or owner personnel has the ultimate responsibility for code compliance.

- b. Codes that may apply are, but not limited to:
 - i. NFPA 1, section 52.3
 - ii. IFC 1206 2018 edition, formerly section 608 in previous editions. Note that municipalities may not currently have adopted, or even plan to adopt these requirements in the immediate future.
 - iii. NFPA 855 (this will become Article 855 in the 2020 edition of the NEC)
 - iv. California Fire Code: "Blue" supplements, applicable July 2018
- c. The requirements and wording in all the above codes are similar.

2) What UL listings do our battery offerings carry?

- a. UL 1642 for the batteries
- b. UL 1973 for battery modules and systems
- c. UL 1998 for the BMS (part of UL 1973 testing)
- d. UL 9540A testing complete; for Samsung black cabinets (Note: 9540A is a test method, not a 'listing'). We have copies of the UL 9540A test report available on request for evaluation by the client or their AHJ.
 - i. UL 9540A Testing is underway at LG Chem. Samsung has completed this testing and the test report is available from Eaton. Availability of UL9540A tested Samsung cabinets is February 2020.

3) Are there Building Code (IBC) considerations for lithium battery installations?

- a. Room location: Not greater than 75' above or 30' below the lowest fire department access level unless successful UL9540A testing and FMEA analysis convinces AHJ to approve.
- b. Seismic: Must comply with IBC Section 16, which describes the building structure, not the battery cabinet, but
 - i. Samsung has been evaluated to seismic Zone 4 with their latest (black) cabinets, available February 2020.
 - ii. LG Chem has been evaluated to seismic Zone 4
- c. Ventilation: The below is not different than that which is required for VRLA installations.
 - i. Maximum gassing is limited to <25% of the lower flammability limit (LFL) of that gas.
 - ii. May require room ventilation or fans which must be remotely monitored
 - iii. Smoke detectors are required.
 - iv. Gas detectors that can automatically start the room fans are required.

4) What size battery systems must comply with the fire code?

- a. Any battery 'system' with capacity greater than 20 kWh must comply with applicable sections of the fire code. Samsung single cabinet is 33 kWh, LG single cabinet is 28 kWh if both strings are present. So, a half-cabinet LG system is only 14 kWh, and technically does not need to comply. That does not mean we can make a system with multiple half-cabinets and avoid the requirements as there are maximum room/building capacities as well.

5) What is a 'battery array' as referenced in IFC 1206 and NFPA 855?

- a. An 'array' cannot be larger than 50 kWh. Both Samsung and dual-string LG Chem cabinets are considered to be 'arrays'. But if more than 1 of those cabinets are paralleled, it is then the kWh is too large to be a single 'array'. EXCEPTION: a dual string LG, in parallel with a single string LG (total 42 kWh), is still considered a single array, even though it comprises 2 cabinets.

6) Cabinet (array) spacing. What is required?

- a. ***If** the user has adopted the latest fire code IFC1206 or NFPA 855, the below will apply.*

- b. Battery arrays (i.e. each cabinet) must be spaced 3' apart on all sides from each other and from the walls. That's 64 sq ft of floorspace, per cabinet.
 - c. EXCEPTION to the above, for arrays tested to UL9540A. In which case the AHJ can review and accept the test results and can allow that the side and rear spacing is NOT required; only 36" at the front of the cabinet.
- 7) **Can these limits be exceeded if the system is accompanied by special failure analysis and lab testing?**
- a. Yes, if the Authority Having Jurisdiction (AHJ, or electrical/building inspector) approves the analysis and data. Note that the AHJ may be reticent to approve a non-code installation for this relatively new battery application and chemistry.
 - b. A successful 9540A test and our available test report, is likely to be approved by the AHJ.
- 8) **What is the electrolyte weight of Eaton's lithium cabinet systems?**
- a. Samsung 136 is ~120 lbs. per cabinet
 - b. Samsung 128 is ~113 lbs. per cabinet
 - c. LG Chem is ~102 lbs. of electrolyte per cabinet (full cabinet).
 - d. LG Chem half-cabinet is ~51 lbs. of electrolyte
- 9) **Why is electrolyte weight important?**
- a. Building Codes require the room to become 'incidental occupancy' with 1-hour separation rating for the lithium ion/UPS battery room, if total electrolyte weight is >1000 lbs. The battery room shall not be more than 10% of the total building area, in the story they are located. See weights above for Samsung and LG Chem.
- 10) **What are the Maximum Allowable Quantities (MAQ) referenced in IFC 1206 and NFPA 855?**
- a. MAQ for lithium batteries in a room is 600 kWh. If the amount of lithium battery capacity in the room exceeds the MAQ, then 'Hazardous Class H-2' room construction is required. This means the room must meet stricter fire rating and other fire and building code requirements. These limits may be waived by the AHJ, but they will need to see the UL9540A test report.
- 11) **Is a BMS required by code?**
- a. Yes, and it must be listed to UL1973. All Eaton-supplied cabinets are listed.
- 12) **What should we know about fire detection and suppression?**
- a. Smoke detectors are required, just like for VRLA.
 - b. Sprinkler systems (water) are required, as per IFC Sec. 903.3.1.1
 - c. 'Clean gaseous' agents like Novec 1230, FM200, and CO2 systems may be used, but due to their expense, are typically recommended for rooms where water would significantly damage other electrical equipment in the same room such as switchgear or IT equipment.
 - d. ABC type fire extinguishers are OK if the fire has NOT 'originated in or spread to', the battery itself. This does not replace the requirement for water sprinkler systems.
 - e. Water may be also used to cool the battery and other systems in the same room during a fire.
 - f. Use the battery vendor's Safety Data Sheets (SDS) to access instructions for fire suppression.
- 13) **Signage on the battery cabinets**
- a. Eaton-supplied battery cabinets contain the correct signage, including nameplates, per the code
 - b. Note: other room signage is the responsibility of the site or owner.
- 14) **Can lithium batteries ship internal to the battery cabinet?**
- a. Not yet, for either vendor
- 15) **Why is the Conduit Landing assembly required?**
- a. Conduit landing provisions are required by code in the US and Canada. Cable may not 'waterfall' into the cabinet from above tray, for example.

- b. The Conduit landing assembly must be affixed to the cabinet onsite. Instructions are provided. Total cabinet height would be an issue otherwise.

16) Can copies of Installation and Operators' Manuals be provided in advance?

- a. Yes, for sales support... However, they may not be shared. The vendors' intent is that the user utilizes only the up-to-date manuals that ship with their cabinets.
- b. Eaton's customer installation drawings can be shared at any time. They are posted for both vendors on the SalesWeb.
- c. Eaton's Guide Form specifications can be shared at any time. Guide specs and Eaton customer drawings for both vendors are available on the SalesWeb.

Operational FAQs

1) Can the battery be tested for runtime?

- a. Yes, allow at least 4 hours for charging prior to a discharge test, assuming the batteries are at least 30% state of charge when installed with the UPS.

2) What are the BTUh numbers when float charging?

- a. See the Eaton customer drawings for BTUh levels. This heat is negligible.

3) What are the BTUh levels during discharge?

- a. Worst case, 8900 BTUh for Samsung, and only during the duration of the discharge
- b. We do not have this value for LG Chem, but it is expected to be similar.

4) How long does it take to return the battery to 90% capacity after a discharge?

- a. At the vendor-specified recharge currents, it should take no more than 4 hours.

5) Should recharging be delayed after a full discharge?

- a. No. We have limited the charge current per cabinet to a level that will not add internal heating to the battery, thus we can begin recharging immediately upon return of input power.

6) Can the battery cabinet communicate over the network?

- a. Yes, both vendors communicate by Modbus TCP. The customer's connection is via a TCP/IP (RJ45) connector from the bank battery BMS module, on either vendor's cabinet/system.
- b. NOTE: no alarm history is provided. Information is real time, unless the user creates an external logging program.

7) How does the lithium Battery Management System (BMS) compare with a traditional Battery Monitoring System (also BMS), like Cellwatch, for example?

- a. Lithium battery management systems and battery monitoring systems like Cellwatch and BTech have the following similarities:
 - i. Both monitor individual battery voltages and string currents
 - ii. Both provide instantaneous status of individual batteries
 - iii. Both (can) monitor battery terminal temperature and cabinet ambient temperature and can warn of possible thermal runaway conditions
- b. Lithium battery management systems differ from Cellwatch/Btech, in the below capabilities:
 - i. Lithium Management systems 'manage' the battery and can take action independently of customer interaction. For example, the BMS can disconnect the entire lithium battery string (cabinet) from the UPS if determined to be necessary and can do this without the client's permission or acknowledgement.
 - ii. Lithium BMS systems also track and manage individual pack DC voltage balance to limit potential for development of thermal issues.
 - iii. Lithium BMSs lack a user-friendly HMI interface/display. Modbus information to the site's Building Management System (also called BMS) has to suffice.
 - iv. Lithium BMS tracks voltage, current, temperature, balance voltages constantly for every battery. It communicates status changes and alarms immediately to the

UPS, which can then send this info onto the client's network via the PXGX card.
But the information history is not logged in the lithium BMS.

- 8) **Will be cabinets eventually be connect-able to PredictPulse?**
 - a. Yes, with all pertinent information and data monitored and logged
- 9) **Is user monitoring software available?**
 - a. No, clients must use Modbus TCP which is built-in for both vendors

Service-related FAQs

- 1) **What does the user do if a battery fails in the field?**
 - a. Call Eaton's field service dispatch 1-800-843-9433, same as for VRLA
- 2) **What parts of the installation is handled by the Eaton CSE vs. the electrical contractor?**
 - a. Contractor places the empty cabinets
 - b. Contractor secures the battery cabinet to the floor of the building following the installation manual
 - c. Contractor installs the conduit landing kit
 - d. Contractor runs wire and conduit for control power (100-120VAC for LG, 480V 3W+G for Samsung).
 - e. Contractor installs and connects all power and control wiring between the battery cabinets and the UPS
 - f. Eaton CSE installs the battery modules in each cabinet, and connects the power and communication cabling internal to the cabinet
 - g. Eaton CSE performs the battery cabinet software setup and commissioning
- 3) **How frequently are Preventative Maintenance (PM) visits recommended?**
 - a. Twice a year
 - b. PM procedure includes re-torquing connections, checking for hot spots, downloading and reviewing real time data from the BMS.
- 4) **Are spare parts recommended?**
 - a. Spares kits are being developed by Service Marketing and New Product Service Engineering.
- 5) **What information is required when quoting a field replacement for an existing VRLA installation?**
 - a. Service Marketing will determine and publish this, but the UPS CTO number, existing battery CTO, available footprint, any weight restrictions, door height, plans for control power and connection to each cabinet's BMS system, and desired runtime for the new system.
 - b. User should refer to local and national codes for compliance with lithium ion battery installations. We can advise on typical requirements.
- 17) **For LG Chem, what are common installation issues?** Refer to the installation manual shipped with each cabinet.
 - a. **Cabinet Height:** The LG cabinet is 95" tall as shipped. Since the batteries are not installed, the cabinet may be moved laying horizontally. Plan for moving this 225lb cabinet through doors, onto small elevators, and note ceiling heights where the cabinet(s) will be placed. Remember that conduit will land on top of the conduit box atop this 100.5" tall cabinet. Commercial/industrial ceiling heights are often 120", but not always. See customer drawing #11000683 for all dimensions and weights.
 - b. **Wall-mount brackets:** The cabinet must be bolted to the floor, by the installing contractor, the wall mounts are not required, but are recommended.
 - c. **Control power:** The LG cabinet requires 100V-240VAC single phase power for its BMS and other controls. This power should be 'protected', i.e. derived from the UPS output.

- d. **Remote trip of the battery cabinet breaker:** note that the UPS does NOT generate the shunt trip command for battery breakers. (a UPS "load off" or UPS EPO command will shut off the UPS but will not trip the battery breakers in the LG cabinets). The user is responsible for providing +24VDC wiring to each LG cabinet to facilitate a remote shunt trip of the battery cabinet breaker. See the installation manual and the customer drawing #110000683 for details of this connection.
 - e. **Inter-cabinet control wiring for non-adjacent cabinet installations:** There is a required inter-cabinet jumper control harness that is supplied but is too short to reach from one cabinet to another when not installed adjacently. Eaton can provide a set of instructions, and parts list for this cable and its end connectors to be assembled onsite. This allows the installer to make a cable with custom length for their specific installation.
- 18) **For Samsung, what are common installation issues?** Refer to the installation manual part # 164000729, shipped with each cabinet.
- a. **Control Power:** Each cabinet has landing terminals for 2 sets of 480VAC, 15A 3-phase power, or 2 sets of 1-phase 120/240VAC. This is necessary to power the BMS and other controls. Minimum requirement is to provide a single, protected (derived from the UPS output), 480V feed (120/240V feed, if powered by a 208VAC UPS). An additional 480V or 120/240Vfeed, from the UPS bypass source is recommended but not required. For 208VAC UPS, the conduit landing kit (below) includes step-up transformers. *NOTE: for newer Samsung cabinets that are black in color, the step-up transformers are no longer required. A single phase 120 or 240VAC feed derived from the output of the 208V UPS connects directly to a terminal block in the conduit landing kit.*
 - b. **Conduit landing kit:** This top-mounted landing kit is installed by the contractor and contains terminals for both DC power and control/status communications wiring. The installation instructions are provided, document part # P-164000742.
 - c. **Remote trip of the battery cabinet breaker:** note that the UPS does NOT generate the shunt trip command for battery breakers. (a UPS "load off" or UPS EPO command will shut off the UPS but will not trip the battery breakers in the Samsung cabinets). The user is responsible for providing a switch or dry contact that must close for 3 seconds to facilitate a remote shunt trip of the battery cabinet breaker. See the installation manual and the customer drawing #110000621 for details of this connection.

RESPONSIBILITIES FOR SECTION 1206 OF 2018 INTERNATIONAL FIRE CODE

General – Section 1206 of the 2018 revision of the International Fire Code is specifying product and site requirements of Electrical Energy Storage Systems which can impact Uninterruptible Power Supply (UPS) Systems. **This document is intended to help the reader understand what portions of the code are a site or owner requirement and what portions is are requirements for the UPS system supplier.**

Clause/Subclause	Notes	Requirement of Site or Owner	Requirement of UPS System Supplier
1206.1	Scope	UPS equipment covered in scope	
1206.2	Stationary storage battery systems	70 kWh and above for lead acid or nickel cadmium batteries and 20 kWh and above for lithium batteries are covered in scope	
1206.2.1	Permits	Yes	
1206.2.2	Construction documents		
1206.2.2 (1)	Location and layout diagram	Yes	
1206.2.2 (2)	Details of fire resistance materials	Yes	
1206.2.2 (3)	Quantities and types of storage batteries		Yes
1206.2.2 (4)	Manufacturer's specifications, ratings, Listings		Yes
1206.2.2 (5)	Details on energy management system		Yes
1206.2.2 (6)	Location and content of signage	Yes	
1206.2.2 (7)	Details of fire-extinguishing, smoke detection, and ventilation systems	Yes	
1206.2.2 (8)	Rack storage arrangement, including seismic support criteria		Yes
1206.2.3	Hazard mitigation analysis	Yes	
1206.2.3.1	Fault condition		
1206.2.3.1 (1)	Thermal runaway		Yes
1206.2.3.1 (2)	Failure of energy management system		Yes
1206.2.3.1 (3)	Failure of required ventilation system	Yes	

1206.2.3.1 (4)	Voltage surges		Yes
1206.2.3.1 (5)	Short circuits		Yes
1206.2.3.1 (6)	Failure of smoke detection, fire-extinguishing, or gas detections system	Yes	
1206.2.3.1 (7)	Spill neutralization not provided or secondary containment system	Yes	
1206.2.3.2	Analysis approval		
1206.2.3.2 (1)	Fires or explosion within unoccupied battery storage rooms	Yes	

1206.2.3.2 (2)	Fires or explosions in battery cabinet	Yes	
1206.2.3.2 (3)	Toxic and highly toxic gases reaching IDLH levels	Yes	
1206.2.3.2 (4)	Flammable gases released during normal operation	Yes	
1206.2.3.2 (5)	Flammable gases released during abnormal operation	Yes	
1206.2.3.3	Additional protection measures		Yes
1206.2.4	Seismic and structural design		Yes
1206.2.5	Vehicle impact protection	Yes	
1206.2.6	Combustible storage	Yes	
1206.7	Testing, maintenance and repair	Yes	
1206.2.8.1	Location and construction	Yes	
1206.2.8.2	Separation	Yes	
1206.2.8.3	Stationary battery arrays	Yes	Yes
1206.2.8.4	Separate rooms	Yes	Yes
1206.2.8.5	Occupied work centers	Yes	
1206.2.8.5.1	Cabinets	Yes	
1206.2.8.6	Signage	Yes	
1206.2.8.6.1	Electrical disconnects	Yes	
1206.2.8.6.2	Cabinet signage		Yes
1206.2.8.7	Outdoor installations		
1206.2.8.7 (1)	Separation	Yes	
1206.2.8.7 (2)	Means of egress	Yes	
1206.2.8.7 (3)	Security of outdoor areas	Yes	
1206.2.8.7 (4)	Walk-in units	Yes	
1206.2.9	Maximum allowable quantities	Yes	
1206.2.10	Storage batteries and equipment		
1206.2.10.1	Listings		Yes

1206.2.10.2	Prepackaged and pre-engineered systems		Yes
1206.2.10.3	Energy management system		Yes
1206.2.10.4	Battery chargers		Yes
1206.2.10.5	Inverters		Yes
1206.2.10.6	Safety caps		Yes
1206.2.10.7	Thermal runaway		Yes
1206.2.10.8	Toxic and highly toxic gas		Yes
1206.2.11	Fire-extinguishing and detection systems		
1206.2.11.1	Fire extinguishing systems	Yes	
1206.2.11.1.1	Alternate fire-extinguishing systems	Yes	
1206.2.11.2	Smoke detection system	Yes	
1206.2.11.3	Ventilation	Yes	
1206.2.11.3.1	Cabinet ventilation		Yes
1206.2.11.3.2	Supervision	Yes	
1206.2.11.4	Gas detection system	Yes	
1206.2.11.5	Spill control and neutralization	Yes	
1206.2.12	Specific battery type requirements		
1206.2.12.1	Lead-acid storage batteries		
1206.2.12.1 (1)	Ventilation	Yes	
1206.2.12.1 (2)	Spill control and neutralization	Yes	
1206.2.12.1 (3)	Thermal run-away protection		Yes
1206.2.12.1 (4)	Signage	Yes	
1206.2.12.2	Nickel cadmium storage batteries		
1206.2.12.2 (1)	Ventilation	Yes	
1206.2.12.2 (2)	Spill control and neutralization	Yes	
1206.2.12.2 (3)	Thermal run-away protection		Yes
1206.2.12.2 (4)	Signage	Yes	
1206.2.12.3	Lithium-ion Storage batteries		
1206.2.12.3 (1)	Signage	Yes	
1206.2.12.4	Sodium-beta storage batteries		
1206.2.12.4 (1)	Ventilation	Yes	
1206.2.12.4 (2)	Signage	Yes	
1206.2.12.5	Flow storage batteries		
1206.2.12.5 (1)	Ventilation	Yes	
1206.2.12.5 (2)	Spill control and neutralization	Yes	
1206.2.12.5 (3)	Signage	Yes	
1206.2.12.6	Other battery technologies		
1206.2.12.6 (1)	Gas detection system	Yes	
1206.2.12.6 (2)	Ventilation	Yes	
1206.2.12.6 (3)	Spill control and neutralization	Yes	

1206.2.12.6 (4)	Signage	Yes	
1206.3	Capacitor energy storage systems		
1206.3.1	Permits	Yes	
1206.3.2	Location and construction	Yes	
1206.3.2.3	Capacitor arrays	Yes	Yes
1206.3.2.4	Signage	Yes	
1206.3.2.5	Electrical disconnects	Yes	
1206.3.2.6	Outdoor installation of capacitor energy storage systems		
1206.3.2.6.1	Separation	Yes	
1206.3.2.6.2	Means of egress	Yes	
1206.3.2.6.3	Security of outdoor areas	Yes	
1206.3.2.6.4	Walk-in units	Yes	
1206.3.3	Maximum allowable quantities	Yes	
1206.3.4	Capacitors and equipment		
1206.3.4.1	Listing		Yes
1206.3.4.2	Prepackaged and pre-engineered systems	Yes	
1206.3.4.3	Energy management system		Yes
1206.3.4.4	Capacitor chargers		Yes
1206.3.4.5	Toxic and highly toxic gas		Yes
1206.3.5	Fire-extinguishing and detection systems		
1206.3.5.1	Fire-extinguishing systems	Yes	
1206.3.5.1.1	Alternative fire-extinguishing systems	Yes	
1206.3.5.2	Smoke detection system	Yes	
1206.3.5.3	Ventilation	Yes	
1206.3.5.3.1	Supervision	Yes	
1206.3.6	Spill control and neutralization	Yes	
1206.3.7	Testing, maintenance and repair	Yes	