March 2017 PNNL-SA-124486 / SAND2017-3066 R

Energy Storage System Safety:

Plan Review and Inspection Checklist

PC Cole
DR Conover

Prepared by

Pacific Northwest National Laboratory
Richland, Washington

and

Sandia National Laboratories
Albuquerque, New Mexico

for the Office of Electricity Delivery and Energy Reliability (OE1)

Funded by the Energy Storage Systems Program of the U.S. Department of Energy
Dr. Imre Gyuk, Program Manager

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Richland, Washington 99352

Sandia National Laboratories
Albuquerque, New Mexico 87185

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This document would not have been possible without valuable contributions from a number of individuals. Under the Energy Storage Safety Strategic Plan, developed with the support of the U.S. Department of Energy (DOE) Office of Electricity Delivery and Energy Reliability Energy Storage Program by Pacific Northwest Laboratory and Sandia National Laboratories, an Energy Storage Safety initiative has been underway since July 2015. One of three key components of that initiative involves codes, standards, and regulations impacting the timely deployment of safe energy storage systems (ESS). The timely deployment of safe ESS is affected by the ability of relevant parties to document and validate that a proposed ESS installation will comply with safety criteria as represented by codes, standards, and regulations (CSR). A Plan Review/Inspection Checklist Task Force composed of all stakeholders that are involved with the ESS safety initiative as described above was formed to foster the deployment of safe ESS, and through their efforts, this document was developed.

The task force participants are listed below. In addition, Dr. Imre Gyuk, Program Manager for the DOE Energy Storage Program, should be recognized for his support of this effort.

ESS Checklist Task Force Participants:

1. Rich Bielen, National Fire Protection Association
2. Philip Cameron, TN Department of Commerce & Insurance
3. Tom Delucia, NEC Energy Solutions Inc.
4. Jason Doling, New York State Energy Research and Development Authority
5. Keith Enstrom, International Code Council
6. Randy Fish, Strategen Consulting
7. Laurie Florence, Underwriters Laboratories
8. Ryan Franks, CSA Group
9. Clinton Marshall, FM Global
10. Tron Melzl, ABB Inc.
11. Robert Neale, International Code Council
12. Matt Paiss, San Jose, CA FD
13. Mike Pfeiffer, International Code Council
14. Timothy Riley, PyroPhobic Systems, Ltd.
15. Paul Rogers, FD NY
16. Chuck Strickland, University of California, San Diego
17. Beth Tubbs, International Code Council
18. Phil Undercuffler, OutBack Power Technologies
19. Chip Voehl, Verison
20. Bekele Zekarias, CSA Group

Executive Summary

Codes, standards, and regulations (CSR) governing the design, construction, installation, commissioning, and operation of the built environment are intended to protect the public health, safety, and welfare. While these documents change over time to address new technology and new safety challenges, there is generally some lag time between the introduction of a technology into the market and the time it is specifically covered in model codes and standards developed in the voluntary sector. After their development, there is also a timeframe of at least a year or two until the codes and standards are adopted. Until existing model codes and standards are updated or new ones are developed and then adopted, one seeking to deploy energy storage technologies or needing to verify the safety of an installation may be challenged in trying to apply currently implemented CSRs to an energy storage system (ESS).

The Energy Storage System Guide for Compliance with Safety Codes and Standards[1] (CG), developed in June 2016, is intended to help address the acceptability of the design and construction of stationary ESSs, their component parts, and the siting, installation, commissioning, operations, maintenance, and repair/renovation of ESS within the built environment. The bases for addressing acceptability are CSRs that have been adopted as of the publication date of this CG. Until those CSRs are updated, specific criteria for some ESS may not be provided in the CSR, and as a result, the acceptability of the ESS may be more challenging in terms of documenting and verifying it for safety.

The CG is anticipated to facilitate the timely deployment of stationary ESSs within an infrastructure of safety-related regulations, specifications, and other governing (adopted) criteria based on voluntary sector standards and model codes developed in the United States that may not have been updated to specifically cover all ESS technologies or their intended application. The availability of this CG hopefully will assist those that need to document compliance with current safety-related codes and standards and guidance that what is proposed is safe. The CG is also intended to assist those responsible for verifying compliance with those same codes and standards.

The CG first covers frequently asked questions in order of how they are likely to occur along the timeline associated with development and deployment of an ESS. It then addresses the ESS as a product or combination of components followed by the installation of the ESS in the built environment. Guidance for documenting or verifying compliance with current CSRs is also provided to facilitate the review and approval of ESS installations. Those seeking approval for an ESS should consider completion of this or a similar document in conjunction with any plans and specifications submitted for consideration by an AHJ.

Because of the current evolution in ESS technology development and deployment, anticipated use of the CG and future availability of details associated with particular ESS technology installations, it is recognized this document can be further enhanced. The CG will be updated to include the following Plan Review/Inspection Checklist. The authors welcome suggestions for future enhancements of this document.

[1] Energy Storage System Guide for Compliance with Safety Codes and Standards, June 2016, http://www.sandia.gov/ess/publication/pacific-northwest-national-laboratory-pnnl-publications-2/

Acronyms and Abbreviations

A	ampere
AC	alternating current
AHJ	authority having jurisdiction
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
CG	Compliance Guide
CSR	codes, standards, and regulations
ESS	energy storage system
FMEA	failure modes and effects analysis
Hz	hertz
HVAC	heating, ventilation, and air conditioning
ICC	International Code Council
ICE	In Case of Emergency
IEEE	Institute of Electrical and Electronics Engineers
IFC	International Fire Code
kW	kilowatt
kWh	kilowatt hour
NFPA	National Fire Protection Association
NRTL	Nationally Recognized Testing Laboratories
UL	Underwriters Laboratory
V	voltage/volt
VA	volt ampere
VAC	volts of alternating current
WG	Working Group

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Energy Storage System (ESS) Plan Review/Inspection Checklist

Date: _____/___/_____

Project Name _____

Address _____

State: _____ County: _____ Jurisdiction: _____

Facility Owner (owner of facility where ESS is installed): _____ I.C.E. #_____

ESS Owner (owner of ESS if different than facility owner):_____ I.C.E. #_____

☐ New System ☐ Addition ☐ Renewal or Renovation ☐ Repair

System Manufacturer(s): _____

System Installer: _____

System Integrator (if one is involved in the project):_____ I.C.E. #_____

System Operator: _____ I.C.E. #_____

System Name: _____

System Address: _____

System Location (in relation to the primary electrical meter): _____

Services Provided: _____

ESS Technology Information			
Type of ESS			
ESS chemistry (if electrochemical)			
Enclosure Type			
Footprint Area ($ft.^2$)			
Weight (lbs.)			
Overall Dimensions L x W x H (ft.)	Length	Width	Height
Rated Continuous Discharge Power (kW)			
Input Voltage into the ESS (VAC)			
Output Voltage (nominal)(VAC)			
Frequency (Hz)			
Number of phases (input and output)	Input	Output	
Duty cycle (if applicable)			
Maximum short circuit current (A)			
Auxiliary (if applicable)	Input voltage (V)	Output voltage (V)	
Auxiliary (if applicable)	Current (A)	Frequency (Hz)	
Rated Discharge Energy (kWh)			
Minimum Discharge Time (min.)			
Maximum Discharge Time (min.)			
Operating Temperature Range (^oF)			
Stored Energy Capacity (kWh)			
Self-discharge Rate (% energy loss/day)			
Liquid Capacity (Gal.) needed for secondary containment of flow batteries			
Special environmental ratings and limitations as applicable	Seismic	Indoor	Outdoor

Pre-Inspection/Plan Review							
1.1	Documentation prepared by a registered engineer or approved third party indicating that the system and system components meet all applicable safety standards (e.g., UL 9540, UL 1973, etc.).						
	Plans Verified		**Field Verified**		**Complies**		**Comments/Assumptions**
		Yes		N/A		Yes	
		No				No	
		N/A				N/A	
1.2	Documentation of Failure Modes and Effects Analysis (FMEA), Hazard Analysis, or other analysis is provided that supports the safety of the system and system components.						
	Plans Verified		**Field Verified**		**Complies**		**Comments/Assumptions**
		Yes		N/A		Yes	
		No				No	
		N/A				N/A	
Self-Contained, Prepackaged Energy Storage Systems							
2.1	Each self-contained, prepackage energy storage system is designed, tested, and listed in accordance with applicable safety standards (e.g., UL 9540).						
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**
		Yes		Yes		Does Not Comply	
		No		No		Not Observable	
		N/A		N/A		Not Applicable	
Pre-Engineered Energy Storage Systems							
3.1	Each pre-engineered energy storage system comprising two or more factor-matched modular components intended to be assembled in the field is designed, tested, and listed in accordance with applicable safety standards (e.g., UL 9540).						
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**
		Yes		Yes		Does Not Comply	
		No		No		Not Observable	
		N/A		N/A		Not Applicable	
Engineered and Field-Constructed Energy Storage Systems							
4.1	System is composed of components that have been listed and evaluated to safety standards that are applicable to each component.						
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**
		Yes		Yes		Does Not Comply	
		No		No		Not Observable	
		N/A		N/A		Not Applicable	
4.2	Documentation in the form of a Failure Modes and Effects Analysis (FMEA), Hazard Analysis or other approved analysis is provided that supports the safety of the system and its components.						
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**
		Yes		Yes		Does Not Comply	
		No		No		Not Observable	
		N/A		N/A		Not Applicable	

Repairs to Existing Energy Storage System							
5.1	Repairs to an existing energy storage system are made in such a manner that the existing system as approved (when originally installed and commissioned) is not modified or documentation is provided by the entity performing the repair(s) (e.g., Failure Modes and Effects Analysis [FMEA] or other approved analysis) that supports the safety of the repair(s) to an existing system and is approved by the authority having jurisdiction.						
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**
		Yes		Yes		Does Not Comply	
		No		No		Not Observable	
		N/A		N/A		Not Applicable	
5.2	Repairs that necessitate any substantial change to the existing energy storage system as originally installed have been assessed in relation to the applicable provisions of the sections below and the system has been recommissioned.						
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**
		Yes		Yes		Does Not Comply	
		No		No		Not Observable	
		N/A		N/A		Not Applicable	
5.3	Any repairs to batteries associated with the existing energy storage system have been performed according to the battery manufacturer's instructions. Where an energy storage system battery is replaced, it has been replaced with a battery that has been tested and listed in accordance with UL 1973 or otherwise approved by the authority having jurisdiction.						
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**
		Yes		Yes		Does Not Comply	
		No		No		Not Observable	
		N/A		N/A		Not Applicable	
Additions to Existing Energy Storage System							
6.1	Additions to existing energy storage system satisfy the provisions applicable to the original system classifications and are made in such a manner that the existing system, as approved when originally installed and commissioned, is not materially modified or documentation is provided (e.g., Failure Modes and Effects Analysis [FMEA] or other approved analysis) by the entity performing the addition that supports the safety of the addition to an existing system and is approved by the authority having jurisdiction.						
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**
		Yes		Yes		Does Not Comply	
		No		No		Not Observable	
		N/A		N/A		Not Applicable	
6.2	Additions to existing energy storage system which necessitate a change to the manner in which the existing system is installed, meet the applicable provisions of this document, and the system has been recommissioned in accordance with the commissioning requirements after the addition is completed.						
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptons**
		Yes		Yes		Does Not Comply	
		No		No		Not Observable	
		N/A		N/A		Not Applicable	

Renewal or Renovation of Existing Energy Storage System							
7.1	Renewal or renovation to existing energy storage system is made in such a manner that the existing system, as approved when originally installed and commissioned, is not materially modified or documentation (e.g., Failure Modes and Effects Analysis [FMEA] or other approved analysis) is provided by the entity performing the renewal or renovation that supports the safety of the renewal or renovation, and is approved by the authority having jurisdiction.						
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**
		Yes		Yes		Does Not Comply	
		No		No		Not Observable	
		N/A		N/A		Not Applicable	
7.2	Renewal or renovation that necessitates any material change meets the applicable provisions of this document and the system is recommissioned in accordance with commissioning requirements.						
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**
		Yes		Yes		Does Not Comply	
		No		No		Not Observable	
		N/A		N/A		Not Applicable	
General Siting of ESS and Associated Equipment, Components, and Controls							
8.1	The system is sited and installed in accordance with the manufacturer's installation instructions or when relevant the system designer or integrator.						
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**
		Yes		Yes		Does Not Comply	
		No		No		Not Observable	
		N/A		N/A		Not Applicable	
8.2	The system is placed on an approved bearing surface capable of supporting the calculated dead and live loads of all system components designed to bear on the foundation.						
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**
		Yes		Yes		Does Not Comply	
		No		No		Not Observable	
		N/A		N/A		Not Applicable	
8.3	When inside or on a building, dead and live loads associated with the system are considered in the building design.						
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**
		Yes		Yes		Does Not Comply	
		No		No		Not Observable	
		N/A		N/A		Not Applicable	
8.4	The system is located or protected where it will not be adversely impacted by natural hazards (i.e., rain, snow, wind, lightning, and wildfire).						
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**
		Yes		Yes		Does Not Comply	
		No		No		Not Observable	
		N/A		N/A		Not Applicable	

8.5	The system is anchored to resist anticipated seismic forces in accordance with IEEE 693 or locally adopted building codes.					
	Plans Verified		**Field Verified**		Complies	**Comments/Assumptions**
		Yes		Yes	Does Not Comply	
		No		No	Not Observable	
		N/A		N/A	Not Applicable	
8.6	The system is located above the base flood elevation or otherwise protected against flooding.					
	Plans Verified		**Field Verified**		Complies	**Comments/Assumptions**
		Yes		Yes	Does Not Comply	
		No		No	Not Observable	
		N/A		N/A	Not Applicable	
8.7	Signage indicating the designated means of access to and egress from the installation is provided.					
	Plans Verified		**Field Verified**		Complies	**Comments/Assumptions**
		Yes		Yes	Does Not Comply	
		No		No	Not Observable	
		N/A		N/A	Not Applicable	
8.8	Signage indicating containment and/or neutralization means provided for incident response mechanisms and any flow battery electrolyte tanks.					
	Plans Verified		**Field Verified**		Complies	**Comments/Assumptions**
		Yes		Yes	Does Not Comply	
		No		No	Not Observable	
		N/A		N/A	Not Applicable	
8.9	The system is installed outside potentially hazardous atmospheres as defined by NFPA 70 or IEEE C-2 or tested and listed for installation within such atmospheres.					
	Plans Verified		**Field Verified**		Complies	**Comments/Assumptions**
		Yes		Yes	Does Not Comply	
		No		No	Not Observable	
		N/A		N/A	Not Applicable	
8.10	Emergency egress: The system is located in a manner to not adversely affect emergency egress from its location and buildings or facilities in which it is installed.					
	Plans Verified		**Field Verified**		Complies	**Comments/Assumptions**
		Yes		Yes	Does Not Comply	
		No		No	Not Observable	
		N/A		N/A	Not Applicable	
8.11	Emergency access: The system is located in a manner that is accessible by emergency responders.					
	Plans Verified		**Field Verified**		Complies	**Comments/Assumptions**
		Yes		Yes	Does Not Comply	
		No		No	Not Observable	
		N/A		N/A	Not Applicable	

8.12	The system is designed and located to allow for service and maintenance and provided with artificial lighting on the serviceable areas of the system.						
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**
		Yes		Yes		Does Not Comply	
		No		No		Not Observable	
		N/A		N/A		Not Applicable	
8.13	The system is located at or greater than minimum required distance away from stored combustible materials, hazardous chemicals, high-piled stock and other fire hazard exposures.						
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**
		Yes		Yes		Does Not Comply	
		No		No		Not Observable	
		N/A		N/A		Not Applicable	
8.14	The system is located or protected to prevent physical damage.						
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**
		Yes		Yes		Does Not Comply	
		No		No		Not Observable	
		N/A		N/A		Not Applicable	
8.15	Multiple systems are located or protected such that a fire or failure of one system does not pose an exposure hazard to an adjacent system.						
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**
		Yes		Yes		Does Not Comply	
		No		No		Not Observable	
		N/A		N/A		Not Applicable	
8.16	Fire protection of systems and the surrounding area is provided during construction.						
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**
		Yes		Yes		Does Not Comply	
		No		No		Not Observable	
		N/A		N/A		Not Applicable	
8.17	Safety signs and labels indicating hazards associated with the system are provided.						
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**
		Yes		Yes		Does Not Comply	
		No		No		Not Observable	
		N/A		N/A		Not Applicable	
Outdoor Installations of Energy Storage System and Associated Equipment, Components and Controls							
9.1	System is designed and constructed for outdoor installation.						
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**
		Yes		Yes		Does Not Comply	
		No		No		Not Observable	
		N/A		N/A		Not Applicable	

9.2	Any air intakes and exhausts are designed and located so they are not adversely affected by other exhausts, gases or contaminants.					
	Plans Verified		**Field Verified**		Complies	**Comments/Assumptions**
		Yes		Yes	Does Not Comply	
		No		No	Not Observable	
		N/A		N/A	Not Applicable	
9.3	Exhaust outlet(s) that exhaust other than ventilation air are designed and located the required distance from heating, ventilating, and air conditioning (HVAC) air intakes; windows, doors; loading docks; and other openings into buildings and facilities.					
	Plans Verified		**Field Verified**		Complies	**Comments/Assumptions**
		Yes		Yes	Does Not Comply	
		No		No	Not Observable	
		N/A		N/A	Not Applicable	
9.4	Exhaust outlet(s) are not directed onto walkways or pedestrian or vehicular travel paths.					
	Plans Verified		**Field Verified**		Complies	**Comments/Assumptions**
		Yes		Yes	Does Not Comply	
		No		No	Not Observable	
		N/A		N/A	Not Applicable	
9.5	Security barriers, fences, landscaping and other enclosures do not affect required intake and exhaust air flow.					
	Plans Verified		**Field Verified**		Complies	**Comments/Assumptions**
		Yes		Yes	Does Not Comply	
		No		No	Not Observable	
		N/A		N/A	Not Applicable	
9.6	Systems and air intakes and exhausts are not located in areas used for combustible, flammable, or hazardous materials storage.					
	Plans Verified		**Field Verified**		Complies	**Comments/Assumptions**
		Yes		Yes	Does Not Comply	
		No		No	Not Observable	
		N/A		N/A	Not Applicable	
9.7	The system is not located in an area designated as an Urban Wildland Interface.					
	Plans Verified		**Field Verified**		Complies	**Comments/Assumptions**
		Yes		Yes	Does Not Comply	
		No		No	Not Observable	
		N/A		N/A	Not Applicable	
Rooftop Installations of Energy Storage System and Associated Equipment, Components and Controls						
10.1	Designed and installed in accordance with applicable outdoor installation requirements and protected against anticipated environmental exposures.					
	Plans Verified		**Field Verified**		Complies	**Comments/Assumptions**
		Yes		Yes	Does Not Comply	
		No		No	Not Observable	
		N/A		N/A	Not Applicable	

10.2	The system is installed on noncombustible rooftops of buildings that are not located above the maximum acceptable height above grade.					
	Plans Verified		**Field Verified**		Complies	**Comments/Assumptionis**
		Yes		Yes	Does Not Comply	
		No		No	Not Observable	
		N/A		N/A	Not Applicable	
10.3	Access to the roof for first responders is provided either through the interior of the building or on the exterior of the building.					
	Plans Verified		**Field Verified**		Complies	**Comments/Assumptions**
		Yes		Yes	Does Not Comply	
		No		No	Not Observable	
		N/A		N/A	Not Applicable	
10.4	A service walkway meeting the minimum required width is provided for service and emergency personnel from the point of access to the roof to and around the system.					
	Plans Verified		**Field Verified**		Complies	**Comments/Assumptions**
		Yes		Yes	Does Not Comply	
		No		No	Not Observable	
		N/A		N/A	Not Applicable	
10.5	The system is located from the edge of the roof a distance equal to at least the height of the system, equipment, or component, but not less than the minimum acceptable distance for roof mounted equipment.					
	Plans Verified		**Field Verified**		Complies	**Comments/Assumptions**
		Yes		Yes	Does Not Comply	
		No		No	Not Observable	
		N/A		N/A	Not Applicable	
10.6	Roofing materials under and within the required horizontal distance are noncombustible or have a Class A rating when tested in accordance with ASTM E108, Standard Test Method for Fire Tests of Roof Coverings, or UL 790, Standard Test Methods for Fire Tests of Roof Coverings.					
	Plans Verified		**Field Verified**		Complies	**Comments/Assumptions**
		Yes		Yes	Does Not Comply	
		No		No	Not Observable	
		N/A		N/A	Not Applicable	
Interior Installations of ESS and Associated Equipment, Components and Controls						
11.1	Rooms, spaces, and areas in which the system is located have a floor level that is not more than the established safe distance above the lowest level of fire department vehicle access and that is not more than the established safe distance below the finished floor of the lowest level of exit discharge (portion of a means of egress system between the termination of an exit and a public way).					
	Plans Verified		**Field Verified**		Complies	**Comments/Assumptions**
		Yes		Yes	Does Not Comply	
		No		No	Not Observable	
		N/A		N/A	Not Applicable	
11.2	Rooms, spaces, or areas dedicated to or housing the system or system components are separated from other areas of the building by building construction in accordance with the building and fire codes.					
	Plans Verified		**Field Verified**		Complies	**Comments/Assumptions**
		Yes		Yes	Does Not Comply	
		No		No	Not Observable	
		N/A		N/A	Not Applicable	

11.3	Openings into rooms, spaces, or areas dedicated to or housing the system or system components are protected by fire doors and dampers in accordance with the building and fire codes.							
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**	
		Yes		Yes		Does Not Comply		
		No		No		Not Observable		
		N/A		N/A		Not Applicable		
11.4	Rooms, spaces, or areas containing dedicated to or housing the system or system components are provided with egress in accordance with the building and fire codes.							
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**	
		Yes		Yes		Does Not Comply		
		No		No		Not Observable		
		N/A		N/A		Not Applicable		
11.5	Rooms, spaces, or areas that contain a potential hazardous level of flammable gas are provided with a gas detection system in accordance with the fire code.							
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**	
		Yes		Yes		Does Not Comply		
		No		No		Not Observable		
		N/A		N/A		Not Applicable		
11.6	When located in an area accessible to other than service personnel, batteries are contained in a noncombustible cabinet or other enclosure that prevents access by unauthorized personnel.							
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**	
		Yes		Yes		Does Not Comply		
		No		No		Not Observable		
		N/A		N/A		Not Applicable		
Interconnections with Other Systems								
12.1	All electrical connections to a self-contained prepackaged energy storage system or the components of a pre-engineered energy storage system comply with the provisions of NFPA 70, National Electrical Code, when installed on the customer side of the primary electrical meter, or IEEE C-2, National Electrical Safety Code, when installed on the utility side of the primary electrical meter.							
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**	
		Yes		Yes		Does Not Comply		
		No		No		Not Observable		
		N/A		N/A		Not Applicable		
12.2	Connections to other energy sources are in accordance with NFPA 54, National Fuel Gas Code; NFPA 58, Liquefied Petroleum Gas Code; NFPA 2, Hydrogen Gas Code; and other national standards applicable to the energy source connected to the energy storage system.							
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**	
		Yes		Yes		Does Not Comply		
		No		No		Not Observable		
		N/A		N/A		Not Applicable		

12.3	All energy sources are provided with disconnecting means and a visible identification of the disconnecting means in accordance with the standards applicable to the interconnection of the energy storage system.						
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**
		Yes		Yes		Does Not Comply	
		No		No		Not Observable	
		N/A		N/A		Not Applicable	
12.4	All connections associated with the energy storage system including any required plumbing, fire alarm, detection, control circuits, or mechanical systems are in accordance with applicable nationally recognized standards, including any necessary provisions for ventilation, thermal management, exhaust, and fire protection.						
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**
		Yes		Yes		Does Not Comply	
		No		No		Not Observable	
		N/A		N/A		Not Applicable	
12.5	Where the building or facilities in which the energy storage system is installed are required by the local building or fire code to have central operation and control systems, the control and management systems associated with the energy storage system are connected into those operational and control systems.						
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**
		Yes		Yes		Does Not Comply	
		No		No		Not Observable	
		N/A		N/A		Not Applicable	
Ventilation, Thermal Management and Exhaust							
13.1	Where self-contained and prepackaged or pre-engineered energy storage system include a tested and listed enclosure as part of the system are located indoors and have sealed direct ventilation and exhaust systems, the ventilation and exhaust systems that connect the system with the outdoor environment are designed and installed in accordance with the terms of the listing and manufacturer's installation instructions.						
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**
		Yes		Yes		Does Not Comply	
		No		No		Not Observable	
		N/A		N/A		Not Applicable	
13.2	Ventilation and exhaust systems are designed to provide a negative or neutral pressure in the room or area where the energy storage system is installed, relative to the remainder of the adjacent interior spaces that are not completely sealed from and have no openings into the room or area where the system is installed.						
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**
		Yes		Yes		Does Not Comply	
		No		No		Not Observable	
		N/A		N/A		Not Applicable	
13.3	Where located indoors and where there is a potential for a hazardous level of gases being produced by the energy storage system or occurring within the indoor space where the system is located, the indoor space is provided by either an explosion prevention system or the indoor space is provided with sufficient ventilation to prevent a potentially hazardous level of flammable gases.						
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**
		Yes		Yes		Does Not Comply	
		No		No		Not Observable	
		N/A		N/A		Not Applicable	

13.4	A separate mechanical ventilation system meeting the provisions of the local building, mechanical, and fire codes is provided for any dedicated room or enclosed area containing an energy storage system.						
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**
		Yes		Yes		Does Not Comply	
		No		No		Not Observable	
		N/A		N/A		Not Applicable	
13.5	Where required, a means of temperature and/or humidity control in the room or enclosed area is provided to maintain required operating conditions for the energy storage system.						
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**
		Yes		Yes		Does Not Comply	
		No		No		Not Observable	
		N/A		N/A		Not Applicable	
13.6	The mechanical ventilation system serving the energy storage system provides sufficient ventilation air for thermal management of the system.						
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**
		Yes		Yes		Does Not Comply	
		No		No		Not Observable	
		N/A		N/A		Not Applicable	
13.7	The inlets of the mechanical ventilation system are designed to prevent foreign matter from entering the ventilation system and accumulating on the outside of or immediately adjacent to the inlet.						
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**
		Yes		Yes		Does Not Comply	
		No		No		Not Observable	
		N/A		N/A		Not Applicable	
13.8	The mechanical ventilation system is controlled so that, if needed, it continues to operate regardless of the operating status of the energy storage system.						
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**
		Yes		Yes		Does Not Comply	
		No		No		Not Observable	
		N/A		N/A		Not Applicable	
13.9	The mechanical ventilation system has a manual control to shut off the energy storage system in case of emergency. The manual control readily visible and accessible and is provided with the necessary signage to immediately identify the control.						
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**
		Yes		Yes		Does Not Comply	
		No		No		Not Observable	
		N/A		N/A		Not Applicable	
13.10	Where required, a separate mechanical exhaust system meeting the provisions of the local building, mechanical and fire codes is provided for the room or area where the energy storage system is located.						
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**
		Yes		Yes		Does Not Comply	
		No		No		Not Observable	
		N/A		N/A		Not Applicable	

13.11	The mechanical exhaust system provides exhaust air equal to or greater than that provided by the ventilation and thermal management system and is interlocked to operate in conjunction with the ventilation and thermal management system.							
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**	
		Yes		Yes		Does Not Comply		
		No		No		Not Observable		
		N/A		N/A		Not Applicable		
13.12	Where harmful emissions from the energy storage system are possible, a mechanical exhaust system is provided and is designed to ensure that harmful emissions are exhausted to a safe location.							
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**	
		Yes		Yes		Does Not Comply		
		No		No		Not Observable		
		N/A		N/A		Not Applicable		
13.13	Inlets to the mechanical exhaust system are designed to prevent foreign matter from entering the system and to prevent the accumulation of foreign matter outside and immediately adjacent to the inlet.							
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**	
		Yes		Yes		Does Not Comply		
		No		No		Not Observable		
		N/A		N/A		Not Applicable		
13.14	Outlets of the mechanical exhaust system are designed to prevent the accumulation of foreign matter outside and immediately adjacent to the outlet.							
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**	
		Yes		Yes		Does Not Comply		
		No		No		Not Observable		
		N/A		N/A		Not Applicable		
13.15	The mechanical exhaust system is controlled so that, if needed, it continues to operate regardless of the operating status of the energy storage system.							
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**	
		Yes		Yes		Does Not Comply		
		No		No		Not Observable		
		N/A		N/A		Not Applicable		
13.16	The mechanical exhaust system has a manual control to shut off the energy storage system in case of emergency, and the manual control is interconnected with the manual control provided on the mechanical ventilation system.							
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**	
		Yes		Yes		Does Not Comply		
		No		No		Not Observable		
		N/A		N/A		Not Applicable		
Fire Protection–Fire and Smoke Detection								
14.1	Self-contained, prepackaged, or pre-engineered energy storage systems that include fire and smoke detection systems in accordance with the manufacturer's installation instructions are interconnected with fire and smoke detection systems as required by local codes for the building, facility, or property associated with the system installation.							
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**	
		Yes		Yes		Does Not Comply		
		No		No		Not Observable		
		N/A		N/A		Not Applicable		

14.2	Engineered and field-constructed energy storage systems that include fire and smoke detection systems in accordance with the system installation hazard analysis and local fire codes are interconnected with fire and smoke detection systems required by local codes for the building, facility or property associated with the system installation.								
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**		
		Yes		Yes		Does Not Comply			
		No		No		Not Observable			
		N/A		N/A		Not Applicable			
14.3	Energy storage systems not capable of being assessed under 14.1 or 14.2 above are accompanied by a fire risk assessment documenting the acceptability of the proposed fire detection and smoke detection systems.								
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**		
		Yes		Yes		Does Not Comply			
		No		No		Not Observable			
		N/A		N/A		Not Applicable			
14.4	Fire protection systems not provided as a component of a tested and listed energy storage system comply with applicable criteria in fire alarm and signaling codes.								
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**		
		Yes		Yes		Does Not Comply			
		No		No		Not Observable			
		N/A		N/A		Not Applicable			
14.5	Smoke detection systems not provided as a component of a tested and listed energy storage system comply with applicable criteria in standards covering smoke alarms.								
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**		
		Yes		Yes		Does Not Comply			
		No		No		Not Observable			
		N/A		N/A		Not Applicable			
Fire Protection–Fire Suppression									
15.1	Self-contained, prepackaged, or pre-engineered energy storage systems that include fire suppression system(s) in accordance with the manufacturer's installation instructions have the fire suppression system(s) interconnected with fire and smoke detection systems as required by local codes for the building, facility or property associated with the system installation.								
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**		
		Yes		Yes		Does Not Comply			
		No		No		Not Observable			
		N/A		N/A		Not Applicable			
15.2	Engineered and field-constructed energy storage systems that include fire suppression system(s) in accordance with the system installation hazard analysis and local fire codes have the fire suppression system(s)interconnected with fire and smoke detection systems as required by local codes for the building, facility or property associated with the system installation.								
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**		
		Yes		Yes		Does Not Comply			
		No		No		Not Observable			
		N/A		N/A		Not Applicable			

15.3	Energy storage systems not capable of being assessed under 15.1 or 15.2 above are accompanied by a fire risk assessment documenting the acceptability of the proposed fire suppression systems.							
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**	
		Yes		Yes		Does Not Comply		
		No		No		Not Observable		
		N/A		N/A		Not Applicable		
15.4	Fire suppression systems that are not provided as a component of a tested and listed energy storage system meet the provisions of an applicable standard as documented in accordance with the hazard analysis.							
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**	
		Yes		Yes		Does Not Comply		
		No		No		Not Observable		
		N/A		N/A		Not Applicable		
15.5	Where the energy storage system type and/or hazard analysis indicates that fire suppression could result in a greater hazard (than if the system is not provided with fire suppression), a fire suppression system is not required subject to the approval of the authority having jurisdiction.							
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**	
		Yes		Yes		Does Not Comply		
		No		No		Not Observable		
		N/A		N/A		Not Applicable		
Fire Protection–Fire Containment								
16.1	Rooms, spaces, and areas dedicated to an energy storage system are separated from other areas of the building in accordance with local building and fire codes.							
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**	
		Yes		Yes		Does Not Comply		
		No		No		Not Observable		
		N/A		N/A		Not Applicable		
Fire Protection–Removal of Smoke								
17.1	Smoke control meeting the provisions of standards for smoke control systems and local fire codes is provided unless: • The energy storage system is installed outdoors and able to freely communicate directly with the outdoor environment • The energy storage system is self-contained and prepackaged or pre-engineered and is listed for application without a smoke control system • A hazard analysis is provided that documents the system or its intended installation does not require smoke containment or management.							
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**	
		Yes		Yes		Does Not Comply		
		No		No		Not Observable		
		N/A		N/A		Not Applicable		
Fire Protection–Containment of Fluids								
18.1	Where the energy storage system contains fluids, it is provided with a means to safely contain the volume of fluid contained in the system unless a hazard analysis documents that all fluids in the system are not hazardous and can be safely conveyed to the sanitary drainage system serving the building, facility or site associated with the energy storage system installation.							
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**	
		Yes		Yes		Does Not Comply		
		No		No		Not Observable		
		N/A		N/A		Not Applicable		

Fire Protection–Signage							
19.1	Self-contained and prepackage or pre-engineered energy storage system include signage on the system and its component parts as required by their listing either on the system or system component or installed onsite in accordance with the manufacture's installation instructions.						
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**
		Yes		Yes		Does Not Comply	
		No		No		Not Observable	
		N/A		N/A		Not Applicable	
19.2	Signage adjacent to all doors, gates, or other means of access to the energy storage system contains the following information: • Point-of-contact(s) in case of emergency (ICE) to include facility owner and energy storage owner, integrator, and operator • Type of system(s) battery technology if applicable and capacity of each system in kWh • Location and purpose of all manual controls and emergency shutoff devices • Amount and type of any corrosive liquids • Amount and type of any hazardous chemicals • Type of any fire suppression system provided • Instructions for first responders for addressing fire and smoke control • Signage should be in accordance with ANSI Z535, locally adopted codes, or approved by the authority having jurisdiction.						
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**
		Yes		Yes		Does Not Comply	
		No		No		Not Observable	
		N/A		N/A		Not Applicable	
Commissioning							
20.1	Self-contained, prepackaged energy, or pre-engineered energy storage systems are evaluated for proper operation by an approved entity in accordance with manufacturer's instructions and a commissioning plan they have prepared that outlines how the safety systems will be tested to ensure they are calibrated, adjusted and in proper working condition after the installation is complete, but prior to final approval. A report documenting the commissioning process and the results are provided prior to final inspection and approval.						
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**
		Yes		Yes		Does Not Comply	
		No		No		Not Observable	
		N/A		N/A		Not Applicable	
20.2	Engineered and field-constructed energy storage systems are evaluated for proper operation by the party responsible for the documentation of the system safety in accordance with a commissioning plan they have prepared that outlines how the safety systems will be tested to ensure they are calibrated, adjusted and in proper working condition after the installation is complete, but prior to final approval. A report documenting the commissioning process and the results are provided prior to final inspection and approval.						
	Plans Verified		**Field Verified**			Complies	**Comments/Assumptions**
		Yes		Yes		Does Not Comply	
		No		No		Not Observable	
		N/A		N/A		Not Applicable	


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