SAFETY COLLABORATIVE

SAND2020-0833R

Highlights

NFPA 855 has been published as a standard.

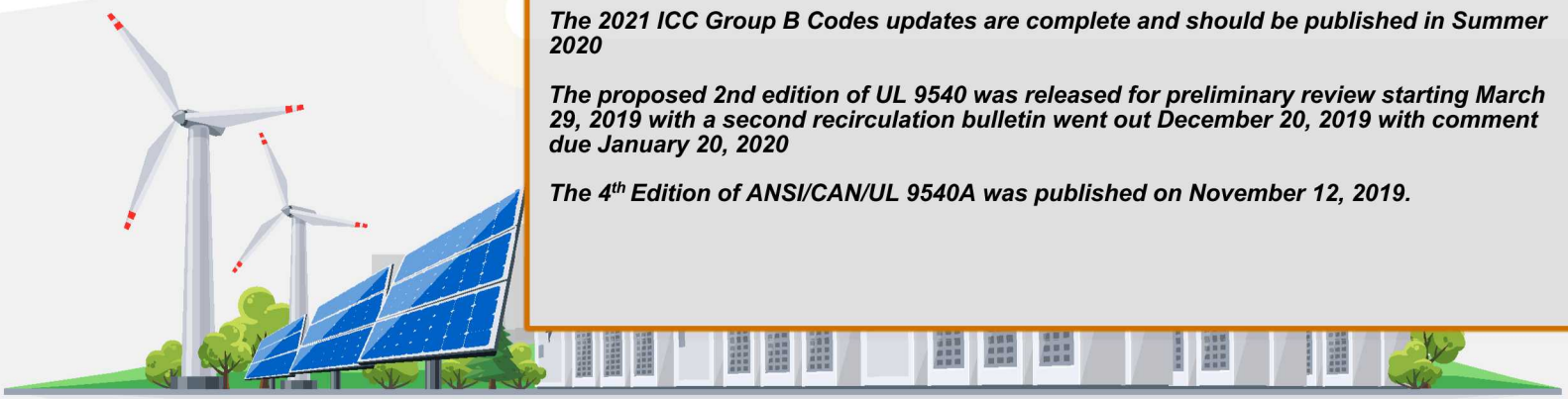
The second draft report on NFPA 791 has been posted and has a closing date of Feb19, 2020 to file a NITMAM.

The second draft report on NFPA 1 will be posted February 12, 2020, with a deadline for filing a NITMAM of March 11, 2020.

The 2021 ICC Group B Codes updates are complete and should be published in Summer 2020

The proposed 2nd edition of UL 9540 was released for preliminary review starting March 29, 2019 with a second recirculation bulletin went out December 20, 2019 with comment due January 20, 2020

The 4th Edition of ANSI/CAN/UL 9540A was published on November 12, 2019.



CODES AND STANDARDS UPDATE WINTER 2019/20

The goal of the DOE OE Energy Storage System Safety Roadmap[1] is to *foster confidence in the safety and reliability of energy storage systems*. There are three interrelated objectives to support the realization of that goal: research, codes and standards (C/S) and communication/coordination. The objective focused on C/S is *"To apply research and development to support efforts that refocused on ensuring that codes and standards are available to enable the safe implementation of energy storage systems in a comprehensive, non-discriminatory and science-based manner."*

The following activities support that objective and realization of the goal:

a. Review and assess C/S which affect the design, installation, and operation of energy storage systems (ESS).

b. Identify gaps in knowledge that require research and analysis that can serve as a basis for criteria in those C/S.

c. Identify areas in C/S that are potentially in need of revision or enhancement and can benefit from activities conducted under research and development.

d. Develop input for new or revisions to existing C/S through individual stakeholders, facilitated task forces, or through laboratory staff supporting these efforts.

The purpose of this Codes and Standards Update is to support the above activities by providing information on efforts being conducted by U.S. standards developing organizations (SDOs) and other entities that are focused on ESS safety.

The information is organized relative to the scope of each document in relation to ESS from the "macro to the micro" (e.g., from overarching covering considerable scope, to installation specific, to ESS and then ESS components). Note that more macro documents are also likely to adopt by reference more micro documents.

Changes in current activity from the prior edition are shown in bold italics. **Time-sensitive items (e.g., those having a schedule/due date) are highlighted in yellow.**

To subscribe to the ES Safety Collaborative and receive ongoing ESS safety- related communications visit https://public.govdelivery.com/accounts/USDOESNLEC/subscriber/new?topic_id=USDOESNLEC_195

[1] DOE OE Energy Storage Systems Safety Roadmap, PNNL-SA-126115 I SAND2017-5140 R https://www.sandia.gov/ess-ssl/publications/EnergyStorage_safetyroadmap_2017.pdf

OVERARCHING CODES AND STANDARDS

	DNV GL – www.dnvgl.com/rules-standards/
Document:	**DNVGL-RP-0043, Safety, Operation, and Performance of Grid-Connected Energy Storage Systems (GRIDSTOR)**
ESS relevance:	The objective of GRIDSTOR is to provide a comprehensive set of recommendations for grid-connected energy storage systems. It aims to be valid in all major markets and geographic regions, for all applications, on all levels from component to system, covering the entire life cycle. End users, operators, and other stakeholders can find specific guidance in the document and references to other relevant standards, codes, and guidelines.
Current activity:	Supporting the second edition of GRIDSTOR released in September 2017. See https://www.dnvgl.com/services/gridstor-recommended-practice-for-grid-connected-energy-storage-52177 for more information.
Date of next edition:	TBD

	International Code Council (ICC) – www.iccsafe.org https://www.iccsafe.org/codes-tech-support/codes/code-development/current-code-development-cycle/
Document:	**International Fire Code (IFC) 2018 & 2021 Editions**
ESS relevance:	Chapter 12 of the IFC covers energy systems and Section 1206 in that chapter covers electrical energy storage systems.
Current activity:	The ICC code development process (CDP) associated with the 2021 IFC has been completed and the 2021 IFC should be published in early 2020. During the process the provisions of the 2018 IFC related to ESS were enhanced to follow the requirements in NFPA 855. A high-level summary of the provisions of the 2015, 2018 and 2021 editions of the IFC is under development. Information on the adoption of the I-Codes is available at https://www.iccsafe.org/advocacy/. Efforts to revise the 2021 IFC are expected to start in 2020 and will include efforts of an ES Task Force under the ICC Fire Code Action Committee. Note that anyone can submit a proposed change to the 2021 IFC (or other I-Codes). See https://www.iccsafe.org/products-and-services/i-codes/code-development/ for more information.
Date of next edition:	2021
Document:	**2021 International Residential Code (IRC)**
ESS relevance:	***Chapter 2 -Definitions, Chapter 3 -Building Planning, Section 327 Energy Storage Systems (2015 referred to as Stationary Storage Battery Systems) (excludes Chapter 11 Energy Efficiency where all proposals regarding energy (IRC and IECC) are lumped together, see activity under IECC below)***
Current activity:	The 2019 Group B Public Comment Hearings (PCH) ended October 30, 2019. Results from the meeting in Las Vegas, NV are now available. Click here for the full results. The Online Governmental Consensus Vote (OGCV) opened November 18, 2019 and closed December 6, 2019. Below is a short summary of the PCH results. A more detailed list is provided in the Special Briefing Update Paper, December 2019. Two proposals were approved that were editorial removing “stationary” storage and “battery” replace with “energy” storage system, added new definitions for renewable energy resources and on-site renewable energy, and new section on commissioning. One proposal to include grid interactive electrical energy storage was disapproved. Two proposals to revamp R327 were initially disapproved (RB153 and RB154). RB154 was disapproved due to concerns with much of the language. During PCH, RB154 was approved as modified with requirements for minor protections to rooms containing ESS. New Section R328 on fuel cell power systems including new definition

	International Code Council (ICC) – www.iccsafe.org https://www.iccsafe.org/codes-tech-support/codes/code-development/current-code-development-cycle/
	was approved as modified from the original proposal submitted. Provisions for adding an ESS room for separation and material installation was disapproved.
Date of next edition:	2021
Document:	**International Building Code (IBC) and International Residential Code (IRC) Plumbing and Mechanical Chapters 2018 and 2021 editions**
ESS relevance:	IBC G– General, IBC-E Egress, IBC-FS Fire Safety provisions, IFC Chapter 10 maintained by IBC-E, IMC, IPC, IRC-M, IRC-P
Current activity:	IBC-G adds "ESS in dedicated use buildings" to the list of building types that are considered moderate-hazard factory industrial, Group F-1 buildings, deletes the stationary storage battery system room/area requirements from the table providing required separation and/or protection requirements (the room is anticipated to be covered under revised Section 1206 of the IFC), add a new Section 3114 covering intermodal shipping containers that are repurposed for use as buildings or structures or as a part of a building or structure but includes an exemption for stationary storage battery arrays located in such containers complying with Chapter 12 of the IFC (modifications do not impact the exception). IBC-FS adds water as a component of certain battery types in the definition (lead acid and Ni-Cd), requires that electrical equipment, wiring, and systems be installed, used, and maintained in accordance with NFPA 70 and provisions in Section 604.2 through 604.11 of the IFC, a comprehensive revision of the provisions in IFC that cover ESSs (see Special Briefing Paper, November 2018 for more details on code changes)
Date of next edition:	2021

	IEEE – www.ieee.org http://standards.ieee.org/about/nesc/
Document:	**IEEE C2-17, National Electric Safety Code (NESC)**
ESS relevance:	Covers electrical safety for utility systems and equipment.
Current activity:	NESC Sub-Committees held meetings to consider all change proposals submitted by the July 16, 2018 deadline and prepared recommendations on each of them. During those meetings the NESC battery section was reorganized into three sections (general, protection and control, and grid storage). The grid storage section is new and provisions for fire protection and spill control were added to that section. A TIA was submitted for the 2017 NESC in response to the gaps expressed during the NFPA 855 development and the utility guidance under the NESC. The link to ANSI Standards Action where the TIA is the first item listed is as follows: https://share.ansi.org/Shared%20Documents/Standards%20Action/2019-PDFs/SAV5049.pdf This is currently in public review in ANSI Standards Action with a deadline for public comment of January 5, 2020. See http://standards.ieee.org/about/nesc/ and https://standards.ieee.org/products-services/nesc/process.html for more information.
Date of next edition:	2022

IEEE – www.ieee.org http://standards.ieee.org/about/nesc/	
Activity:	**IEEE PES Energy Storage and Stationary Battery Committee (ESSB)**
ESS relevance:	This is a growing subcommittee of the power and energy society (PES) that manages many of the standards related to energy storage and battery technologies. http://sites.ieee.org/pes-essb/
Current activity:	An ESSB Safety Codes and Standards Working Group has mobilized their ~~future~~ efforts to play a more active role within IEEE to effectively liaise with various safety codes organizations and ensure that safety codes and standards are understood in the development of IEEE standards related to energy storage systems, ~~and~~ batteries and DC power systems. as well as laying out their involvement in the development of codes and standards by other organizations that are related to energy storage systems and batteries. ***In March 2019, a collaborative Energy Storage Task Force (ESTF) effort between IEEE SA SCC 21 (home of the 1547 series of grid interconnectivity standards) and the IEEE ESSB was brought under the domain of the ESSB Committee and renamed the Energy Storage Collaboration Team (ESCT~~).~~ The scope of the ESCT is to coordinate standards development for energy storage systems among IEEE Societies and technical committees as well as other standards development groups.*** An example of this collaborative effort is the joint sponsorship of IEEE P1547.9 Guide for ES Interconnection which had its kick-off working group (WG) meeting on February 28, 2019 at NERC headquarters in Atlanta.

National Fire Protection Association (NFPA) – www.nfpa.org	
Document:	**NFPA 1-21, Fire Code**
ESS relevance:	Chapter 52 of the 2021 edition that is under development includes extracts referencing NFPA 855 for requirements related to the installation of energy storage systems. Requirements recognize both established battery technologies and new energy storage technologies. Provisions apply to new and existing energy storage system applications. Note that the 2018 version did not contain such extracts. The 2018 version of NFPA 1 only included requirements ~~as~~ developed by the NFPA 1 committee and approved for the 2018 edition.
Current activity:	The second draft meeting to act on public comments associated with proposed changes to NFPA 1 was held November 6, 2019. ***The second draft report will be posted February 12, 2020, with a deadline for filing a NITMAM of March 11, 2020.*** See https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=1&tab=nextedition for more information
Date of next edition:	2021
Document:	**NFPA 70-20, National Electrical Code (NEC)**
ESS relevance:	Article 706 (new in the 2017 edition) applies to energy storage systems and Article 480 remains applicable to batteries, in addition to other criteria in the NEC relevant to electrical equipment and installations. The NEC is made up of 18 Code Making Panels (CMP's). CMP 4 covers requirements for articles 690 for PV and 705 for Interconnections. CMP 13 covers requirements for articles 480 for batteries, and article 706 for ESS.
Current activity:	The 2020 edition was published on August 25, 2019. **Public inputs (e.g. proposed changes) to the 2020 NEC that will be considered during the 2023 cycle are due on June 10, 2020**. See https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=70&tab=nextedition https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=70&tab=nextedition for more information.

	National Fire Protection Association (NFPA) – www.nfpa.org
Date of next edition:	2023

Document:	**NFPA 5000-18, Building Code**
ESS relevance:	Provides a basis for adoption and application of other standards.
Current activity:	***The second draft report will be posted on Jan 22, 2020, and deadline for Notice of Intent to Make a Motion (NITMAM)s is Feb 19, 2020.*** See https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=5000&tab=nextedition for more information.
Date of next edition:	2021

CODES AND STANDARDS FOR ESS INSTALLATIONS

	FM Global – http://www.fmglobal.com (https://www.fmglobal.com/research-and-resources/fm-global-data-sheets)
Document:	**FM Global Property Loss Prevention Data Sheet # 5-33, Electrical Energy Storage Systems**
ESS relevance:	The data sheet describes loss prevention recommendations for the design, operation, protection, inspection, maintenance, and testing of electrical energy storage systems, which can include batteries, battery chargers, battery management systems, thermal management and associated enclosures and auxiliary systems. The focus of this data sheet is primarily on lithium-ion battery technology.
Current activity:	Work to update the data sheet via an interim revision will begin in 2019. Typically data sheets are developed internally at FM Global with support from FM Global field operations. ***See https://www.fmglobal.com/research-and-resources/fm-global-data-sheets for more information.***
Date of next edition:	2019 (est.).

	IEEE – www.ieee.org
Document:	**IEEE 1635-18/ASHRAE Guideline 21-18, Guide for Ventilation and Thermal Management of Batteries for Stationary Applications**
ESS relevance:	Covers how stationary battery systems utilizing vented lead-acid (VLA), valve-regulated lead-acid (VRLA) and nickel-cadmium (NiCad) stationary battery applications can be provided with appropriate ventilation and thermal management.
Current activity:	The revisions to the 2012 edition have been completed and the 2018 edition of the document was published on July 31, 2018.
Date of next edition:	TBD
Document:	**IEEE 1578-18, Recommended Practice for Stationary Battery Electrolyte Spill Containment and Management**
ESS relevance:	Provides descriptions of products, methods, and procedures relating to stationary batteries, battery electrolyte spill mechanisms, electrolyte containment and control methodologies, and firefighting considerations.
Current activity:	None. The standard was approved October 23, 2018 and is available at https://standards.ieee.org/standard/1578-2018.html
Date of next edition:	TBD

	National Electrical Contractors Association (NECA)—www.necanet.org
Document:	**NECA 416-16, Recommended Practice for Installing Stored Energy Systems**
ESS relevance:	National Electrical Installation Standards (NEISs) are designed to improve communication among specifiers, purchasers, and suppliers of electrical construction services and are intended to be referenced in contract documents for electrical construction projects. NECA 416-16 describes installation practices for energy storage systems such as battery systems, flywheels, ultra-capacitors, and smart chargers used for electric vehicle (EV) vehicle-to-grid (V2G) applications.
Current activity:	Suggestions for revisions and improvements to this document are welcome and can be directed to NECA at www.neca-neis.org

	National Electrical Contractors Association (NECA)—www.necanet.org
Date of next edition:	TBD based on current activity.
Document:	**NECA 417 (new standard), Recommended Practice for Designing, Installing, Maintaining, and Operating Micro-grids**
ESS relevance:	The document is designed to improve communication among specifiers, purchasers, and suppliers of electrical construction services and is intended to be referenced in contract documents for electrical construction projects. NECA 417 will cover the design, installation, maintenance, and operation of microgrids.
Current activity:	The fourth ballot for NECA 417, which closed on January 28, 2019, did not receive the required minimum number of returned votes. A new ballot opened on February 15, 2019 and closed on March 17, 2019. This is expected to be the last ballot for this standard. See http://www.neca-neis.org/ballot/fifth-ballot-for-creation-of-neca-417-201x-recommended-practice-for-designing-installing-operating-and-maintaining-microgrids for more information.
Date of first edition:	***Anticipated on X date.***

	National Fire Protection Association (NFPA) – www.nfpa.org
Document:	**NFPA 855-20, Standard for the Installation of Stationary Energy Storage Systems**
ESS relevance:	The standard covers the safety of all energy storage systems and their installation in the built environment. Chapters of the standard cover equipment, protection and installation, limitations on energy storage system capacity as a function of technology and location and then provide additional criteria focused on specific energy storage system technologies. Requirements for commissioning, O&M, emergency response, and decommissioning are also included in the standard.
Current activity:	The first edition (2020) of the standard was published on August 6, 2019. Based on the floor action at the NFPA Conference on Certified Amending Motions submitted requesting exemption from the scope of standard for utilities, the Standards Council made the final decision to revert to previous language. The net effect for a First Edition (with no previous language), is that the standard is published with a "Reserved" scope as no previous language exists. The Technical Committee held Pre-First Draft meetings on Nov 19-20, 2019 in preparation for the 2023 cycle, out of which a new edition of the standard will be published. ***The Public Input period, which is open to any interested party to submit a proposed change for consideration, is open until June 30, 2020***
Date of first edition:	**2020**
Document:	**NFPA 1078 (new standard), Standard for Electrical Inspector Professional Qualifications**
ESS relevance:	Addressed qualifications of those who would review and approve electrical plans and conduct electrical inspections. Such plan reviews and electrical inspections would include, but not be limited to, energy storage systems.
Current activity:	The edition was published on June 10, 2019. The standard was moved from the Annual 2022 to the Annual 2023 revision cycle with the document open for public input. Public input closing date is June 1, 2021. See https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=1078&tab=nextedition for more information.
Date of first edition:	2020

	National Fire Protection Association (NFPA) – www.nfpa.org
Document:	**NFPA 78 (new standard), Guide on Electrical Inspections (proposed edition).**
ESS relevance:	This document covers the minimum criteria to aid in organizing and conducting electrical inspections, including plan review and field inspection. Such plan reviews and electrical inspections would include, but not be limited to, energy storage systems.
Current activity:	The first draft report was open for submission of public comments with a closing date of October 31, 2018. The second draft meeting occurred February 26-27, 2019 in Tampa, FL. ***The second draft report will be posted April 5, 2019 and the closing date to submit a NITMAM is April 26, 2019.*** See https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=78&tab=nextedition for more information.
Date of first edition:	2021

CODES AND STANDARDS FOR A COMPLETE ESS

	American Society of Mechanical Engineers (ASME) – www.asme.org
Document:	**TES-1 (new standard) Safety Standard for Thermal Energy Storage Systems**
ESS relevance:	Provides safety-related criteria for molten salt thermal energy storage systems.
Current activity:	A revised TES-1 draft was sent to the Committee for Review & Comment Ballot, which closed on February 22, 2019. Four committee members submitted comments, which were discussed during the TES Standards Committee teleconference meeting on March 21, 2019. As a result, the draft was further revised and was issued for First Consideration Ballot to the committee members with a due date of April 22, 2019. Committee is addressing public review comments.
Date of first edition:	2020
Document:	**TES-2 (new standard) Safety Standard for Thermal Energy Storage Systems, Requirements for Phase Change, Solid and Other Thermal Energy Storage Systems**
ESS relevance:	The TES-2 standard will provide guidance on the design, construction, testing, maintenance, and operation of thermal energy storage systems, including but not limited to phase change materials and solid state energy storage media. This standard will be suitable for use by manufacturers, owners, employers, users, and others concerned with, or responsible for its application by prescribing safety requirements.
Current activity:	A PINS has been filed with ANSI to develop a new standard. The TES Standards Committee is currently seeking participants with in-depth knowledge of phase change thermal energy storage systems who are interested in joining the committee. For more information or to join the Committee, contact Nicole Gomez at gomezn@asme.org.
Date of first edition:	TBD

	National Electrical Manufacturers Association – www.nema.org
Document:	**ESS-1-2019 Standard for Uniformly Measuring and Expressing the Performance of Electrical Energy Storage Systems**
ESS relevance:	Provides safety-related criteria for electrical ESSs.
Current activity:	The standard was published in February 2019. ***See https://www.nema.org/Standards/Pages/Standard-for-Uniformly-Measuring-and-Expressing-the-Performance-of-Electrical-Energy-Storage-Systems.aspx for more information.***
Date of next edition:	TBD

	National Fire Protection Association (NFPA) – www.nfpa.org
Document:	**NFPA 791-2018, Recommended Practice and Procedures for Unlabeled Electrical Equipment**
ESS relevance:	Provides recommended procedures for evaluating unlabeled electrical equipment for compliance with nationally recognized standards. As such if an ESS were unlabeled NFPA 791 could be used to evaluate the acceptability of an ESS.
Current activity:	Changes to NFPA 791 that would foster its application to an ESS were submitted and considered by the NFPA 791 committee. Many of those changes were accepted. **The final draft is available with a closing date of February 19, 2020 to file a NITMAM.**
Date of next edition:	2021

Underwriters Laboratories Inc.®	Underwriters Laboratories (UL) – https://ulstandards.ul.com/develop-standards/
Document:	**ANSI/CAN/UL 9540, Energy Storage Systems and Equipment**
ESS relevance:	Product safety standard for an energy storage system.
Current activity:	The first edition of the standard was issued November 21, 2016. A 2nd edition is being developed. New public review comments were received during the 2019-10-18 Recirculation of the proposed 2nd edition of ANSI/CAN/UL 9540. **As such, a second recirculation is required for a minimum of 14 days if no additional changes are needed, or for a minimum of 30 days if revisions are needed. The second recirculation work area will open once responses to comments are posted in the 2019-10-18 UL 9540 Recirculation work area. A second recirculation bulletin went out December 20, 2019 with comment due January 20, 2020.** ***See https://csds.ul.com/Home/ProposalsDefault.aspx for more information on the preliminary review proposal for UL 9540.***
Date of next edition:	Expected in 2020 – UL standards are under continuous maintenance and are updated as warranted
Document:	**UL 9540A, Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems (BESSs)**
ESS relevance:	This test method evaluates the fire characteristics of a battery energy storage system that undergoes thermal runaway. The data generated can be used to determine the fire and explosion protection required for an installation of a battery energy storage system.
Current activity:	The 4th Edition of ANSI/CAN/UL 9540A was published on November 12, 2019. The published standard can be purchased or Digitally Viewed from: https://www.shopulstandards.com/ProductDetail.aspx?UniqueKey=36503 2 CRDs (certification requirement decisions) will be published in January 2020 dealing with some corrections to the test method such as making the FTIR an optional gas analysis since it is redundant to FID gas analysis which is still a requirement, and correcting wait times after charging of samples to reflect current practice. These changes have also been submitted as proposals to the 4th edition of UL 9540A and should be out sometime in 2020 for review and comment. UL is proposing UL 9540A as a Joint National Standard for Canada and the United States, ANSI/CAN/UL 9540A. ***See https://csds.ul.com/Home/ProposalsDefault.aspx for more information on the proposal for UL 9540A.***
Date of next edition:	TBD – UL standards are under continuous maintenance and are updated as warranted

CODES AND STANDARDS FOR ESS COMPONENTS

CSA Group	CSA GROUP (CSA) – www.csagroup.org
Document:	**CSA C22.2 No. 107.1-2016, Power Conversion Equipment**
ESS relevance:	Applies to alternating current (AC) and direct current (DC) type power conversion equipment, which can be associated with an energy storage system.
Current activity:	The standard is under continuous maintenance and updated as warranted. See https://webstore.ansi.org/Standards/CSA/CSAC221072016 for more information on the standard.
Date of next edition:	TBD
Document:	**CSA C22.2 No. 340-20XX (new standard), Battery Management Systems**
ESS relevance:	The standard covers the design, performance, and safety of battery management systems (electronic or electromechanical systems that control or regulate a battery or batteries, which may include external communication capabilities).
Current activity:	A technical committee has been formed to develop the first standard draft, which had is initial meeting December 12, 2019. For more information contact Mohsen Sepehr at mohsen.sepehr@csagroup.org. Note that IEEE is developing a guide on battery management systems (BMS), P2686-"Battery Management Systems in Energy Storage Applications". The CSA standard will be a consensus safety standard and the IEEE document (a publicly available specification or PAS) will be a non-normative guide that details more procedural aspects of implementing a BMS and the techniques to achieve best functionality of a BMS. The CSA Group and IEEE are aware of each other's activities and have established liaisons to one another.
Date of first edition:	TBD

IEEE Advancing Technology for Humanity	IEEE – www.ieee.org
Document:	**IEEE 1679.1-17, Guide for the Characterization and Evaluation of Lithium-Based Batteries in Stationary Applications**
ESS relevance:	Provides appropriate information about the safety attributes and operating conditions related to stationary applications of lithium-based batteries including recommendations for how to characterize lithium-ion battery performance and safety in stationary applications. Very general and nonprescriptive content with the caveat to "consult the manufactures recommendations" for specific devices or technologies. The guide points to existing standards (e.g., UL 1642) and existing regulatory requirements (e.g., adoption of NFPA 70) wherever possible. The 2017 edition was approved on December 6, 2017 and published on January 31, 2018.
Current activity:	An active working group is engaged in considering updates to the standard. ***See https://standards.ieee.org/standard/1679_1-2017.html for more information.***
Date of next edition:	TBD

IEEE Advancing Technology for Humanity	IEEE – www.ieee.org
Document:	**IEEE P1679.2-18, Guide for the Characterization and Evaluation of Sodium-Beta Batteries in Stationary Applications**
ESS relevance:	Provides the similar information and content as described above for lithium-based batteries but for sodium-beta batteries instead.
Current activity:	***None. See https://standards.ieee.org/standard/1679_2-2018.html for more information concerning the 2018 edition that was published on December 21, 2018.***
Date of first edition:	2018
Document:	**IEEE P1679.3 (new standard under development), Guide for the Characterization and Evaluation of Flow Batteries in Stationary Applications**
ESS relevance:	Provides the similar information and content as described above for Lithium and Sodium batteries used in Energy Storage applications but for flow batteries instead.
Current activity:	***The working group will meet at the IEEE ESSB 2020 Winter General Meeting in Orlando FL, February 10-14, 2020 (*** https://cmte.ieee.org/pes-essb/ ***).*** Contact the working group chair to get involved: Vilayanur ("Vish") Viswanathan, vilayanur.viswanathan@pnnl.gov.
Date of first edition:	TBD
Document:	**IEEE P2686 (new standard under development) Recommended Practice for Battery Management Systems in Energy Storage Applications**
ESS relevance:	As opposed to a Guide, this recommended practice includes information on the design, installation, and configuration of battery management systems (BMS) in stationary energy storage applications, including both grid-interactive, standalone cycling and certain standby modes where overlap may exist. This document will cover battery management hardware, software, and configuration parameters. Hardware capabilities in large systems include grounding and isolation; passive and active balancing; and wired or wireless sensors. Software capabilities include algorithms for optimal operation with reduced risk; best practices for verification and validation; alarms; and communication with external systems. Common settings are discussed along with setting selection methods. Battery types that this document covers include lithium-ion, sodium-beta, advanced lead-acid, and flow batteries. General factors for other types are provided. Note that the CSA is developing a document on battery management systems (CSA C22.2 No. 340). The IEEE recommended practice will focus on non-normative design options and best practices rather than safety requirements. The CSA Group and IEEE are aware of each other's activities and have established liaisons with one another.
Current activity:	***The working group will meet at the IEEE ESSB 2020 Winter General Meeting in Orlando FL, February 10-14 (*** https://cmte.ieee.org/pes-essb/ ***).*** Contact the working group chair David Rosewater, dmrose@sandia.gov to get involved.
Date of first edition:	TBD
Document:	IEEE P1547.9 (new standard under development) Guide to Using the IEEE Standard 1547 series for Interconnection of Energy Storage Distributed Energy Resources with Electric Power Systems
ESS relevance:	Addresses how to interconnect ESS (and other distributed energy resources) to power systems. It will also consider ESS-related topics not addressed or fully covered in IEEE 1547 such as guidance on when ESS are or are not within the scope of IEEE 1547.
Current activity:	The second meeting of the working group developing this standard occurred October 31-November 1, 2019 as a remote/Skype meeting. ***The working group will meet next in Austin Texas, February 24-26, 2020.*** Contact one of the working group chairs, Michael Ropp meropp@sandia.gov or Jim McDowall jim.mcdowall@saftamerica.com to get involved.
Date of first edition:	TBD

Underwriters Laboratories Inc.®	Underwriters Laboratories (UL) – https://ulstandards.ul.com/develop-standards/
Document:	**ANSI/UL 810A, Electrochemical Capacitors**
ESS relevance:	Addresses the safety of electrochemical capacitors, which can be used as an energy source in energy storage systems.
Current activity:	The first edition of the standard was reaffirmed via a CSDS bulletin on February 3, 2017 and approved by ANSI on March 28. 2017.
Date of next edition:	TBD - UL standards are under continuous maintenance and are updated as warranted.
Document:	**UL 1642, Lithium Batteries**
ESS relevance:	Lithium cell/battery requirements for battery systems that would be employed in energy storage systems.
Current activity:	The fifth edition of the standard was published March 13, 2012 and revised in 2013 and 2015. Three topics were balloted June 24, 2019: (1) Proposed new requirements for soft-case prismatic cells, (2) Clarification of Projectile Test set-up, and (3) Revision of Coin Cell warning marking. Topic 1 has failed and will be forwarded on to a Task Group for further development. Topic 2 will be recirculated to propose additional changes. Topic 3 achieved consensus and will be published once Topic 2 has been recirculated. **See https://csds.ul.com/Home/ProposalsDefault.aspx for more details on the Recirculation of UL 1642, Topic 2, once available.**
Date of next edition:	TBD - UL standards are under continuous maintenance and are updated as warranted.
Document:	**UL 1741, Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources**
ESS relevance:	Applies to the subject technology when used in conjunction with an energy storage system.
Current activity:	***The Second Edition of UL 1741 has been published with an edition date of March 8, 2018. See https://www.shopulstandards.com/ProductDetail.aspx?UniqueKey=20941 for more information.*** ***Revisions contained in the second edition address rapid shutdown to better align UL 1741 with the Standard for Photovoltaic (PV) Module Safety Qualification - Part 1: Requirements for Construction, UL 61730-1.*** A Preliminary Review Proposal was issued November 13, 2019 with comments due November 27, 2019 proposing new requirements for Grid Support Utility Interactive Interoperability Optional Functions: Prevent Enter Service and Limit Active Power (CA Rule 21, Phase 3, functions 2 and 3). Comments were received and are being considered. **See https://csds.ul.com/Home/ProposalsDefault.aspx for any future proposal activity for UL 1741.**
Date of next edition:	TBD - UL standards are under continuous maintenance and are updated as warranted.
Document:	**ANSI/CAN/UL 1973, Standard for Batteries for Use in Stationary, Vehicle Auxiliary Power and Light Electric Rail (LER) Applications**
ESS relevance:	Battery systems that would be employed in energy storage systems
Current activity:	The second edition of the standard was issued February 7, 2018. A Call for Proposals for UL 1973 was sent out to STP members and standard subscribers. Numerous proposals were received. These proposals are being included in a preliminary review document that will be sent out for comment only to the STP and standard subscribers in the future. **See https://csds.ul.com/Home/ProposalsDefault.aspx for future preliminary review proposal activity for UL 1973.**
Date of next edition:	TBD – UL standards are under continuous maintenance and are updated as warranted.

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Document:	**ANSI/CAN/UL 1974-18, Evaluation for Repurposing Batteries**
ESS relevance:	This standard covers the sorting and grading process of battery packs, modules and cells, and electrochemical capacitors that were originally configured and used for other purposes, such as electric vehicle (EV) propulsion, and that are intended for a repurposed use application, such as for use in stationary energy storage systems and other applications. The process of sorting and grading these devices is essentially determining their state of health and other parameters to identify continued viability and the rating mechanisms the repurposing manufacturer may use for those that are determined suitable for continued use. This standard also covers application specific requirements for battery packs utilizing repurposed batteries and components.
Current activity:	The first edition of the Joint National Standard for Canada and the United States, ANSI/CAN/UL 1974 was published October 25, 2018. See https://www.shopulstandards.com/ProductDetail.aspx?UniqueKey=35079 for more information on the published standard.
Date of next edition:	TBD – UL standards are under continuous maintenance and are updated as warranted.
Document:	**UL 2580, Batteries for Use in Electric Vehicles**
ESS relevance:	This standard covers electrical energy storage assemblies such as battery packs and combination battery pack-electrochemical capacitor assemblies and the subassembly/modules that make up these assemblies for use in electric-powered vehicles. The requirements evaluate the electrical energy storage assembly's ability to safely withstand simulated abuse conditions and prevents any exposure of persons to hazards as a result of the abuse. This standard evaluates the electric energy storage assembly and modules based upon the manufacturer's specified charge and discharge parameters at specified temperatures. UL 1974 references UL 2580 for battery construction and cell safety requirements.
Current activity:	***This standard is a Joint Binational Standard with ULC.*** Proposed revisions were released for ballot and comment on February 8, 2019, with ballots and comments due April 9, 2019. Additional revisions were recirculated with comments due September 23, 2019 and maintained consensus. ***Revisions will be Published in a Joint 3rd edition of ANSI/CAN/UL/ULC 2580, expected in the first quarter of 2020.*** ***See https://www.shopulstandards.com/ProductDetail.aspx?UniqueKey=35420 for more information on the proposal out for ballot and comment.***
Date of next edition:	TBD – UL standards are under continuous maintenance and are updated as warranted.
Document:	**UL CSDS Proposal 62133-1, Secondary Cells and Batteries Containing Alkaline or Other Non-Acid Electrolytes - Safety Requirements for Portable Sealed Secondary Cells, and for Batteries Made from Them, for Use in Portable Applications - Part 1: Nickel Systems**
ESS relevance:	Subject 62133-1 is an IEC based standard that specifies requirements and tests for the safe operation of portable sealed secondary nickel cells and batteries containing alkaline electrolyte for Canada and the US.
Current activity:	The proposed first edition of UL 62133-1 was sent out for ballot on April 12, 2019 with ballots comments due May 28, 2019. The proposed standard is a binational standard with CSA Group and harmonized with the first edition of IEC 62133-1. ***The proposed 1st edition of UL 62133-1 achieved consensus and will be published first quarter of 2020.*** See https://www.shopulstandards.com/ProductDetail.aspx?UniqueKey=35323 for more information.
Date of publication:	TBD

Underwriters Laboratories Inc.®	Underwriters Laboratories (UL) – https://ulstandards.ul.com/develop-standards/
Document:	**UL CSDS Proposal 62133-2, Secondary Cells and Batteries Containing Alkaline or Other Non-Acid Electrolytes - Safety Requirements for Portable Sealed Secondary Cells, and for Batteries Made from Them, for Use in Portable Applications - Part 2: Lithium Systems**
ESS relevance:	Subject 62133-2 is an IEC based standard that specifies requirements and tests for the safe operation of portable sealed secondary lithium cells and batteries containing non-acid electrolyte for Canada and the U.S..
Current activity:	The proposed first edition of UL 62133-2 was sent out for ballot on April 12, 2019 with ballots comments due May 28, 2019, and then a recirculation was opened September 5, 2019 and closed September 19, 2019. The proposed standard is a binational standard with CSA Group and harmonized with the first edition of IEC 62133-2. ***The proposed 1st edition of UL 62133-2 achieved consensus and will be published first quarter of 2020.*** See https://www.shopulstandards.com/ProductDetail.aspx?UniqueKey=353244 for more information.
Date of publication:	TBD

Every effort is made by the Pacific Northwest National Laboratory (PNNL) and Sandia[1] staff to ensure the accuracy of the information presented in this report. PNNL and Sandia very much appreciate the input from staff of the standards developing organizations (SDOs) covered in the report as well as volunteers who are involved in one or more of the SDO initiatives covered in this document. Suggestions for revision, additions, and enhancements to this document are welcome and encouraged.

We at PNNL and Sandia, on behalf of the U.S. Department of Energy, Office of Energy, Energy Storage System Program whose support has made this report possible, want this document to be "the" source of information about codes and standards related to ESS safety. With your help we can make that happen and as outlined on page one achieve the codes and standards related objective in the ESS Safety Roadmap and the goal of fostering confidence in the safety and reliability of ESSs. For more information about the ESS Safety Roadmap efforts visit http://www.sandia.gov/ess/. For questions related to or to provide input on this document, please contact matthew.paiss@pnnl.gov

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Sandia National Laboratories

Contact Information

For more information about this document and/or ES Safety Collaborative activities, contact:

Josh Lamb
Principle Member of the Technical Staff
Sandia National Laboratories
P.O. Box 5800 MS 0613
Albuquerque, NM87185-0613
Phone: 505-284-9709

Pacific Northwest NATIONAL LABORATORY

Contact Information

For more information about this document and/or ES Safety Collaborative activities, contact:

Matthew Paiss
Pacific Northwest National Laboratory
P.O. Box 999, MSIN K2-44
Richland, WA 99352
Phone: 831-566-3057
Email: matthew.paiss@pnnl.gov