

Highlights

SAND2019-1940R

The second draft report on NFPA 855 has been posted. The closing date to submit a NITMAM is April 29, 2019.

The first draft report on NFPA 791 has been posted. The closing date to submit a public comment is May 8, 2019.

ESS-1-2019 Standard for Uniformly Measuring and Expressing the Performance of Electrical Energy Storage Systems has been published by NEMA.

A revised draft of ASME TES-1 was submitted for committee ballot and the committee will meet via teleconference on March 21, 2019 to discuss any comments received and implement further revisions to the draft if necessary.

A new ballot for NECA 417 opened on February 15, 2019 and will close on March 17, 2019.

The final action results on the Group A proposed changes to the ICC International Codes have been published.

CODES AND STANDARDS UPDATE FEBRUARY 2019

The goal of the DOE OE Energy Storage System Safety Roadmap¹ 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:

- Review and assess C/S which affect the design, installation, and operation of energy storage systems (ESS).
- Identify gaps in knowledge that require research and analysis that can serve as a basis for criteria in those C/S.
- Identify areas in C/S that are potentially in need of revision or enhancement and can benefit from activities conducted under research and development.
- 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 | 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:	2018 International Fire Code (IFC)
ESS relevance:	Chapter 12 of the IFC covers energy systems and Section 1206 in that chapter covers electrical energy storage systems.
Current activity:	<i>The final action on all code change proposals has been posted (See https://www.iccsafe.org/codes-tech-support/codes/code-development/current-code-development-cycle/ for more information).</i> The final actions did NOT change the outcome of any of the proposed changes to the IFC as reported in the November 2018 Special Brief covering the results of the public comment hearings on proposed code changes to the IFC related to ESS safety. See https://www.sandia.gov/energystoragesafety-ssl/wp-content/uploads/2018/11/ICC-2018-ESS-code-changes-11-2018-002.pdf
Date of next edition:	2021
Document:	2018 International Residential Code (IRC)
ESS relevance:	A section of the IRC covers energy storage systems.
Current activity:	See current activity above under the IFC.
Date of next edition:	2021
Document:	2018 International Building Code (IBC) (except structural)
ESS relevance:	Provides a basis for adoption and application of other standards and ICC model codes.
Current activity:	<i>See current activity above under the IFC. The final actions DID change the outcome of one of the proposed changes to the IBC (G91-18 was disapproved)</i> reported in the November 2018 Special Brief covering the results of the public comment hearings on proposed code changes to the IBC related to ESS safety. See https://www.sandia.gov/energystoragesafety-ssl/wp-content/uploads/2018/11/ICC-2018-ESS-code-changes-11-2018-002.pdf
Date of next edition:	2021

	<p align="center">International Code Council (ICC) – www.iccsafe.org https://www.iccsafe.org/codes-tech-support/codes/code-development/current-code-development-cycle/</p>
Document:	2018 International Mechanical Code (IMC)
ESS relevance:	Includes basic requirements for stationary fuel cell power systems and criteria for ventilation and exhaust of spaces.
Current activity:	See current activity above under the IFC.
Date of next edition:	2021
Documents:	2018 International Building Code (structural), International Existing Buildings Code, International Energy Conservation Codes, International Residential Code (energy and building) and International Green Construction Code
ESS relevance:	No direct relevance, although some provisions in these codes could indirectly impact ESS. These codes are included because they are part of the package of ICC model codes.
Current activity:	Proposed changes were due January 14, 2019 and will be considered during 2019 as the IFB, IBC, IRC and IMC were during 2018. The Committee Action Hearings for these codes will occur April 28 to May 8, 2019 in Albuquerque, NM. See http://media.iccsafe.org/2019_CAH/index.html for more information.
Date of next edition:	2021


	<p align="center">IEEE – www.ieee.org http://standards.ieee.org/about/nesc/</p>
Document:	IEEE C2-17, National Electric Safety Code (NESC)
ESS relevance:	Covers electrical safety for utility systems and equipment.
Current activity:	NESC Sub-Committees have held meetings to consider all change proposals and prepare recommendations. 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 preprint of change proposals, that opens the comment period, is scheduled for release July 1, 2019 with comments due March 1, 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
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:	<p>An ESSB task force on codes and standards is organizing their future efforts associated with development of IEEE standards related to energy storage systems and batteries 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. The IEEE ESSB held their Winter General Meeting in Phoenix AZ, February 4-8, 2019.</p> <p>The ESSB and IEEE Standard Association's Standards Coordinating Committee 21 have formed the joint Energy Storage Task Force (ESTF). The ESTF will coordinate standards development for energy storage systems that encompass DC through AC scope. A first deliverable from the ESTF was the approved PAR (IEEE project request) to create IEEE P1547.9, Guide for ES Interconnection, <i>which is having its kick-off working group meeting on February 28, 2019 in Atlanta in conjunction with the IEEE 1547 meetings.</i></p>





National Fire Protection Association (NFPA) – www.nfpa.org


Document:	NFPA 1-18, Fire Code
ESS relevance:	Chapter 52 (new in the 2018 edition) includes 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.
Current activity:	The first draft meeting to act on public inputs was held September 18 and 19, 2018 and an extract review meeting was held November 15, 2018 at which time a task force was formed to review NFPA 855 for inclusion by reference in NFPA 1. The first draft report is scheduled to be posted on March 27, 2019 and will have a June 5, 2019 public comment closing date. 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 and to view the public comments and first draft committee information.
Date of next edition:	2021
Document:	NFPA 70-17, 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.
Current activity:	The Second Draft Report is scheduled to be posted April 5, 2019 and the closing date for NITMAMs (notice of intent to make an amendment) is April 26, 2019. See https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=70&tab=nextedition for more information.
Date of next edition:	2020
Document:	NFPA 5000-18, Building Code
ESS relevance:	Provides a basis for adoption and application of other standards.
Current activity:	The first draft report was posted on February 27, 2019 and will have a public comment closing date of May 8, 2019. 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

	<p style="text-align: center;">FM Global – http://www.fmglobal.com (https://www.fmglobal.com/research-and-resources/fm-global-data-sheets)</p>
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.
Date of next edition:	Publication of updated data sheet is expected in 2019.


	<p style="text-align: center;">IEEE – www.ieee.org</p>
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

	<p style="text-align: center;">National Electrical Contractors Association (NECA)—www.necanet.org</p>
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
Date of next edition:	TBD based on current activity.


	National Electrical Contractors Association (NECA)—www.necanet.org
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:	<i>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 will close 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.</i>
Date of first edition:	<i>Anticipated after the results of the current ballot, which closes on March 17, 2019.</i>


	National Fire Protection Association (NFPA) – www.nfpa.org
Document:	NFPA 855, 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.
Current activity:	The ballot on the second revisions closed February 8, 2019 and the second draft was posted on February 18, 2019. The closing date to submit a NITMAM is April 29, 2019.
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 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. No public comments were received on the document. 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:	2021
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. 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


 <small>SETTING THE STANDARD</small>	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:	<i>The complete draft of the standard was issued for public review, which closed on January 8, 2019. Comments were received from one commenter, which were reviewed by the ASME TES Standards Committee during a meeting on January 17 2019. Based on the meeting discussion, it was deemed that changes to the draft were necessary, therefore a revised TES-1 draft has been submitted to the committee for a Review & Comment Ballot that closed on February 22, 2019. The Committee will meet via teleconference on March 21, 2019 to discuss any comments received and implement further revisions if necessary.</i>
Date of first edition:	TBD
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:	<i>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.</i>
Date of first edition:	TBD
Document:	PTC 53 (new standard) Performance Test Code for Mechanical and Thermal Energy Storage Systems
ESS relevance:	Provides test methods for conducting performance tests on mechanical and thermal energy storage systems intended for various energy storage applications.
Current activity:	Sections 1 to 3 of the standard have been published as a draft standard for trial use. See https://www.asme.org/products/codes-standards/ptc-53-2018-thermal-energy-storage-systems-draft for more information. The PTC 53 Committee is currently pursuing the approval process for the Sections 4 to 7 of the standard, which contains the instrumentation and uncertainty requirements for the performance test. The Committee welcomes participation by any interested in aiding in the development of the standard. Contact Donnie Alonzo (alonzod@asme.org) at ASME for more information.
Date of first edition:	It is anticipated that the publication of PTC 53 will be complete before the end of 2019.


	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:	<i>The standard was published in February 2019. For more information see www.nema.org.</i>
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:	Could form a basis for assessing an energy storage system that is not labeled. Note that recommended practices are guides and are not documents that can be enforced by jurisdictions.
Current activity:	<i>A number of changes were submitted during the prior public comment period to help ensure the standard could better address ESS. Many of those changes were approved and appear in the first draft revisions. The first draft report was posted February 12, 2019. Public comments are being accepted with a closing date of May 8, 2019.</i>
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. UL is preparing a proposed 2 nd edition of UL 9540 based on the proposal requests submitted. Once final input is received from the proposal submitters, the proposed second edition should be ready to be sent for preliminary review in early 2019. See https://csds.ul.com/Home/ProposalsDefault.aspx for more information on the upcoming preliminary review proposal for UL 9540 once it is available in CSDS.
Date of next edition:	TBD – 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:	<p>A third edition of the standard was issued June 15, 2018. A Certification Requirement Decision (CRD) has been published for UL 9540A to clarify current practice for the cell portion of the test method. See https://www.shopulstandards.com/ProductDetail.aspx?UniqueKey=34477 to purchase the standard and access the information with regards to the CRD.</p> <p>UL is proposing UL 9540A as a Joint National Standard for Canada and the United States, ANSI/CAN/UL 9540A. The draft standard was out for preliminary review starting November 26, 2018 with comments due December 20, 2018. Comments were received during preliminary review and are being considered before proceeding to ballot. See https://www.shopulstandards.com/ProductDetail.aspx?UniqueKey=35170 for more information on the proposal that was out for preliminary review.</p>
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:	<p>A standard seed document is under development by a Task Force. The seed document will be used as a starting point by the development committee to develop the first standard draft. CSA is still accepting members to join the working group. For more information and to join contact Mohsen Sepehr at mohsen.sepehr@csagroup.org.</p> <p>Note that IEEE is also planning to develop a document on battery management systems (BMS). The CSA standard will be a consensus safety standard and the IEEE document (a publically 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.</p>
Date of first edition:	TBD

 IEEE <small>Advancing Technology for Humanity</small>	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
Document:	IEEE P1679.2-18, Guide for the Characterization and Evaluation of Sodium-Beta Batteries in Stationary Applications
ESS relevance:	Provides the same 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), Guide for the Characterization and Evaluation of Flow Batteries in Stationary Applications
ESS relevance:	Provides the same information and content as described above for Lithium-based batteries but for flow batteries instead.
Current activity:	<i>The working group had a meeting during the IEEE ESSB 2019 Winter General Meeting in Phoenix AZ, February 4-8. Contact the working group chair to get involved: Vilayanur ("Vish") Viswanathan, vilayanur.viswanathan@pnnl.gov</i>
Date of first edition:	TBD
Document:	IEEE P2686 (new standard) Recommended Practice for Battery Management Systems in Energy Storage Applications
ESS relevance:	<p>This recommended practice includes information on the design, installation, and configuration of battery management systems in stationary applications, including both grid-interactive, standalone cycling and standby modes. This document covers battery management hardware, software, and configuration. 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.</p> <p>Note that the CSA will also develop a document on battery management systems. The IEEE recommended practice will focus on non-normative design options and best-practices rather than requirements. The CSA Group and IEEE are aware of each other's activities and have established liaisons to one another.</p>
Current activity:	<i>The kickoff meeting for the newly approved working group was held at the IEEE ESSB 2019 Winter General Meeting in Phoenix AZ, February 4-8, 2019. The working group formed four study groups to collect information and references that will be used in the initial draft: BMS requirements, failure mode analysis, modelling, and architecture. Each study group will present their findings at the IEEE ESSB summer meeting, June 24th-28th in Santa Fe, NM (http://sites.ieee.org/pes-essb/event/essb-2019-meeting-sante-fe-nm/). Contact the working group chair to get involved: David Rosewater, dmrose@sandia.gov</i>
Date of first edition:	TBD
Document:	IEEE P1547.9 (new standard) Guide to Using IEEE Standard 1547 for Interconnection of Energy Storage Distributed Energy Resources with Electric Power Systems
ESS relevance:	<i>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.</i>
Current activity:	<i>The first meeting of the working group developing this standard occurred February 28, 2019 in Atlanta in conjunction with the IEEE 1547 meetings. See http://www.cvent.com/events/ieee-p1547-1-p1547-2-p1547-9-meetings-february-2019/event-summary-d925c96b49a741e59786afa4db221d76.aspx for more information.</i>
Date of first edition:	TBD

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:	New test requirements for soft-case pouch cells for a Narrow Bar Crush Test or Dent Test instead of the Impact Test were sent out August 24, 2018 for preliminary review with comments due September 28, 2018. See https://www.shopulstandards.com/ProductDetail.aspx?UniqueKey=34818 for more information on the proposal dated August 24, 2018. Comments were received during preliminary review and are being considered before proceeding to ballot.
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 was issued on October 31, 2018. The edition included rapid shutdown requirements to better align with the Standard for Photovoltaic (PV) Module Safety Qualification - Part 1: Requirements for Construction, UL 61730-1. Revisions were proposed on October 31, 2018 and achieved consensus on December 14, 2018 for Rapid Shutdown Revisions to Better Align with the Standard for Photovoltaic (PV) Module Safety Qualification - Part 1: Requirements for Construction, UL 61730-1. Comments were received and are being considered before proceeding to recirculation. See https://www.shopulstandards.com/ProductDetail.aspx?UniqueKey=35088 for more information on the proposal dated October 31, 2018.
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 with any new proposals due by October 15, 2018. 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.
Date of next edition:	TBD – UL standards are under continuous maintenance and are updated as warranted.

	Underwriters Laboratories (UL) – https://ulstandards.ul.com/develop-standards/
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 ANSI/CAN/UL 1974 Edition 1 dated October 25, 2018 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 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 preliminary review on January 11, 2019 with comments due February 11, 2019. This proposed standard is binational standard with CSA Group and harmonized with the first edition of IEC 62133-1. See https://www.shopulstandards.com/ProductDetail.aspx?UniqueKey=35323 for more information on the proposal out for comment.
Date of publication:	TBD
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 preliminary review on January 11, 2019 with comments due February 11, 2019. This proposed standard is binational standard with CSA Group and harmonized with the first edition of IEC 62133-2. See https://www.shopulstandards.com/ProductDetail.aspx?UniqueKey=35324 for more information on the proposal out for comment.
Date of publication:	TBD

Every effort is made by the Pacific Northwest National Laboratory (PNNL) and Sandia¹ 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 david.conover@pnnl.gov.

1. Sandia National Laboratories is a multitechnology laboratory managed and operated by National Technology and Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International, Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.



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