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Electrical energy storage (EES) systems -
Part 5-2: Safety requirements for grid-integrated EES systems - Electrochemical-based systems

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Electrical energy storage (EES) systems - Part 5-2: Safety requirements for grid-integrated EES systems - Electrochemical-based systems

FOREWORD

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This commented version (CMV) of the official standard IEC 62933-5-2:2025 edition 2.0 allows the user to identify the changes made to the previous IEC 62933-5-2:2020 edition 1.0. Furthermore, comments from IEC TC 120 experts are provided to explain the reasons of the most relevant changes, or to clarify any part of the content.

A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text. Experts' comments are identified by a blue-background number. Mouse over a number to display a pop-up note with the comment.

This publication contains the CMV and the official standard. The full list of comments is available at the end of the CMV.

IEC 62933-5-2 has been prepared by IEC technical committee 120: Electrical Energy Storage (EES) systems. It is an International Standard.

This second edition cancels and replaces the first edition published in 2020. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) New BESS categories: This document created new BESS energy categories “E-LI” (integrated within one enclosure), and “E-LS”(separated by two or more enclosures), because the safety measures are different for systems with one enclosure and systems with multiple enclosures.
b) Location risk: This document added information about differences in risk depending on location.
c) Reused or repurposed battery: Regarding ensuring the safety of BESS using reused or repurposed batteries, a reference to the new standard IEC 629933-5-3 was added.
d) Protection from fire hazards: Based on an analysis of BESS fires occurring around the world, the number of fire propagation measures have been significantly increased.
e) System validation and test: Test methods and criteria have been clarified. In addition, the validation of measures against gas generation and fire spread has been significantly revised.

This International Standard is to be used in conjunction with IEC 62933-5-1:2024.

The text of this International Standard is based on the following documents:

Draft	Report on voting
120/415/FDIS	120/436/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 62933 series, published under the general title *Electrical energy storage (EES) systems*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

– reconfirmed,
– withdrawn, or
– revised.

INTRODUCTION

All the electrical energy storage systems (EESS) follow the general safety requirements as described in IEC ~~TS~~ 62933-5-1, which is based on a system approach. This document follows the same structure as IEC ~~TS~~ 62933-5-1 and provides additional requirements for ~~battery energy storage systems (BESS)~~ electrochemical-based EESS. The additional requirements are provided for the following reasons:

a) ~~BESS~~ Electrochemical-based EESS can be integrated into a significant range of electrical grids.

b) The level of safety requirements awareness can vary between utilities, system integrators, operators and end-users.

c) Although the safety of individual subsystems is generally covered by international standards at ISO and IEC levels, the safety matters that arise due the combination of electrochemical accumulation subsystems and any electrical subsystems are not always considered. ~~BESS~~ Electrochemical-based EESS are complex at the systems level due to the variety of potential battery options and configurations, including the combination of subsystems (e.g. control systems for electrochemical accumulation subsystems, electrochemical accumulation subsystems, power conversion subsystems and auxiliary subsystems). Compliance with standards and related material produced specifically for the safety of subsystems cannot be sufficient to reach an acceptable level of safety for the overall system.

d) ~~BESS~~ Electrochemical-based EESS can have additional safety hazards, due, for example, to the presence of chemicals, the emission of toxic gases, chemicals spilt around the electrochemical accumulation subsystems and to events critical for safety from electrochemical accumulation subsystems that cause safety issues for the entire ~~BESS~~ electrochemical-based EESS. They can cause loss of power at any part of the systems and buildings that can result in additional threats to safety. From a systems perspective, these individual hazards can have a system wide impact.

1 Scope

This part of IEC 62933 primarily describes safety aspects for people and, where appropriate, safety matters related to the surroundings and living beings for grid-connected energy storage systems where an electrochemical storage subsystem is used.

This document is applicable to the entire life cycle of BESS (from design to end of service life management).

This document provides further safety provisions that arise due to the use of an electrochemical storage subsystem (e.g. battery system) in ~~energy storage~~ EES systems that are beyond the general safety considerations described in IEC ~~TS~~ 62933-5-1.

This document specifies the safety requirements of an "electrochemical" energy storage system as a "system" to reduce the risk of harm or damage caused by the hazards of an electrochemical energy storage system due to interactions between the subsystems as presently understood.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60068-2-52, *Environmental testing - Part 2-52: Tests - Test Kb: Salt mist, cyclic (sodium chloride solution)*

IEC 60079-7:2015, *Explosive atmospheres - Part 7: Equipment protection by increased safety "e"*
IEC 60079-7:2015/AMD1:2017

IEC 60079-13, *Explosive atmospheres - Part 13: Equipment protection by pressurized room "p" and artificially ventilated room "v"*

IEC 60079-29 (all parts), *Explosive atmospheres - Gas detectors*

IEC 60364 (all parts), *Low-voltage electrical installations*

IEC 60364-4-44, *Low-voltage electrical installations - Part 4-44: Protection for safety - Protection against voltage disturbances and electromagnetic disturbances*

IEC 60364-6:2016, *Low voltage electrical installations - Part 6: Verification*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 60664-1:~~2007~~2020, *Insulation coordination for equipment within low-voltage systems - Part 1: Principles, requirements and tests*

IEC 60812, *Failure modes and effects analysis (FMEA and FMECA)*

IEC 61000-1-2, *Electromagnetic compatibility (EMC) - Part 1-2: General - Methodology for the achievement of functional safety of electrical and electronic systems including equipment with regard to electromagnetic phenomena*

IEC 61000-6-7, *Electromagnetic compatibility (EMC) - Part 6-7: Generic standards - Immunity requirements for equipment intended to perform functions in a safety-related system (functional safety) in industrial locations*

IEC 61025, *Fault tree analysis (FTA)*

IEC 61660-1, *Short-circuit currents in d.c. auxiliary installations in power plants and substations - Part 1: Calculation of short-circuit currents*

IEC 61660-2, *Short-circuit currents in d.c. auxiliary installations in power plants and substations - Part 2: Calculation of effects*

IEC 61882, *Hazard and operability studies (HAZOP studies) - Application guide*

IEC 61936-1:~~2010~~2021, *Power installations exceeding 1 kV AC and 1,5 kV DC - Part 1: ~~Common rules~~ AC*
~~IEC 61936-1:2010/AMD1:2014~~

IEC 62305-2*, Protection against lightning - Part 2: Risk management*

IEC 62368-1, *Audio/video, information and communication technology equipment - Part 1: Safety requirements*

IEC 62477-1:~~2012~~2022, *Safety requirements for power electronic converter systems and equipment - Part 1: General*
~~IEC 62477-1:2012/AMD1:2016~~

IEC 62485-2, *Safety requirements for secondary batteries and battery installations - Part 2: Stationary batteries*

IEC 62619:~~2017~~2022, *Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for secondary lithium cells and batteries, for use in industrial applications*

IEC 62933-1, *Electrical energy storage (EES) systems - Part 1: Vocabulary*

IEC ~~TS~~ 62933-5-1:~~2017~~2024, *Electrical energy storage (EES) systems - Part 5-1: Safety considerations for grid integrated EES systems - General specification*

IEC 62933-5-3:2023, *Electrical energy storage (EES) systems - Part 5-3: Safety requirements for grid-integrated EES systems - Performing unplanned modification of electrochemical based system*

ISO/IEC 31010, *Risk management - Risk assessment techniques*

ISO/IEC Guide 51:2014, *Safety aspects - Guidelines for their inclusion in standards*

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~~IEC 60050-482, *International Electrotechnical Vocabulary (IEV) – Part 482: Primary and secondary cells and batteries*~~

IEC 60364-4-41, *Low-voltage electrical installations - Part 4-41: Protection for safety - Protection against electric shock*

IEC 60364-4-42, *Low-voltage electrical installations - Part 4-42: Protection for safety - Protection against thermal effects*

IEC 60364-4-43, *Low-voltage electrical installations - Part 4-43: Protection for safety - Protection against overcurrent*

IEC 60617 (all parts), *Graphical symbols for diagrams*

IEC 60721 (all parts), *Classification of environmental conditions*

IEC 60896-21, *Stationary lead-acid batteries - Part 21: Valve regulated types - Methods of test*

IEC 60896-22, *Stationary lead-acid batteries - Part 22: Valve regulated types - Requirements*

IEC 61000-6-1:2016, *Electromagnetic compatibility (EMC) - Part 6-1: Generic standards - Immunity standard for residential, commercial and light-industrial environments*

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IEC 61140, *Protection against electric shock - Common aspects for installation and equipment*

IEC 61427-1, *Secondary cells and batteries for renewable energy storage - General requirements and methods of test - Part 1: Photovoltaic off-grid application*

IEC 61427-2, *Secondary cells and batteries for renewable energy storage - General requirements and methods of test - Part 2: On-grid applications*

IEC 61508 (all parts), *Functional safety of electrical/electronic/programmable electronic safety-related systems*

IEC 61511-1:2016, *Functional safety - Safety instrumented systems for the process industry sector - Part 1: Framework, definitions, system, hardware and application programming requirements*

IEC 62040-1, *Uninterruptible power systems (UPS) - Part 1: Safety requirements*

IEC 62040-2, *Uninterruptible power systems (UPS) - Part 2: Electromagnetic compatibility (EMC) requirements*

IEC 62116:2014, *Utility-interconnected photovoltaic inverters - Test procedure of islanding prevention measures*

IEC 62351 (all parts), *Power systems management and associated information exchange - Data and communications security*

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IEC 62381:2012, *Automation systems in the process industry - Factory acceptance test (FAT), site acceptance test (SAT), and site integration test (SIT)*

IEC TS 62443-1-1:2009, *Industrial communication networks - Network and system security - Part 1-1: Terminology, concepts and models*

IEC 62443-2-4, *Security for industrial automation and control systems - Part 2-4: Security program requirements for IACS service providers*

IEC 62485-1, *Safety requirements for secondary batteries and battery installations - Part 1: General safety information*

IEC 62531:2012, *Property Specification Language (PSL)*

IEC TS 62686-1:2015, *Process management for avionics - Electronic components for aerospace, defence and high performance (ADHP) applications - Part 1: General requirements for high reliability integrated circuits and discrete semiconductors*

IEC 62909-1, *Bi-directional grid connected power converters - Part 1: General requirements*

~~IEC 62932-1:2020, *Flow battery energy systems for stationary applications – Part 1: Terminology and general aspects*~~

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