ICS 13.020.30 SLOVENSKÁ TECHNICKÁ NORMA December 2024

STN	**Systémy na akumuláciu elektrickej energie (EES) Časť 5-1: Bezpečnostné hľadiská pre systémy EES integrované do siete Všeobecná špecifikácia**	**STN EN IEC 62933-5-1** 36 4400

Electrical energy storage (EES) systems - Part 5-1: Safety considerations for grid-integrated EES systems - General specification

Táto norma obsahuje anglickú verziu európskej normy.
This standard includes the English version of the European Standard.

Táto norma bola oznámená vo Vestníku ÚNMS SR č. 11/24

Obsahuje: EN IEC 62933-5-1:2024, IEC 62933-5-1:2024

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EUROPEAN STANDARD
NORME EUROPÉENNE
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EN IEC 62933-5-1

September 2024

ICS 13.020.30

English Version

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

Systèmes de stockage de l'énergie électrique (EES) - Partie 5-1: Considérations de sécurité pour les systèmes EES intégrés au réseau - Spécifications générales (IEC 62933-5-1:2024)

Elektrische Energiespeichersysteme (EES-Systeme) - Teil 5-1: Sicherheitserwägungen für netzintegrierte EES-Systeme - Allgemeine Spezifikation (IEC 62933-5-1:2024)

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

Ref. No. EN IEC 62933-5-1:2024 E

European foreword

The text of document 120/368/FDIS, future edition 1 of IEC 62933-5-1, prepared by TC 120 "Electrical Energy Storage (EES) systems" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 62933-5-1:2024.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2025-06-03
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2027-09-03

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Endorsement notice

The text of the International Standard IEC 62933-5-1:2024 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standard indicated:

IEC 60079-0	NOTE	Approved as EN IEC 60079-0
IEC 60079-10-1	NOTE	Approved as EN IEC 60079-10-1
IEC 60079-10-2	NOTE	Approved as EN 60079-10-2
IEC 60085	NOTE	Approved as EN 60085
IEC 60127-1	NOTE	Approved as EN 60127-1
IEC 60309 series	NOTE	Approved as EN IEC 60309 series
IEC 60317 series	NOTE	Approved as EN IEC 60317 series
IEC 60335-2-40	NOTE	Approved as EN IEC 60335-2-40
IEC 60691	NOTE	Approved as EN IEC 60691
IEC 60730-1	NOTE	Approved as EN 60730-1
IEC 60730-2-8	NOTE	Approved as EN IEC 60730-2-8
IEC 60738-1	NOTE	Approved as EN IEC 60738-1
IEC 60812:2018	NOTE	Approved as EN IEC 60812:2018 (not modified)
IEC 60896-11	NOTE	Approved as EN 60896-11
IEC 60896-21	NOTE	Approved as EN 60896-21
IEC 60896-22	NOTE	Approved as EN 60896-22

IEC 60947-1	NOTE	Approved as EN IEC 60947-1
IEC 60947-7 series	NOTE	Approved as EN IEC 60947-7 series
IEC 60999-1	NOTE	Approved as EN 60999-1
IEC 60999-2	NOTE	Approved as EN 60999-2
IEC 61000 series	NOTE	Approved as EN IEC 61000 series
IEC 61025:2006	NOTE	Approved as EN 61025:2007 (not modified)
IEC 61058-1	NOTE	Approved as EN IEC 61058-1
IEC 61140	NOTE	Approved as EN 61140
IEC 61204-7	NOTE	Approved as EN IEC 61204-7
IEC 61508-1	NOTE	Approved as EN 61508-1
IEC 61508-4:2010	NOTE	Approved as EN 61508-4:2010 (not modified)
IEC 61558-1	NOTE	Approved as EN IEC 61558-1
IEC 61558-2-16	NOTE	Approved as EN 61558-2-16
IEC 61643-11	NOTE	Approved as EN 61643-11
IEC 61643-331	NOTE	Approved as EN IEC 61643-331
IEC 61810-1	NOTE	Approved as EN 61810-1
IEC 61882:2016	NOTE	Approved as EN 61882:2016 (not modified)
IEC 61984	NOTE	Approved as EN 61984
IEC 62271 series	NOTE	Approved as EN IEC 62271 series
IEC 62282-3-100	NOTE	Approved as EN IEC 62282-3-100
IEC 62351 series	NOTE	Approved as EN IEC 62351 series
IEC 62368-1:2018	NOTE	Approved as EN IEC 62368-1:2020 (not modified) +A11:2020
IEC 62485-1:2015	NOTE	Approved as EN IEC 62485-1:2018 (not modified)
IEC 62619	NOTE	Approved as EN IEC 62619
IEC 62932-2-2	NOTE	Approved as EN IEC 62932-2-2
IEC 62984-2	NOTE	Approved as EN IEC 62984-2
IEC 62990-2	NOTE	Approved as EN IEC 62990-2
IEC 63056	NOTE	Approved as EN IEC 63056
IEC 63115-2	NOTE	Approved as EN IEC 63115-2
ISO 12944 series	NOTE	Approved as EN ISO 12944 series
ISO 13732-1:2006	NOTE	Approved as EN ISO 13732-1:2008 (not modified)
ISO 13850:2015	NOTE	Approved as EN ISO 13850:2015 (not modified)
ISO 13857:2019	NOTE	Approved as EN ISO 13857:2019 (not modified)
ISO 19353:2019	NOTE	Approved as EN ISO 19353:2019 (not modified)

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cencenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 60068-2-52	-	Environmental testing - Part 2-52: Tests - Test Kb: Salt mist, cyclic (sodium chloride solution)	EN IEC 60068-2-52	-
IEC 60079-2	2014	Explosive atmospheres - Part 2: Equipment protection by pressurized enclosure "p"	EN 60079-2	2014
IEC 60204-1	-	Safety of machinery - Electrical equipment of machines - Part 1: General requirements	EN 60204-1	-
IEC 60204-11	-	Safety of machinery - Electrical equipment of machines - Part 11: Requirements for equipment for voltages above 1 000 V AC or 1 500 V DC and not exceeding 36 kV	EN IEC 60204-11	-
IEC 60364	series	Low-voltage electrical installations	HD 60364	series
IEC 60364-4-41	2005	Low-voltage electrical installations - Part 4-41: Protection for safety - Protection against electric shock	HD 60364-4-41	2017
+ A1	2017		-	-
-	-		+ A11	2017
-	-		+ A12	2019
IEC 60364-4-43	-	Low-voltage electrical installations - Part 4-43: Protection for safety - Protection against overcurrent	HD 60364-4-43	-
IEC 60364-4-44	-	Low-voltage electrical installations - Part 4-44: Protection for safety - Protection against voltage disturbances and electromagnetic disturbances	HD 60364-4-442	-
IEC 60364-6	2016	Low voltage electrical installations - Part 6: Verification	HD 60364-6	2016
-	-		+ A11	2017
-	-		+ A12	2017

Publication	Year	Title	EN/HD	Year
-	-		+ AC	2017-11
IEC 60529	-	Degrees of protection provided by enclosures (IP Code)	EN 60529	-
IEC 60664-1	2020	Insulation coordination for equipment within low-voltage supply systems - Part 1: Principles, requirements and tests	EN IEC 60664-1	2020
IEC 60695-11-10	-	Fire hazard testing - Part 11-10: Test flames - 50 W horizontal and vertical flame test methods	EN 60695-11-10	-
IEC 60730-1	2022	Automatic electrical controls - Part 1: General requirements	EN IEC 60730-1	2024
IEC 60730-2-9	-	Automatic electrical controls - Part 2-9: Particular requirements for temperature sensing control	EN IEC 60730-2-9	-
IEC 60947-5-1	-	Low-voltage switchgear and controlgear - Part 5-1: Control circuit devices and switching elements - Electromechanical control circuit devices	EN 60947-5-1	-
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	EN 61000-1-2	-
IEC 61000-6-1	-	Electromagnetic compatibility (EMC) - Part 6-1: Generic standards - Immunity standard for residential, commercial and light-industrial environments	EN IEC 61000-6-1	-
IEC 61000-6-2	-	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity standard for industrial environments	EN IEC 61000-6-2	-
IEC 61000-6-3	-	Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for equipment in residential environments	EN IEC 61000-6-3	-
IEC 61000-6-4	-	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments	EN IEC 61000-6-4	-
IEC 61000-6-5	-	Electromagnetic compatibility (EMC) - Part 6-5: Generic standards - Immunity for equipment used in power station and substation environment	EN 61000-6-5	-
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	EN 61000-6-7	-
IEC/TR 61340-1	-	Electrostatics - Part 1: Electrostatic phenomena - Principles and measurements	-	-

EN IEC 62933-5-1:2024 (E)

Publication	Year	Title	EN/HD	Year
IEC 61439-1	-	Low-voltage switchgear and controlgear assemblies - Part 1: General rules	EN IEC 61439-1	-
IEC 61508	series	Functional safety of electrical/electronic/programmable electronic safety-related systems	EN 61508	series
IEC 61511	series	Functional safety - Safety instrumented systems for the process industry sector	EN 61511	series
IEC 61936-1	-	Power installations exceeding 1 kV AC and 1,5 kV DC - Part 1: AC	EN IEC 61936-1	-
IEC/TS 61936-2	-	Power installations exceeding 1 kV a.c. and 1,5 kV d.c. - Part 2: d.c.	-	-
IEC 62061	-	Safety of machinery - Functional safety of safety-related control systems	EN IEC 62061	-
IEC 62109-1	-	Safety of power converters for use in photovoltaic power systems - Part 1: General requirements	EN 62109-1	-
IEC 62109-2	-	Safety of power converters for use in photovoltaic power systems - Part 2: Particular requirements for inverters	EN 62109-2	-
IEC 62116	2014	Utility-interconnected photovoltaic inverters - Test procedure of islanding prevention measures	EN 62116	2014
IEC 62305-2	-	Protection against lightning - Part 2: Risk management	EN 62305-2	-
IEC 62443-3-3	-	Industrial communication networks - Network and system security - Part 3-3: System security requirements and security levels	EN IEC 62443-3-3	-
IEC 62477-1	2022	Safety requirements for power electronic converter systems and equipment - Part 1: General	EN IEC 62477-1	2023
IEC 62477-2	-	Safety requirements for power electronic converter systems and equipment - Part 2: Power electronic converters from 1 000 V AC or 1 500 V DC up to 36 kV AC or 54 kV DC	EN IEC 62477-2	-
IEC 62689-2	-	Current and voltage sensors or detectors, to be used for fault passage indication purposes - Part 2: System aspects	EN 62689-2	-
IEC 62909-1	-	Bi-directional grid connected power converters - Part 1: General requirements	EN IEC 62909-1	-
IEC 62909-2	-	Bi-directional grid-connected power converters - Part 2: Interface of GCPC and distributed energy resources	EN IEC 62909-2	-
IEC 62933-1	-	Electrical energy storage (EES) systems - Part 1: Vocabulary	EN IEC 62933-1	-
IEC 62933-5-2	-	Electrical energy storage (EES) systems - Part 5-2: Safety requirements for grid-integrated EES systems - Electrochemical-	EN IEC 62933-5-2	-

Publication	Year	Title	EN/HD	Year
		based systems		
ISO 1182	-	Reaction to fire tests for products - Non-combustibility test	EN ISO 1182	-
ISO 7010	-	Graphical symbols_- Safety colours and safety signs - Registered safety signs	-	-
ISO 12100	2010	Safety of machinery - General principles for design - Risk assessment and risk reduction	EN ISO 12100	2010
ISO 13849	series	Safety of machinery - Safety-related parts of control systems	EN ISO 13849	series
ISO 15649	-	Petroleum and natural gas industries - Piping	-	-
ASME B31.1	-	Code for Pressure Piping, Section 1: Power Piping	-	-
ASME B31.3	-	Code for Pressure Piping, Section 3: Process piping	-	-
IEEE Std 1547.1	2020	Standard Conformance Test Procedures for Equipment Interconnecting Distributed Energy Resources with Electric Power Systems and Associated Interfaces	-	-

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INTERNATIONAL STANDARD

NORME INTERNATIONALE

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Electrical energy storage (EES) systems – Part 5-1: Safety considerations for grid-integrated EES systems – General specification

Systèmes de stockage de l'énergie électrique (EES) – Partie 5-1: Considérations de sécurité pour les systèmes EES intégrés au réseau – Spécifications générales

IEC 62933-5-1:2024-07(en-fr)

IEC 62933-5-1

Edition 1.0 2024-07

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Electrical energy storage (EES) systems – Part 5-1: Safety considerations for grid-integrated EES systems – General specification

Systèmes de stockage de l'énergie électrique (EES) – Partie 5-1: Considérations de sécurité pour les systèmes EES intégrés au réseau – Spécifications générales

INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ELECTRICAL ENERGY STORAGE (EES) SYSTEMS –

Part 5-1: Safety considerations for grid-integrated EES systems – General specification

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at https://patents.iec.ch. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 62933-5-1 has been prepared by IEC technical committee TC 120: Electrical Energy Storage (EES) systems. It is an International Standard.

This first edition cancels and replaces the first edition of IEC TS 62933-5-1 published in 2017. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to IEC TS 62933-5-1:2017:

a) Revising “should” statements to “shall” statements for all requirements and move some “should” statements clauses to Annex B for informative purposes.
b) Update standard references (normative).
c) Update definitions and add or remove definitions where necessary.

d) Revise criteria in Clause 6 and Clause 7 to be actionable and add standard references where necessary.

e) Revise Clause 8 for more thorough test method and criteria, add tests where necessary.

f) Add markings and instruction criteria.

g) Revise Annex A to add technology safety information on gravitational and thermal EESS.

h) Add Annex B and Annex C for safety considerations for EESS and test method for mechanical EESS.

i) Add informative list of standards and update bibliography.

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

Draft	Report on voting
120/368/FDIS	120/377/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.

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

Many governments' plans for how electricity will be generated and managed in the future have been determined. Such current plans cannot be implemented without long-term storage with capacities in the large scale range.

There are a number of types of storage technologies that have emerged. Examples of these technologies are pumped hydro storage (PHS), electrochemical batteries, flywheel storage systems and hydrogen and synthetic natural gas (SNG). Pumped hydro storage has been widely used in terms of the total amount of stored energy. A flywheel is a model of kinetic energy storage with a high power density, excellent cycle stability and long life. While some flywheels are intended for short term operation, others can operate over longer periods of time of up to a few hours. Batteries require development primarily to decrease cost, and for some technologies to increase energy density as well. Hydrogen and synthetic natural gas (SNG) added to natural gas are likely to be essential elements of future electric grids because of their energy storage duration and capacity. Hydrogen and SNG should be further researched and developed across a broad front, including physical facilities, interactions with existing uses of gas for supply and distribution network, optimal chemical processes, safety, reliability and efficiency. The IEC White Paper on electrical energy storage can provide further background information concerning EES systems.

For mature EES systems, various IEC standards exist, covering technical features, testing and system integration. For other technologies, there are only a few standards, covering special topics.

Up to now no general standard addressing safety for EESS integration into an electrical grid has been developed.

The rapid growth and the new technologies involved in electrical energy storage in the near future, as well as their installation by consumers will impose particular requirements for safety. At the same time, society and governments will need assurance of safety before the much-needed systems can be deployed.

This document stands as a decisive step towards the gradual alignment with specific technologies and applications concerning the safety of packaged or site-assembled grid-integrated EESS.

Additional criteria specific to electrochemical type electrical energy storage (EES) systems are given in IEC 62933-5-2.

ELECTRICAL ENERGY STORAGE (EES) SYSTEMS –

Part 5-1: Safety considerations for grid-integrated EES systems – General specification

1 Scope

This part of IEC 62933 specifies safety considerations (e.g. hazards identification, risk assessment, risk mitigation) applicable to EES systems integrated with the electrical grid.

This document provides criteria to enable the safe application and use of electrical energy storage systems of any type or size intended for grid-integrated applications.

This document can be applied to all EESS technologies, but for requirements specific to electrochemical EES systems, reference is also made to IEC 62933-5-2.

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 60079-2:2014, *Explosive atmospheres – Part 2: Equipment protection by pressurized enclosure "p"*

IEC 60204-1, *Safety of machinery – Electrical equipment of machines – Part 1: General requirements*

IEC 60204-11*, Safety of machinery – Electrical equipment of machines – Part 11: Requirements for equipment for voltages above 1 000 V AC or 1 500 V DC and not exceeding 36 kV*

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

IEC 60364-4-41:2005, *Low-voltage electrical installations – Part 4-41: Protection for safety – Protection against electric* shock
IEC 60364-4-41:2005/AMD1:2017

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

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

IEC 60695-11-10, *Fire hazard testing – Part 11-10: Test flames – 50 W horizontal and vertical flame test methods*

IEC 60730-1:2020, *Automatic electrical controls – Part 1: General requirements*

IEC 60730-2-9, *Automatic electrical controls – Part 2-9: Particular requirements for temperature sensing controls*

IEC 60947-5-1, *Low-voltage switchgear and controlgear – Part 5-1: Control circuit devices and switching elements – Electromechanical control circuit devices*

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

IEC 61000-6-2, *Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity standard for industrial environments*

IEC 61000-6-3, *Electromagnetic compatibility (EMC) – Part 6-3: Generic standards – Emission standard for equipment in residential environments*

IEC 61000-6-4, *Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments*

IEC 61000-6-5, *Electromagnetic compatibility (EMC) – Part 6-5: Generic standards – Immunity for equipment used in power station and substation environment*

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 TR 61340-1, *Electrostatics – Part 1: Electrostatic phenomena – Principles and measurements*

IEC 61439-1*, Low voltage switchgear and control gear assemblies – Part 1: General rules*

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

IEC 61511 (all parts), *Functional safety – Safety instrumented systems for the process industry sector*

IEC 61936-1, *Power installations exceeding 1 kV AC and 1,5 kV DC – Part 1: AC*

IEC TS 61936-2, *Power installations exceeding 1 kV AC and 1,5 kV DC – Part 2: DC*

IEC 62061*, Safety of machinery – Functional safety of safety-related control systems*

IEC 62109-1, *Safety of power converters for use in photovoltaic power systems – Part 1: General requirements*

IEC 62109-2, *Safety of power converters for use in photovoltaic power systems – Part 2: Particular requirements for inverters*

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

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

IEC 62443-3-3, *Industrial communication networks – Network and system security – Part 3-3: System security requirements and security levels*

IEC 62477-1:2022, *Safety requirements for power electronic converter systems and equipment – Part 1: General*

IEC 62477-2, *Safety requirements for power electronic converter systems and equipment – Part 2: Power electronic converters from 1 000 V AC or 1 500 V DC up to 36 kV AC or 54 kV DC*

IEC 62689-2, *Current and voltage sensors or detectors, to be used for fault passage indication purposes – Part 2: System aspects*

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

IEC 62909-2, *Bi-directional grid-connected power converters – Part 2: Interface of GCPC and distributed energy resources*

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

IEC 62933-5-2, *Electrical energy storage (EES) systems – Part 5-2: Safety requirements for grid-integrated EES systems – Electrochemical-based systems*

ISO 1182, *Reaction to fire tests for products – Non-combustibility test*

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