SVENSK STANDARD

SS-EN IEC 62093, utg 2:2023

Fastställd	Sida	Ansvarig kommitté
2023-02-22	1 (64)	SEK TK 82

Solcellsanläggningar – Utrustning för omvandling av systemspänning – Konstruktions- och typgodkännande

Photovoltaic system power conversion equipment – Design qualification and type approval

Som svensk standard gäller europastandarden EN IEC 62093:2022. Den svenska standarden innehåller den officiella engelska språkversionen av EN IEC 62093:2022.

Nationellt förord

Europastandarden EN IEC 62093:2022

består av:

– **europastandardens ikraftsättningsdokument,** utarbetat inom CENELEC
– **IEC 62093, Second edition, 2022 - Photovoltaic system power conversion equipment - Design qualification and type approval**

utarbetad inom International Electrotechnical Commission, IEC.

Tidigare fastställd svensk standard SS-EN 62093, utg 1, 2005, gäller ej fr o m 2025-02-14.

ICS 27.160.00

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN IEC 62093

February 2022

ICS 27.160

Supersedes EN 62093:2005 and all of its amendments and corrigenda (if any)

English Version

Photovoltaic system power conversion equipment - Design qualification and type approval (IEC 62093:2022)

Matériel de conversion de puissance des systèmes photovoltaïques - Qualification de la conception et approbation de type (IEC 62093:2022)

Leistungsumrichter für photovoltaische Systeme - Prüfung der Bauarteignung (IEC 62093:2022)

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 62093:2022 E

SEK Svensk Elstandard SS-EN IEC 62093, utg 2:2023

European foreword

The text of document 82/1963/FDIS, future edition 2 of IEC 62093, prepared by IEC/TC 82 "Solar photovoltaic energy systems" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 62093:2022.

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)	2022-11-14
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2025-02-14

This document supersedes EN 62093:2005 and all of its amendments and corrigenda (if any).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a Standardization Request given to CENELEC by the European Commission and the European Free Trade Association.

Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

Endorsement notice

The text of the International Standard IEC 62093:2022 was approved by CENELEC as a European Standard without any modification.

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.cenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 60068-2-2	2007	Environmental testing - Part 2-2: Tests - Test B: Dry heat	EN 60068-2-2	2007
IEC 60068-2-6	-	Environmental testing - Part 2-6: Tests - Test Fc: Vibration (sinusoidal)	EN 60068-2-6	-
IEC 60068-2-14	-	Environmental testing - Part 2-14: Tests - Test N: Change of temperature	EN 60068-2-14	-
IEC 60068-2-27	-	Environmental testing - Part 2-27: Tests - Test Ea and guidance: Shock	EN 60068-2-27	-
IEC 60068-2-52	-	Environmental testing - Part 2-52: Tests – Test Kb: Salt mist, cyclic (sodium, chloride solution)	EN IEC 60068-2-52	-
IEC 60068-2-60	2015	Environmental testing - Part 2-60: Tests - Test Ke: Flowing mixed gas corrosion test	EN 60068-2-60	2015
IEC 60068-2-68	-	Environmental testing - Part 2-68: Tests - Test L: Dust and sand	EN 60068-2-68	-
IEC 60068-2-78	-	Environmental testing - Part 2-78: Tests - Test Cab: Damp heat, steady state	EN 60068-2-78	-
IEC 60068-3-5	2018	Environmental testing - Part 3-5: Supporting documentation and guidance - Confirmation of the performance of temperature chambers	EN IEC 60068-3-5	2018
IEC 60068-3-6	-	Environmental testing - Part 3-6: Supporting documentation and guidance – Confirmation of the performance of temperature/humidity changes	EN IEC 60068-3-6	-
IEC 60529	1989	Degrees of protection provided by enclosures (IP Code)	EN 60529	1991
-	-		+ corrigendum May	1993
+ A1	1999		+ A1	2000
+ A2	2013		+ A2	2013

IEC 60721-3-3	-	Classification of environmental conditions - Part 3-3: Classification of groups of environmental parameters and their severities - Stationary use at weather protected locations	EN IEC 60721-3-3	-
IEC 60721-3-4	-	Classification of environmental conditions - Part 3-4: Classification of groups of environmental parameters and their severities - Stationary use at non-weather protected locations	EN IEC 60721-3-4	-
IEC 61000-3-2	-	Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)	EN IEC 61000-3-2	-
IEC 61000-3-12	-	Electromagnetic compatibility (EMC) - Part 3-12: Limits - Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current >16 A and ≤ 75 A per phase	EN 61000-3-12	-
IEC/TR 61000-3-14	-	Electromagnetic compatibility (EMC) - Part 3-14: Assessment of emission limits for harmonics, interharmonics, voltage fluctuations and unbalance for the connection of disturbing installations to LV power systems		
IEC 61180	-	High-voltage test techniques for low-voltage equipment - Definitions, test and procedure requirements, test equipment	EN 61180	-
IEC 61557-1	-	Electrical safety in low voltage distribution systems up to 1 000 V AC and 1 500 V DC - Equipment for testing, measuring or monitoring of protective measures - Part 1: General requirements	EN IEC 61557-1	-
IEC/TS 61836	-	Solar photovoltaic energy systems - Terms, definitions and symbols		
IEC 62109-1	2010	Safety of power converters for use in photovoltaic power systems - Part 1: General requirements	EN 62109-1	2010
IEC 62116	2014	Utility-interconnected photovoltaic inverters - Test procedure of islanding prevention measures	EN 62116	2014
IEC 62477-1	2012	Safety requirements for power electronic converter systems and equipment - Part 1: General	EN 62477-1	2012
-	-		+ A11	2014
+ A1	2016		+ A1	2017
-	-		+ A12	2021
IEC 62716	2013	Photovoltaic (PV) modules - Ammonia corrosion testing	EN 62716	2013
IEC 62852	-	Connectors for DC-application in photovoltaic systems - Safety requirements and tests	EN 62852	-

IEC 62894	2014	Photovoltaic inverters - Data sheet and name plate	-	-
+ A1	2016		-	-
IEC/TS 63106-2		Basic requirements for simulator used for testing of photovoltaic power conversion equipment - Part 2: DC power simulator	-	-
ISO 4892-2	-	Plastics - Methods of exposure to laboratory light sources - Part 2: Xenon-arc lamps	EN ISO 4892-2	-
ISO 12103-1	2016	Road vehicles - Test contaminants for filter evaluation - Part 1: Arizona test dust	-	-
ISO 22479	2019	Corrosion of metals and alloys - Sulfur dioxide test in a humid atmosphere (fixed gas method)	-	-

IEC 62093

Edition 2.0 2022-01

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Photovoltaic system power conversion equipment – Design qualification and type approval

Matériel de conversion de puissance des systèmes photovoltaïques – Qualification de la conception et approbation de type

INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

ICS 27.160

ISBN 978-2-8322-1064-7

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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PHOTOVOLTAIC SYSTEM POWER CONVERSION EQUIPMENT – DESIGN QUALIFICATION AND TYPE APPROVAL

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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IEC 62093 has been prepared by IEC technical committee 82: Solar photovoltaic energy systems. It is an International Standard.

This second edition cancels and replaces the first edition published in 2005. This edition constitutes a technical revision.

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

a) Title modified.
b) This edition focusses on the design qualification of power conversion electronics (PCE), and eliminates the clauses associated with qualification testing of other balance of system components.
c) While many clause titles remain the same as the first edition, substantial changes have been made.
d) Whereas the first edition establishes requirements for the design qualification of balance-of-system components used in terrestrial photovoltaic (PV) systems, this edition is limited to power conversion equipment.

e) The test protocols have been changed.

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

Draft	Report on voting
82/1963/FDIS	82/1983/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/standardsdev/publications.

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,
- replaced by a revised edition, or
- amended.

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.

PHOTOVOLTAIC SYSTEM POWER CONVERSION EQUIPMENT – DESIGN QUALIFICATION AND TYPE APPROVAL

1 Scope

This document lays down IEC requirements for the design qualification of power conversion equipment (PCE) suitable for long-term operation in terrestrial photovoltaic (PV) systems.

This document covers electronic power conversion equipment intended for use in terrestrial PV applications. The term PCE refers to equipment and components for electronic power conversion of electric power into another kind of electric power with respect to voltage, current, and frequency. This document is suitable for PCE for use in both indoor and outdoor climates as defined in IEC 60721-3-3 and IEC 60721-3-4. Such equipment may include, but is not limited to, grid-tied and off-grid DC-to-AC PCEs, DC-to-DC converters, battery charger converters, and battery charge controllers.

This document covers PCE that is connected to PV arrays that do not nominally exceed a maximum circuit voltage of 1 500 V DC. The equipment may also be connected to systems not exceeding 1 000 V AC at the AC mains circuits, non-main AC load circuits, and to other DC source or load circuits such as batteries. If particular ancillary parts whereby manufacturers and models are specified in the manual for use with the PCE, then those parts are tested with the PCE.

Exceptions:

a) This document does not address characteristics of power sources other than PV systems, such as wind turbines, fuel cells, rotating machine sources, etc.

b) This document does not address the characteristics of power electronic conversion equipment fully integrated into photovoltaic modules. Separate standards exist or are in development for those types of devices. It is, however, applicable to devices where the manufacturer explicitly specifies the capability of full detachment from and subsequent reattachment to the PV module or if the input and output terminals can be accessed and a specification sheet for the PCE is available. Devices meeting these requirements may be tested as individual samples independent from the PV module.

c) This document does not apply to power conversion equipment with integrated (built-in) electrochemical energy storage (*e.g.* lead acid or lithium-ion). It is, however, applicable to equipment where the manufacturer specifies and permits complete removal of the electrochemical energy storage from the PCE so that stand-alone assessment of the PCE with the storage removed becomes possible.

The object of the test sequences contained herein is to establish a basic level of durability and to show, as far as it is possible within reasonable constraints of cost and time, that the PCE is capable of maintaining its performance after prolonged exposure to the simulated environmental stresses described herein that are based on the intended use conditions specified by the manufacturer. Optional tests contained herein may be selected depending on the intended installation, market, or special environmental conditions that the PCE is anticipated to experience. The categorization imposes differentiated test sequences and test severity levels reflecting the different requirements of mechanical and electrical components in different environments.

PCEs are grouped into categories based on size and installation environment.

The actual life expectancy of components so qualified depends on their design, their environment, and the conditions under which they are operated. Estimation of a lifetime and wear out is not generally covered by this document.

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 60068-2-2:2007, *Environmental testing – Part 2-2: Tests – Test B: Dry heat*

IEC 60068-2-6, *Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-14, *Environmental testing – Part 2-14: Tests – Test N: Change of temperature*

IEC 60068-2-27, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

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

IEC 60068-2-60:2015, *Environmental testing – Part 2-60: Tests – Test Ke: Flowing mixed gas corrosion test*

IEC 60068-2-68, *Environmental testing – Part 2-68: Tests – Test L: Dust and sand*

IEC 60068-2-78, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

IEC 60068-3-5:2018, *Environmental testing – Part 3-5: Supporting documentation and guidance – Confirmation of the performance of temperature chambers*

IEC 60068-3-6, *Environmental testing – Part 3-6: Supporting documentation and guidance – Confirmation of the performance of temperature/ humidity chambers*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP Code)*
IEC 60529:1989/AMD1:1999
IEC 60529:1989/AMD2:2013

IEC 60721-3-3, *Classification of environmental conditions – Part 3-3: Classification of groups of environmental parameters and their severities – Stationary use at weather protected locations*

IEC 60721-3-4, *Classification of environmental conditions – Part 3-4: Classification of groups of environmental parameters and their severities – Stationary use at non-weather protected locations*

IEC 61000-3-2, *Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current ≤16 A per phase)*

IEC 61000-3-12, *Electromagnetic compatibility (EMC) – Part 3-12: Limits – Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current >16 A and ≤75 A per phase*

IEC TR 61000-3-14, *Electromagnetic compatibility (EMC) – Part 3-14: Assessment of emission limits for harmonics, interharmonics, voltage fluctuations and unbalance for the connection of disturbing installations to LV power systems*

IEC 61180, *High-voltage test techniques for low-voltage equipment – Definitions, test and procedure requirements, test equipment*

IEC 61557-1, *Electrical safety in low voltage distribution systems up to 1 000 V AC and 1 500 V DC – Equipment for testing, measuring or monitoring of protective measures – Part 1: General requirements*

IEC TS 61836, *Solar photovoltaic energy systems – Terms, definitions and symbols*

IEC 62109-1:2010, *Safety of power converters for use in photovoltaic power systems – Part 1: General requirements*

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

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

IEC 62716:2013, *Photovoltaic (PV) modules – Ammonia corrosion testing*

IEC 62852, *Connectors for DC-application in photovoltaic systems – Safety requirements and tests*

IEC 62894:2014, *Photovoltaic inverters – Data sheet and name plate*
IEC 62894:2014/AMD1:2016

IEC TS 63106-2, *Basic requirements for simulator used for testing of photovoltaic power conversion equipment – Part 2: DC power simulator*

ISO 4892-2, *Plastics – Methods of exposure to laboratory light sources – Part 2: Xenon-arc lamps*

ISO 12103-1:2016, *Road vehicles – Test contaminants for filter evaluation – Part 1: Arizona test dust*

ISO 22479:2019, *Corrosion of metals and alloys – Sulfur dioxide test in a humid atmosphere (fixed gas method)*