



PRE-RELEASE VERSION (FDIS)

**Solar thermal electric plants –
Part 4-1: General requirements for the design of solar power tower plants**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 27.160

Warning! Make sure that you obtained this publication from an authorized distributor.



FINAL DRAFT INTERNATIONAL STANDARD (FDIS)

PROJECT NUMBER:

IEC 62862-4-1 ED1

DATE OF CIRCULATION:

2022-07-08

CLOSING DATE FOR VOTING:

2022-08-19

SUPERSEDES DOCUMENTS:

117/118/CDV, 117/154/RVC

IEC TC 117 : SOLAR THERMAL ELECTRIC PLANTS

SECRETARIAT:

Spain

SECRETARY:

Ms Lourdes González Martínez

OF INTEREST TO THE FOLLOWING COMMITTEES:

TC 5, TC 8, TC 14, TC 17

HORIZONTAL STANDARD:

FUNCTIONS CONCERNED:

EMC

ENVIRONMENT

QUALITY ASSURANCE

SAFETY

SUBMITTED FOR CENELEC PARALLEL VOTING

NOT SUBMITTED FOR CENELEC PARALLEL VOTING

This document is a draft distributed for approval. It may not be referred to as an International Standard until published as such.

In addition to their evaluation as being acceptable for industrial, technological, commercial and user purposes, Final Draft International Standards may on occasion have to be considered in the light of their potential to become standards to which reference may be made in national regulations.

Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

TITLE:

Solar thermal electric plants – Part 4-1: General requirements for the design of solar power tower plants

PROPOSED STABILITY DATE: 2025

NOTE FROM TC/SC OFFICERS:

CONTENTS

FOREWORD	4
1 Scope	6
2 Normative references	6
3 Terms and definitions	8
4 Basic requirements	9
5 Electric power system requirements	10
5.1 General requirements	10
5.2 Requirements for grid-connection	10
5.3 Relay protection and automatic safety device	10
5.4 Dispatching automation.....	10
5.5 Electric power system communication.....	11
5.6 Electric energy metering	11
6 Solar resource assessment.....	11
7 Site selection.....	11
8 Overall planning	12
8.1 General requirements	12
8.2 Off-site planning	12
8.3 On-site planning.....	13
9 Layout of heliostat field and receiver tower.....	14
9.1 General requirements	14
9.2 Layout of heliostat field	14
9.3 Layout of receiver tower.....	14
9.4 Safety protection facilities	15
9.5 Maintenance and inspection facilities	15
10 Layout of power block.....	15
10.1 General requirements	15
10.2 Layout of thermal energy storage area	16
10.3 Layout of steam generation system area	16
10.4 Layout of steam turbine house	17
10.5 Layout of auxiliary heating area	17
10.6 Maintenance facilities	17
11 Collector system.....	17
11.1 General requirements	17
11.2 Heliostats.....	17
11.3 Receiver	18
11.4 Heliostat cleaning	19
12 Heat transfer, thermal energy storage and steam generation system	19
12.1 General requirements	19
12.2 Heat transfer system.....	20
12.3 Thermal energy storage system	20
12.4 Steam generation system.....	21
12.5 Auxiliary system.....	21
13 Steam turbine system	22
14 Water treatment system.....	22

14.1	Water quality and pretreatment	22
14.2	Water pre-desalination	22
14.3	Demineralized water treatment system.....	22
14.4	Heliostat cleaning water treatment	22
14.5	Wastewater treatment	23
15	Information system	23
15.1	Security and protection system	23
15.2	Video monitoring system for production	23
15.3	Information system cabling	23
15.4	Information security	23
16	Instrumentation and control	23
16.1	Automation level	23
16.2	Control mode and control room	23
16.3	Measurements and instrumentation.....	24
16.4	Alarms	24
16.5	Protection	24
16.6	Analogue control.....	25
16.7	Control system.....	25
16.8	Power supply to control system.....	26
17	Electrical equipment and system	26
17.1	Generator and main transformer	26
17.2	AC auxiliary power system	26
17.3	DC system and AC uninterruptible power supply	26
17.4	High-voltage electrical switchgear.....	27
17.5	Electric monitoring and control.....	27
17.6	Elements relay protection.....	27
17.7	Lighting system.....	27
17.8	Grounding system.....	27
17.9	Other facilities.....	27
18	Occupational safety and occupational health	27
Annex A (informative)	Electricity output estimation	28
Bibliography.....		30

INTERNATIONAL ELECTROTECHNICAL COMMISSION

SOLAR THERMAL ELECTRIC PLANTS –

Part 4-1: General requirements for the design of solar power tower plants

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.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 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) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 62862-4-1 has been prepared by IEC technical committee 117: Solar thermal electric plants. It is an International Standard.

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

Draft	Report on voting
117/XX/FDIS	117/XX/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 62862 series, published under the general title *Solar thermal electric plants*, 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,
- replaced by a revised edition, or
- amended.

SOLAR THERMAL ELECTRIC PLANTS –

Part 4-1: General requirements for the design of solar power tower plants

1 Scope

This part of IEC 62862 specifies the general requirements for the design of solar power tower plants and covers the electric power system requirements, the solar resource assessment, the site selection, the overall planning, the layout of the heliostat field and the receiver tower, the layout of the power block, the collector system, the heat transfer, the thermal energy storage and steam generation system, the steam turbine system, the water treatment system, the information system, instrumentation and control, the electrical equipment and system, occupational safety and occupational health.

This document is applicable to the design requirements of newly built, expanded or rebuilt solar power tower plants employing steam turbines with molten salt or water-steam as heat transfer fluid. If other heat transfer fluids are employed, it is possible that the provisions set out in this document will need to be adapted.

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 60034-1, *Rotating electrical machines – Part 1: Rating and performance*

IEC 60034-3, *Rotating electrical machines – Part 3: Specific requirements for synchronous generators driven by steam turbines or combustion gas turbines and for synchronous compensators*

IEC 60034-16 (all parts), *Rotating electrical machines – Part 16: Excitation systems for synchronous machines*

IEC 60038, *IEC standard voltages*

IEC 60045-1, *Steam turbines – Part 1: Specifications*

IEC 60076-1, *Power transformers – Part 1: General*

IEC 60076-2, *Power transformers – Part 2: Temperature rise for liquid-immersed transformers*

IEC 60076-3, *Power transformers – Part 3: Insulation levels, dielectric tests and external clearances in air*

IEC 60076-4, *Power transformers – Part 4: Guide to the lightning impulse and switching impulse testing – Power transformers and reactors*

IEC 60076-5, *Power transformers – Part 5: Ability to withstand short circuit*

IEC 60076-7, *Power transformers – Part 7: Loading guide for mineral-oil-immersed power transformers*

IEC 60086-1, *Primary batteries – Part 1: General*

IEC 60183, *Guidance for the selection of high-voltage A.C. cable systems*

IEC 60255 (all parts), *Measuring relays and protection equipment*

IEC 60479 (all parts), *Effects of current on human beings and livestock*

IEC TS 60815 (all parts), *Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 1: Definitions, information and general principles*

IEC 60839-11-2, *Alarm and electronic security systems – Part 11-2: Electronic access control systems – Application guidelines*

IEC 60870-5 (all parts), *Telecontrol equipment and systems – Part 5: Transmission protocols*

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 61850 (all parts), *Communication networks and systems for power utility automation*

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

IEC 62052-11, *Electricity metering equipment – General requirements, tests and test conditions – Part 11: Metering equipment*

IEC 62053 (all parts), *Electricity metering equipment – Particular requirements*

IEC 62053-21, *Electricity metering equipment – Particular requirements – Part 21: Static meters for AC active energy (classes 0,5, 1 and 2)*

IEC 62053-41, *Electricity metering equipment – Particular requirements – Part 41: Static meters for DC energy (classes 0,5 and 1)*

IEC 62271 (all parts), *High-voltage switchgear and controlgear*

IEC 62305-1, *Protection against lightning – Part 1: General principles*

IEC 62642-1, *Alarm systems – Intrusion and hold-up systems – Part 1: System requirements*

IEC 62676-1-1, *Video surveillance systems for use in security applications – Part 1-1: System requirements – General*

IEC TS 62749, *Assessment of power quality – Characteristics of electricity supplied by public networks*

IEC TS 62862-1-1, *Solar thermal electric plants – Part 1-1: Terminology*

IEC TS 62862-2-1, *Solar thermal electric plants – Part 2-1: Thermal energy storage systems – Characterization of active, sensible systems for direct and indirect configurations*

IEC 81346 (all parts), *Industrial systems, installations and equipment and industrial products – Structuring principles and reference designations*

ISO/IEC 11801-3, *Information technology – Generic cabling for customer premises – Part 3: Industrial premises*

ISO 8995-1, *Lighting of workplaces – Part 1: Indoor*

ISO/CIE 8995-3, *Lighting of workplaces – Part 3: Lighting requirements for safety and security of outdoor workplaces*

ISO 11064-3, *Ergonomic design of control centres – Part 3: Control room layout*

ISO 11064-6, *Ergonomic design of control centres – Part 6: Environmental requirements for control centres*

ISO 12100, *Safety of machinery – General principles for design – Risk assessment and risk reduction*

ISO/TR 14121-2, *Safety of machinery – Risk assessment – Part 2: Practical guidance and examples of methods*

ISO 45001, *Occupational health and safety management systems – Requirements with guidance for use*