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Solar thermal electric plants – Part 1-1: Terminology

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CONTENTS

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SOLAR THERMAL ELECTRIC PLANTS –

Part 1-1: Terminology

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Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC TS 62862-1-1, which is a technical specification, has been prepared by IEC technical committee 117: Solar thermal electric plants.

The text of this technical specification is based on the following documents:

Enquiry draft	Report on voting
117/75/DTS	117/85/RVDTS

Full information on the voting for the approval of this technical specification can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

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SOLAR THERMAL ELECTRIC PLANTS –

Part 1-1: Terminology

1 Scope

This part of IEC 62862 contains the main terms and definitions used by the solar thermal electric (STE) industry and intends to be a reference for users of industry documents.

Since the components and configurations of STE plants depend on the concentrating solar thermal technology used (i.e., central *receiver*, *parabolic-trough collector*, parabolic-dish or linear Fresnel *concentrator*), some terms are not applicable to all types of STE plants and notes have been introduced in their definitions for clarification.

The reference STE plant configuration assumed is composed of three main subsystems: *solar field*, *power block* and (eventually) *thermal storage system*.

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.

ISO 9488:1999, *Solar energy – Vocabulary*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1 SECTION 01: DESCRIPTION OF SYSTEMS, SUB-SYSTEMS AND COMPONENTS

3.1.1
absorber
element of the *receiver* absorbing *radiant solar energy* and transferring it to a fluid in the form of heat

3.1.2
absorber cover
transparent element that covers the *absorber* to reduce heat losses and provide weather protection

Note 1 to entry: When this element is made of glass it is usually referred to as a "glass cover".

3.1.3
active length of a linear receiver
length of the *absorber* exposed to concentrated solar radiation, at a reference temperature

Note 1 to entry: This temperature is 25 °C if not otherwise stated. The *absorber* length considered to be exposed is that where the radiation impinging normal to the *absorber*'s surface is not shadowed.

Note 2 to entry: Unit: the SI unit is m.

3.1.4
auxiliary heater
equipment in which thermal energy is transferred to the *heat transfer fluid* by means of *non-solar fuel consumption*

3.1.5
collector aperture normal
vector perpendicular to the *collector aperture plane*

3.1.6
collector aperture plane
plane, perpendicular to the *collector transversal plane*, that contains the *solar thermal collector aperture area*

3.1.7
collector axis
<*line-focus solar thermal collectors*> straight line resulting from the intersection of the *collector aperture plane* and a plane containing the *linear receiver* and perpendicular to the *collector aperture plane*

SEE: Figure 3.

3.1.8
collector longitudinal plane
plane defined by the *collector axis* and the *collector aperture normal*

SEE: Figure 2.

3.1.9
collector loop
set of *line-focus solar thermal collectors* assembled in series, in such a way that the same *heat transfer fluid* mass flow is circulating through the *absorber* tube of each

Note 1 to entry: A loop is composed of one or more *collector rows* connected in series.

3.1.10
collector row
set of *line-focus solar thermal collectors* assembled in series with the same *heat transfer fluid* mass flow and direction

3.1.11
collector transversal plane
plane perpendicular to the *collector axis*

SEE: Figure 2.

3.1.12
concentrator
reflecting or refracting elements that concentrate and redirect the *beam solar radiation* onto the *receiver*

3.1.13
dispatchability
capability of the *STE plant* to respond to the grid operator on demand, regardless of weather conditions

Note 1 to entry: The design of the plant and the availability of backup energy determine the degree on which grid operator demands can be fulfilled.

3.1.14
dispatchable STE plant
STE plant able to decouple the electricity production periods from the solar resource availability periods in order to satify the grid operator dispatch demands

3.1.15
effective length factor of a linear receiver
ratio of the *active length of a linear receiver* to its total length, at the specific temperature of the *receiver* tube

Note 1 to entry: Although the *effective length factor* can be given for any *absorber* temperature, its nominal reference temperature is 25 °C if not specified otherwise.

3.1.16
facet
smallest reflecting or refracting element composing a solar *concentrator*

3.1.17
heat transfer fluid
HTF
fluid used to carry heat from one system component to another in the *STE plant*

3.1.18
heliostat
system that reflects the *beam solar radiation* towards a predetermined fixed target by means of a single or a set of reflecting elements (*facets*) controlled by a 2-axis solar tracking system

3.1.19
linear collector incident plane
plane defined by the solar vector and the *collector axis*.

3.1.20
linear Fresnel collector
line-focus solar thermal collector that uses reflectors composed of at least two longitudinal segments with parallel axes to concentrate the solar radiation onto a fixed *receiver*

3.1.21
line-focus solar system
solar system using *line-focus solar thermal collectors.*

3.1.22
line-focus solar thermal collector
concentrating *solar thermal collector* that concentrates *solar radiation* in one plane only, producing a linear focus

[SOURCE: ISO 9488:1999, 7.7, modified – The term has been changed from "line-focus collector".]

3.1.23
line-focus solar thermal collector module
minimum subdivision of a *line-focus solar thermal collector* for which the *concentrator*, in its whole transversal extent, can be actuated independently

3.1.24
parabolic-dish collector
point-focus solar thermal collector using a parabolic-dish reflector

[SOURCE: ISO 9488:1999, 7.10.]

3.1.25
parabolic-trough collector
solar collector assembly
SCA
line-focus solar thermal collector that concentrates the solar radiation by means of a reflector with a parabolic cross section

Note 1 to entry: It is composed of a set of elements that altogether can track the sun as a single unit.

[SOURCE: ISO 9488:1999, 7.8, modified – Note 1 to entry added.]

3.1.26
parabolic-trough solar field circuit
linear Fresnel solar field circuit
parabolic-trough heat transfer fluid system
linear Fresnel heat transfer fluid sytem
system made up of the component parts through which the *solar field heat transfer fluid* flows from/to other sub-system of the plant (e.g. *power block*, *thermal storage* system, *auxiliary heater)*

3.1.27
point-focus solar system
solar system using *point-focus solar thermal collectors* or a *central receiver*

3.1.28
point-focus solar thermal collector
solar thermal collector that concentrates the solar radiation on a single point or non-linear focus

3.1.29
positive collector axis
defines the orientation of the *solar thermal collector*

Note 1 to entry: The alignment in space is described by the *collector axis azimuth angle*.

Note 2 to entry: The axis orientation is positive or there is a *positive collector axis* when the projection of the *collector axis* into the horizontal plane points towards the south in the northern hemisphere, and towards the north in the southern hemisphere. In the case of east-west aligned *solar thermal collectors*, the *positive collector axis* is when the projection points towards the west.

3.1.30
power block
STE plant equipment or components in which thermal-to-electric conversion takes place

Note 1 to entry: In those *STE plants* provided with steam generators fed by the *heat transfer fluid* used in the *solar field*, the steam-generating system is included in the *power block*. In STE plants with direct steam generation, the solar *receivers* are not included in the *power block.*

3.1.31
receiver
set of components (*absorbers*, glass cover, bellows, getters, etc.) that converts the concentrated solar radiation into thermal energy

Note 1 to entry: For solar tower plants, other plant components, required for the *receiver* to work, are included.

3.1.32
central receiver
single receiver used with *solar fields* composed of *heliostats*

3.1.33
linear receiver
receiver used in *line-focus solar thermal collectors*

3.1.34
solar field
part of the *STE plant* that collects and concentrates the *beam solar radiation*

Note 1 to entry: In *STE plants* with *parabolic-trough collector* or *Fresnel linear collectors*, the *solar field* is composed of a set of *solar thermal collectors* and their piping interconnections and headers. The *solar field* inlet is the last connecting point in the direction from the pumping equipment to the *solar thermal collectors* at which either the storage system, *auxiliary heater* or pumps are connected, while the *solar field* outlet is the first connecting point in the direction from the *solar thermal collectors* to the *power block* at which either the *thermal storage system* or *auxiliary heater* is connected. In a central *receiver* plant, the *solar field* is composed of the *heliostats*. In STE plants with parabolic dishes, the *solar field* is composed of the parabolic dishes.

3.1.35
solar thermal collector
device designed to absorb the solar radiation (concentrated or non-concentrated) and transfer the thermal energy thus generated to a *heat transfer fluid*

Note 1 to entry: For concentrating *solar thermal collectors*, the main components are: the *concentrator*, the *receiver* and the *supporting structure*.

3.1.36
solar thermal electricity plant
STE plant
solar thermal power plant
STP plant

facility, which applies solar concentration and thermodynamic processes, to convert direct solar radiation into electricity suitable for its distribution and consumption

Note 1 to entry: The facility can include further sources of thermal energy, such as fossil fuel or biomass, in parallel to solar radiation.

Note 2 to entry: Historically, "CSP" (concentrated solar power) universally referred only to, and was used in place of, "STE". Only in recent years has the term "STE" (solar thermal electricity) become widespread and have some organizations changed the definition of CSP to include both STE and concentrating photovoltaics (CPV). However, some organizations still use "CSP" to refer to, and in place of, "STE", and in these cases CSP does not include CPV. Therefore, the meaning of CSP varies between organizations without a clear definition and is not used herein. The term "CST" (concentrating solar thermal) is used to globally or individually refer to the technologies used to concentrate and convert solar radiation into thermal energy (i.e. CST technology or technologies).

3.1.37
supporting structure
structure that serves to support the components of the *solar thermal collector* with the required mechanical stiffness.

3.2 SECTION 02: ANGLE DEFINITIONS

3.2.1
acceptance angle of a concentrating solar thermal collector
$2 \cdot \theta_c$
angular range ($2 \cdot \theta_c$) over which all parallel rays intercepted by the *solar thermal collector* hit the *absorber* without moving all or part of the *collector*

Note 1 to entry: For nominal values, a perfect shape of the *concentrator* is assumed.

Note 2 to entry: Unit: the non-SI unit is °.

3.2.2
angle of acceptance of specular reflectance
ψ
polar angle defined by the direction of the ideal specular reflected beam and the direction of the admissible maximum dispersion of reflection on the surface

SEE: Figure 1.

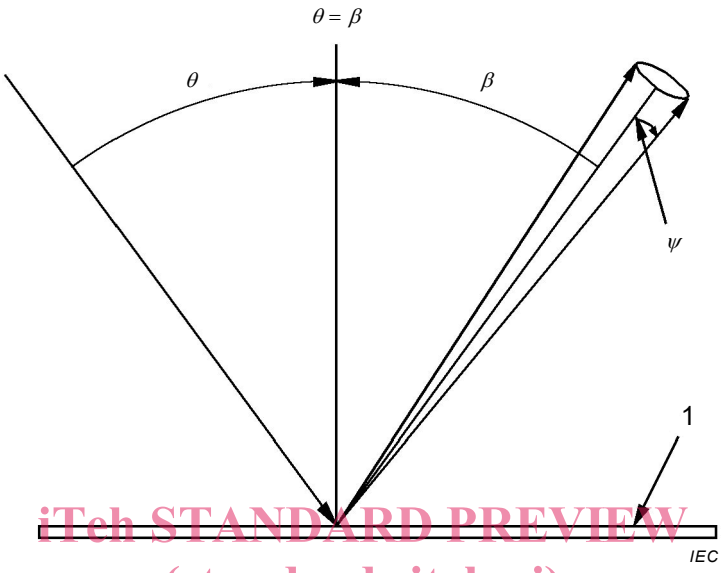

Figure 1 – Angle of acceptance of specular reflectance, ψ

Key:

θ Incidence angle

β Reflection angle

ψ *Angle of acceptance of specular reflectance*

1 Reflecting surface

Note 1 to entry: Unit: the non-SI unit is °.

3.2.3
angle of incidence of the beam solar radiation
incidence angle of the beam solar radiation
incident angle of the beam solar radiation
θ
angle between the straight line joining the centre of the solar disk to a point on an irradiated surface and the outward normal to the irradiated surface at that point

SEE: Figure 2.

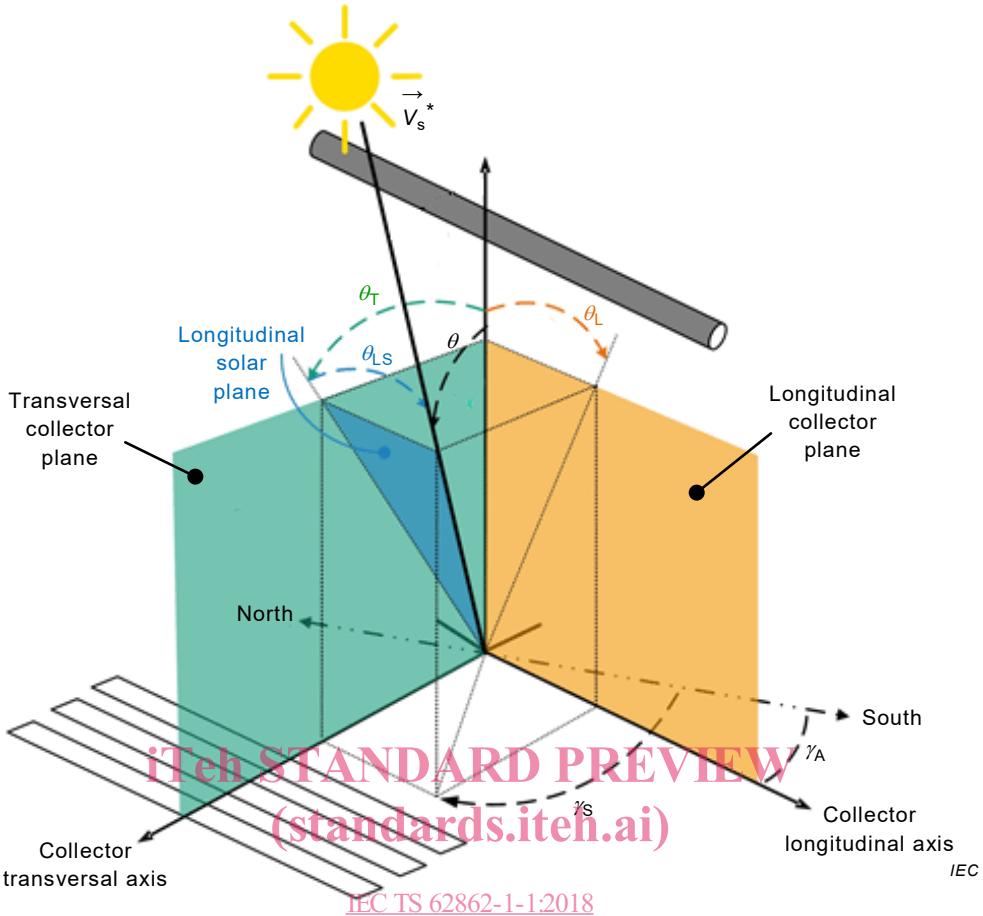

Figure 2 – Angles of incidence in *linear Fresnel collectors*

Note 1 to entry: For *parabolic-trough collectors* and *parabolic dishes*, the irradiated surface is the *solar thermal collector aperture area*. For *linear Fresnel collectors*, the irradiated surface is fixed in space and usually horizontal.

Note 2 to entry: Unit: the non-SI unit is °.

[SOURCE: ISO 9488:1999, 2.11, modified – Term changed to "angle of incidence of the beam solar radiation" and reference to Figure 2 added.]

3.2.4
transversal angle of incidence
θ_T
angle between the *collector aperture normal* and the projection of the sun beam into the transversal plane (plane perpendicular to the *collector axis*)

SEE: Figure 2.

Note 1 to entry: The *transversal angle of incidence* gets positive if the projection of the solar beam into the transversal plane rotates in clockwise direction from the vertical for an observer placed at the northern end of the *solar thermal collector*. For a collector exactly aligned east-west, the angle gets positive if the projection of the solar beam into the transversal plane rotates counter-clockwise from the vertical for an observer placed at the eastern end of the *solar thermal collector*.

Note 2 to entry: Unit: the non-SI unit is °.

3.2.5
longitudinal angle of incidence
θ_L
angle between the *collector aperture normal* and the projection of the sun beam into the longitudinal plane (plane defined by the *collector axis* and the *collector aperture normal*)