BS EN ISO 24194:2022+A1:2024

BSI Standards Publication

Solar energy — Collector fields — Check of performance

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The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to ISO text carry the number of the ISO amendment. For example, text altered by ISO amendment 1 is indicated by A1 A1.

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Solar energy - Collector fields - Check of performance (ISO 24194:2022)

Energie solaire - Champs de capteurs - Vérification de la performance (ISO 24194:2022)

Sonnenenergie - Kollektorfelder - Überprüfung der Leistungsfähigkeit (ISO 24194:2022)

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Foreword

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This document was prepared by Technical Committee ISO/TC 180, *Solar energy*, Subcommittee SC 4, *Systems - Thermal performance, reliability and durability*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 312, *Thermal solar systems and components,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

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Introduction

This document specifies procedures for checking the performance of solar thermal collector fields. Measured performance is compared with calculated performance - and conditions for conformity are given.

Three levels for accuracy in the checking can be chosen:

— Level I - giving possibility for giving a very accurate estimate (with low safety retention, e.g. f_{safe} = 0,95) - but with requirements for use of expensive measurement equipment.

— Level II/III - allowing for a less accurate estimate (with higher safety retention, e.g. f_{safe} = 0,90) - but possibility to use less expensive measurement equipment.

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Solar energy — Collector fields — Check of performance

1 Scope

This document specifies two procedures to check the performance of solar thermal collector fields. This document is applicable to glazed flat plate collectors, evacuated tube collectors and/or tracking, concentrating collectors used as collectors in fields.

The check can be done on the thermal power output of the collector field and also be on the daily yield of the collector field.

The document specifies for the two procedures how to compare a measured output with a calculated one.

The document applies for all sizes of collector fields.

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 9060, *Solar energy — Specification and classification of instruments for measuring hemispherical solar and direct solar radiation*

ISO 9488, *Solar energy — Vocabulary*

ISO 9806, *Solar energy — Solar thermal collectors — Test methods*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 9488 and the following apply.

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
transversal plane
plane defined by the normal to the plane of the collector and the line orthogonal to the concentrator axis, or the shortest symmetry line for flat biaxial geometries

4 Symbols

	A_G	Gross area of collector as defined in ISO 9488	m^2
	A_{GF}	Gross area of collector field	m^2
A1	a_1	Heat loss coefficient at $(\vartheta_m - \vartheta_a) = 0$	$W/(m^2 \cdot K)$
A1	a_2	Temperature dependence of the heat loss coefficient	$W/(m^2 \cdot K^2)$
A1	a_3	Wind speed dependence of the heat loss coefficient	$J/(m^3 \cdot K)$

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A1 a_4 A1	Sky temperature dependence of the heat loss coefficient	—
a_5	Effective thermal capacity. In some literature and data sheets denoted C_{eff}. Note that C_{eff} unit is kJ/m²K.	J/(m²·K)
A1 a_6 A1	Wind speed dependence of the zero-loss efficiency	s/m
A1 a_7 A1	Wind speed dependence of IR radiation exchange	W/(m²·K⁴)
a_8	Radiation losses dependence	W/(m²·K⁴)
b_u	Collector efficiency coefficient (wind dependence)	s/m
C	Effective thermal capacity of collector	J/K
C_R	Geometric concentration ratio	—
c_f	Specific heat capacity of heat transfer fluid	J/(kg·K)
$c_{f,i}$	Specific heat capacity of heat transfer fluid at the collector inlet	J/(kg·K)
$c_{f,e}$	Specific heat capacity of heat transfer fluid at the collector outlet	J/(kg·K)
A1 G_{bn} A1	Solar radiation received per unit area by a surface that is always held perpendicular (or normal) to the rays that come in a straight line from the direction of the sun at its current position	W/m²
A1 E_L A1	Longwave irradiance ($\lambda > 3$ µm)	W/m²
f_P	Safety factor taking into account heat losses from pipes etc. in the collector loop.	-
f_U	Safety factor taking into account measurement uncertainty.	-
f_O	Safety factor for other uncertainties e.g. related to non-ideal conditions such as non-ideal flow distribution and unforeseen heat losses - and uncertainties in the model/procedure itself.	-
f_{safe}	Mathematical product based on the individual safety factors f_P, f_U, f_O	-
f_{sh}	Shading factor	-
D	Gap in between adjacent collectors	m
G_{hem}	Hemispherical solar irradiance on the plane of collector	W/m²
G_b	Direct solar irradiance (beam irradiance) on the plane of collector	W/m²
G_d	Diffuse solar irradiance on the plane of collector	W/m²
A1 H_{hem} A1	Total daily irradiation sum on collector plane without shadow	kWh/m²
h	Solar altitude angle. sin h = cos θ_Z	°
h_{min}	Minimum solar altitude angle	°
H_{sh}	Height of the shaded area	m
$K_{hem}(\theta_L,\theta_T)$	Incidence angle modifier for hemispherical solar radiation	—
$K_b(\theta_L,\theta_T)$	Incidence angle modifier for direct solar irradiance	—

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