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

Énergie solaire — Spécification et classification des instruments de mesurage du rayonnement solaire hémisphérique et direct

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 180, *Solar energy*, Subcommittee SC 1, *Climate — Measurement and data*.

This second edition cancels and replaces the first edition (ISO 9060:1990), which has been technically revised. The main changes compared to the previous edition are as follows:

— in addition to thermopile radiometers, other technology options have been included such as photoelectric sensors as long as they fulfil the requirements specified in this document;

— the spectral error is used to characterize the spectral responsivity;

— to further characterize the radiometers, the additional properties “spectrally flat” and “fast response” can be added to the classification if the radiometers fulfil specific criteria;

— more intuitive names have been introduced for the classes: “A”, “B”, “C”.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document is one of a series of standards that specify methods and instruments for the measurement of solar radiation in support to solar energy utilization.

Accurate solar radiation data are used in meteorology and are needed for developing solar energy appliances, in particular for performance testing, solar radiation simulation and resource assessment.

The measurement of radiation is needed for determination of the conversion efficiencies of solar appliances. The specification and classification of these instruments are needed in order to enable the comparison of solar radiation data on a worldwide basis. In addition, this classification is intended to assist end users/consumers and entities requiring and tendering radiometers with the choice or comparison of instruments, to protect end users/consumers and to offer a level playing field for manufacturers.

The specification and classification of solar radiometers specified in this document provides an accuracy ranking and focuses on application specific requirements and qualities. However, solar radiometers are used in a wide range of applications with often conflicting requirements. The best radiometer for one application may be inadequate for a different application. In order to address this issue at least partly, a sensor of a given class can be assigned the additional properties “fast response” and/or “spectrally flat” to further characterize the radiometers.

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

1 Scope

This document establishes a classification and specification of instruments for the measurement of hemispherical solar and direct solar radiation integrated over the spectral range from approximately 0,3 µm to about 3 µm to 4 µm.

Instruments for the measurement of hemispherical solar radiation and direct solar radiation are classified according to the results obtained from indoor or outdoor performance tests. This document does not specify the test procedures.

2 Normative references

There are no normative references in this document.

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:

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

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

3.1
hemispherical solar radiation
solar radiation received by a plane surface from a solid angle of 2π sr

Note 1 to entry: Approximately 97 % to 99 % of the hemispherical solar radiation incident at the Earth's surface is contained within the wavelength range from 0,3 µm to 3 µm[1]. Generally, hemispherical solar radiation is composed of direct solar radiation and diffuse solar radiation (solar radiation scattered in the atmosphere) as well as solar radiation reflected by the ground.

3.2
global horizontal irradiance
hemispherical solar radiation received by a horizontal plane surface

Note 1 to entry: The tilt angle and the azimuth of the receiver surface should be specified, e.g. horizontal.

3.3
direct solar radiation
radiation received from a small solid angle centred on the sun's disc, on a given plane

Note 1 to entry: In general, direct solar radiation is measured by instruments with field-of-view angles of up to 6°. Therefore a part of the scattered radiation around the sun's disc (circumsolar radiation or aureole) is also included (see 5.1). Historic pyrheliometers of the Angström type (compensation pyrheliometer) have a larger field of view of up to 15°. A more detailed definition of circumsolar radiation and related parameters can be found in Reference [2].

Note 2 to entry: Approximately 97 % to 99 % of the direct solar radiation received at the ground is contained within the wavelength range from 0 µm to 3 µm[1].