STANDARD **9059**

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Solar energy — Calibration of field pyrheliometers by comparison to a reference pyrheliometer

Énergie solaire — Étalonnage des pyrhéliomètres de terrain par comparaison à un pyrhéliomètre de référence

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Contents

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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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 9059 was prepared by Technical Committee ISO/TC 180, *Solar energy*.

Annexes A and B of this International Standard are for information only.

Introduction

This International Standard is one of a series of International Standards specifying methods and instruments for the measurement of solar radiation.

Pyrheliometers are used to measure direct solar irradiance. The data collected are used for

— the determination of the efficiency of concentrating collectors,

— the determination of the direct beam resource for concentrating solar energy devices as well as for determining their siting, sizing, etc., and

— the accurate determination of hemispherical solar radiation as a sum of the measured direct solar and diffuse solar radiation.

The calibration hierarchy of pyrheliometers specified in this International Standard follows the scheme developed by the World Meteorological Organization (WMO) [1], and the classification and specification used are prescribed in ISO 9060. During the elaboration of this International Standard, extensive reference was made to ASTM 816-81 [2].

Solar energy — Calibration of field pyrheliometers by comparison to a reference pyrheliometer

1 Scope

This International Standard describes the calibration of field pyrheliometers using reference pyrheliometers and sets out the calibration procedures and the calibration hierarchy for the transfer of the calibration.

This International Standard is mainly intended for use by calibration services and test laboratories to enable a uniform quality of accurate calibration factors to be achieved.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 9060:1990, *Solar energy — Specification and classification of instruments for measuring hemispherical solar and direct solar radiation.*

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 direct solar radiation: Radiation received from a small solid angle centred on the sun's disc, on a given plane. [ISO 9060:1990, 3.3.]

3.2 pyrheliometers: Radiometers designed for measuring the irradiance which results from the solar radiant flux from a well-defined solid angle the axis of which is perpendicular to the plane receiver surface.

NOTE 1 It follows from this definition that pyrheliometers are used to measure direct solar radiation at normal incidence. Typical field-of-view angles of pyrheliometers range from 5° to 10°. Unlike the windowless instruments, the spectral responsivity of field pyrheliometers is limited to the range approximately 0,3 μm to 3 μm, depending on the spectral transmittance of the window which protects the receiver surface. However, windowless instruments operate with a loss of energy of less than 1 % (see ISO 9060:1990, note 2 to 3.3).

3.3 field pyrheliometers: Pyrheliometers which are designed and used for long-term field measurements of direct solar radiation. These pyrheliometers are weather-proofed. The receiver is protected from wind, dirt, rain, snow and insects by a window (made of quartz) or alternatively by a system ensuring strong ventilation with air.

3.4 reference pyrheliometers: Pyrheliometers of any category serving as a reference in calibration procedures. They are selected and well-tested instruments (see ISO 9060:1990, table 2), which have a low rate of yearly change in responsivity. They are controlled on a routine basis by comparisons with other reference pyrheliometers.

NOTE 2 Generally, reference pyrheliometers are operated without protective windows.

To achieve the above-mentioned stability of the responsitivity, the use of a reference pyrheliometer should be restricted to comparisons and calibration activities. The instrument should be stored carefully in a laboratory under moderate ambient conditions.

3.5 primary standard pyrheliometers: Pyrheliometers, selected from the group of absolute pyrheliometers (also called absolute radiometers), which meet the requirements of ISO 9060:1990, 5.3.1.

3.6 secondary standard pyrheliometers: Pyrheliometers of high precision and stability whose calibration factors are derived from primary standard pyrheliometers. The group comprises absolute pyrheliometers, which do not fulfil the requirements of