STANDARD 9846

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Solar energy — Calibration of a pyranometer using a pyrheliometer

Énergie solaire — Étalonnage d'un pyranomètre utilisant un pyrhéliomètre

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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 9846 was prepared by Technical Committee ISO/TC 180, *Solar energy*, Sub-Committee SC 1, *Climate – Measurement and data*.

Annexes A, B, C, D, E, F and G of this International Standard are for information only.

Introduction

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

From meteorological applications of pyranometers, considerable experience has been gained with a number of calibration methods. These methods may be divided into two groups specified by the type of reference radiometer used. Calibration methods using pyranometers as a reference have been treated in ISO 9847; methods using pyrheliometers are the subject of this standard.

The latter methods are more complicated than the former, because the pyranometers, which typically have a field-of-view angle of 2π, have to be compared with pyrheliometers, which are designed to measure direct solar radiation within a relatively small field of view.

On the other hand, due to the relatively high accuracy of pyrheliometers, the latter methods are more accurate than the former ones. Since the WMO world radiometric reference (WRR), which represents the SI units of irradiance, is determined by a group of selected pyrheliometers, the transfer of the scale to pyranometers has to be accomplished by using standard pyrheliometers (see ISO 9060). Short descriptions of the calibrations are given in [1], [2] and [3].

It should be emphasized that "calibration of a pyranometer" essentially means the transfer of the WRR scale to the pyranometer under selected conditions. The determination of the dependence of the calibration factor (calibration function) on variable parameters is called "characterization". The characterization of pyranometers is the subject of the appropriate International Standard for test methods for pyranometers.

Solar energy — Calibration of a pyranometer using a pyrheliometer

1 Scope

The object of this International Standard is to promote the uniform application of reliable methods to calibrate pyranometers, since accurate calibration factors are the basis of accurate hemispherical solar radiation data which are needed for solar energy test applications or simulations.

This International Standard is applicable to all pyranometers in horizontal as well as in tilted positions. Its use is mandatory for the calibration of secondary standard pyranometers according to ISO 9060, and is recommended for the calibration of pyranometers which are used as reference instruments in comparisons. For other applications, the method using pyranometers as references may be used (see ISO 9847).

This International Standard is intended for use by test institutions or test laboratories equipped with well-maintained pyrheliometers.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were 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 editions of the standards 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.*

ISO 9847:1992, *Solar energy — Calibration of field pyranometers by comparison to a reference pyranometer.*

ISO/TR 9901:1990, *Solar energy — Field pyranometers — Recommended practice for use.*

3 Definitions

For the purposes of this International Standard, the definitions given in ISO 9060 and the following definitions apply.

3.1 calibration of a radiometer: Determination of the responsivity (or the calibration factor, as its reciprocal) of a radiometer under well-defined measurement conditions.

3.2 reference pyranometer: Pyranometer (see ISO 9060), used as a reference to calibrate other pyranometers (see ISO 9847), which is a well-maintained and carefully selected instrument of relatively high stability and which has been calibrated using a pyrheliometer.

3.3 field-of-view angle of a pyrheliometer: Full angle of the cone which is defined by the centre of the receiver surface (see ISO 9060, 5.1) and the border of the aperture, if the latter is circular and concentric to the receiver surface; if not, effective angles may be calculated [4].

3.4 solar tracker; sun tracker: Power-driven or manually operated support which is employed to direct a pyrheliometer to the sun.

"Equatorial trackers" are sun-following devices which have an axis of rotation pointing towards the elevated pole; the axes of motion are the hour angle and the declination of the sun. "Altazimuth trackers" are sun-following devices with the solar elevation angle and the azimuth angle of the sun as coordinates of movement.

3.5 sun-shading disc device; shade disc device: Device which allows movement of a disc in such a way that the receiver of the radiometer (for example, a pyranometer) is shaded from the sun.