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Solar energy — Pyranometers — Recommended practice for use

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National foreword

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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/TR 9901:1990), which has been technically revised.

The main changes compared to the previous edition are as follows:

— adaptation of the terminology to the revised ISO 9060:2018 including reference to new “non-spectrally flat” and “fast response” instruments;

— added recommended practices for use of modern pyranometers with a digital output, including internal diagnostics;

— added recommended practices for use of pyranometers to measure “plane of array” and reflected radiation;

— added references to the main standards used in solar energy application of pyranometers: IEC 61724-1:2017, ASTM G213-17 and ASTM G183-15.

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.

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Introduction

This document contains recommendations for use of pyranometers in solar energy applications. It summarises the state of the art and updates the first edition of 1990. In recent years the application of solar radiation measurement, using pyranometers, has risen sharply. The main application of pyranometers now is no longer scientific research, but assessment of the performance of PV solar power plants, that is power plants employing photovoltaic solar modules. The reflected irradiance measurement also has become more relevant with the increasing application of bifacial modules.

Between 1990 and now the use of pyranometers has been further standardized. Two examples are the 2017 revision of IEC 61724, the group of standards governing use of PV system performance monitoring, and the 2018 revision of ISO 9060 covering pyranometer and pyrheliometer specification and classification. The IEC standard implicitly recognises that solar irradiance is a critical and often the least accurately known parameter in solar energy performance assessment. For those users that choose to work according to this standard, IEC 61724-1 now defines 3 monitoring system classes and offers detailed guidelines for use of pyranometers including requirements (not recommendations) for the pyranometer classes that must be used, for instrument heating and for inspection-, cleaning and recalibration intervals.

The solar community also has come to realize that a measurement without an uncertainty evaluation is meaningless. IEC 61724-1 requires this evaluation when measurement results are reported, usually as PV performance ratio and performance index. ASTM has issued the G213 standard in 2017 for uncertainty evaluation of the measurement with pyranometers.

The 1990 version of ISO TR 9901 included reference only to “spectrally flat” pyranometers. Now that ISO 9060 in its latest version also defines and classifies “non-spectrally flat” pyranometers, this document also refers to the use of these instruments.

As in all above documents, uncertainties mentioned in this document are expanded uncertainties with a coverage factor $k = 2$.

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TECHNICAL REPORT **ISO/TR 9901:2021**

Solar energy — Pyranometers — Recommended practice for use

1 Scope

This document gives recommended practice for the use of pyranometers in solar energy applications (e.g. testing of solar photovoltaic panels, solar thermal collectors or other devices, and performance monitoring of solar energy systems). It is applicable for both outdoor and indoor use of pyranometers, when measuring plane of array, global horizontal and reflected irradiance, or radiation from a solar simulator. The measurement may be carried out on either a horizontal or an inclined surface, and the pyranometer may be part of a diffusometer, i.e. combined with a sun-shading device to measure diffuse radiation.

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
pyranometer
radiometer designed for measuring the irradiance on a plane receiver surface which results from the radiant fluxes incident from the hemisphere above within the wavelength range from approximately 0,3 µm to about 3 µm to 4 µm

[SOURCE: ISO 9060:2018, 3.5, modified — Note 1 to entry was deleted.]

3.2
hemispherical radiation
solar radiation received by a plane surface from a solid angle of 2π sr

[SOURCE: ISO 9060:2018, 3.1, modified — Note 1 to entry was deleted.]

3.3
global horizontal irradiance
GHI
hemispherical radiation (3.2) received by a horizontal plane surface, also denoted as G

[SOURCE: ISO 9060:2018, 3.2, modified — "GHI" was added as abbreviated term and "also denoted as G" was added at the end of the definition.]

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