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International

ISO 9059

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

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

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

This second edition cancels and replaces the first edition (ISO 9059:1990) which has been technically revised.

The main changes are as follows:

— focus on current calibration practices;

— adapted recommendations for mathematical treatment of data;

— revised terminology in line with ISO 9060, ISO 9488, ISO Guide 99 and BIPM VIM[2];

— added comments on uncertainty evaluation of the calibration with reference to ASTM G213[3] and ISO/IEC GUIDE 98-3.

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Pyrheliometers measure the direct solar irradiance, expressed in Watts per square meter ($W \cdot m^{-2}$), received from the sun when the instrument is pointed directly at it.

Accurate measurements of the direct solar irradiance are required for:

a) determination of the energy input to solar energy systems such as photovoltaic (PV), and solar thermal systems, as a basis for performance assessment;

b) testing and assessment of solar technologies;

c) geographic mapping of solar energy resources;

d) understanding climate change and extreme weather through the surface radiation budget;

e) other applications such as agriculture, building efficiency, material degradation and reliability, health.

Current solar energy performance assessment demands high-accuracy measurements and low measurement uncertainties. To meet this demand, reliable and accurate solar irradiance measurements with synchronized time stamps (see Reference [4]) and a correct uncertainty evaluation are required.

Calibration of measurement instrumentation is an essential part of the uncertainty evaluation and part of any quality management system. Regular instrument recalibration according to this document helps attain the required low measurement uncertainties. Consistent calibration results indicate instrument stability combined with best measurement practices confirm that the measurement data collected over the time interval from the previous to the present calibration are reliable.

Unless otherwise specified, uncertainties mentioned in this document are expanded uncertainties with a coverage factor $k = 2$.

The calibration of pyrheliometers specified in this document is traceable to the international system of units (SI) through the world radiometric reference (WRR) according to the world meteorological organization (WMO) guidelines.[5] The classification and specification used are given in ISO 9060.

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