

Method for

Calibrating field pyrheliometers by comparison to a reference pyrheliometer

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Refrigeration Heating and Air Conditioning Standards Policy Committee (RHE/-) to Technical Committee RHE/25, upon which the following bodies were represented:

- Association for Consumer Research (ACRE)
- Association of Consulting Engineers
- British Gas plc
- British Precast Concrete Federation Ltd.
- Chartered Institution of Building Services Engineers
- Copper Development Association
- Cranfield Institute of Technology
- Department of the Environment
- Department of the Environment (Building Research Establishment)
- Design Council
- Institution of Gas Engineers
- International Solar Energy Society
- National Centre for Alternative Technology
- Royal Institute of British Architects
- Solar Trade Association
- Swimming Pool and Allied Trades Association Ltd.
- University College Cardiff
- Water Byelaws Advisory Service

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National foreword

This British Standard has been prepared under the direction of the Refrigeration Heating and Air Conditioning Standards Policy Committee and is identical with ISO 9059:1990 “*Solar energy — Calibration of field pyrheliometers by comparison to a reference pyrheliometer*”, published by the International Organization for Standardization (ISO) and prepared by Technical Committee ISO/TC 180, Solar heating, in which the UK played an active part.

Cross-reference

The Technical Committee has reviewed the provisions of ISO 9060:1990, to which reference is made in the text, and has decided that they are acceptable for use in conjunction with this standard.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 8, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

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].

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 responsivity, 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