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Glass in building — Determination of the emissivity

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Foreword

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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).

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This document was prepared by the European Committee for Standardization (CEN) (as EN 12898:2019) and was adopted, without modification other than those given below by Technical Committee ISO/TC 160, *Glass in building*.

— informative parts of the Scope have been moved to the Introduction;

— “this European Standard” was changed to “this document”;

— references to EN standards have been changed to references to the corresponding ISO standards;

— clarifications have been made to Figure D.1, Figure D.2, Figure D.3 and Figure D.4, and their keys;

— the term “sample” has been changed to “specimen”.

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 is based on the use of reflectance measurements using double beam dispersive infrared spectrometers capable of measuring over almost the entire spectral range of a black body standard reference temperature and determining the emissivity by the 30 ordinate method.[1] It also takes account of Fourier Transform Infrared (FTIR) spectrophotometers where the spectral range is limited. It describes a method whereby spectrophotometers can be used to determine emissivity if they are able to measure up to the 24th ordinate point and if they satisfy a noise criterion for this spectral range. It allows the inclusion of data from the 25th ordinate point up to the 30th ordinate point.

As FTIR spectrophotometers are single beam instruments as opposed to dispersive spectrophotometers which are double beam instruments (and thus able to correct for instrument drift), a procedure was developed by the European funded project, THERMES, to correct for drift. This procedure is described in [2] and [3]. Other categories of ordinate errors using FTIR spectrophotometers are discussed in [4].

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Glass in building — Determination of the emissivity

1 Scope

This document specifies a procedure for determining the emissivity at room temperature of the surfaces of glass and coated glass.

The emissivity is necessary for taking into account heat transfer by radiation from surfaces at the standard temperature of 283 K in the determination of the U value and of the total solar transmittance of glazing according to ISO 9050[5], ISO 10291[6], ISO 10292[7], and ISO 10293[8].

The procedure, being based on spectrophotometric specular reflectance measurements at near normal incidence on materials that are non-transparent in the infrared region, is not applicable to glazing components with at least one of the following characteristics:

a) with rough or structured surfaces where the incident radiation is diffusely reflected;

b) with curved surfaces where the incident radiation is regularly reflected at angles unsuitable to reach the detector while using specular reflectance accessories;

c) infrared transparent.

However, it can be applied with caution to any glazing component provided its surfaces are flat and non-diffusing (see non-diffusing glazing component) and it is non-transparent in the infrared region (see glazing component non-transparent in the infrared region).

Although transmittance measurements are included in this document, they are only necessary to check if the specimen is non-transparent in the infrared region in the context of this document (see glazing component non-transparent in the infrared region). If the specimen is transparent in the infrared region, this document is not applicable.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 10292, *Glass in building — Calculation of steady-state U values (thermal transmittance) of multiple glazing*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at http://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
infrared
5 µm to 50 µm spectral range

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3.2
emissivity
ratio of the energy emitted by a given surface at a given temperature to that of a perfect emitter (black body with normal and corrected emissivity = 1,0) at the same temperature

Note 1 to entry: Two different definitions of emissivity should theoretically be used to describe radiation exchange between:

a) glass surfaces facing each other in multiple glazing (effective emissivity);

b) a glass surface facing a room (hemispherical emissivity).

However, in practice numerical differences were found to be negligibly small.[9] Thus, corrected emissivity is used to describe both types of heat exchange with a close approximation.

3.3
specular reflectance
regular reflectance
reflectance according to the laws of geometrical optics, without the diffuse component

Note 1 to entry: The measurement arrangement should be such that the instrument beam reaches the detector after being specularly reflected on the surface of the specimen (reference mirror) at an angle of incidence ≤ 10°.

3.4
diffuse reflectance
reflectance not containing any regular component, due to rough surfaces and/or transparent materials containing inhomogeneous particles

3.5
total reflectance
sum of *specular reflectance* (3.3) and *diffuse reflectance* (3.4)

3.6
non-diffusing glazing component
glazing component with a *diffuse reflectance* (3.4) ≤ 0,05, measured at the near *infrared* (3.1) wavelength of 2 µm

Note 1 to entry: The purpose of this measurement is to ensure that the specimen is non-diffusing in the measurement range. Most integrating spheres sold with visible/near infrared spectrophotometers have a port designed to measure diffuse reflectance. Diffuse reflectance measurements in the infrared range are difficult to perform.

Note 2 to entry: See Annex C.

3.7
glazing component non-transparent in the infrared region
glazing component with a total normal transmittance ≤ 0,05 at 283 K, measured spectrophotometrically

4 Symbols

For the purposes of this document, the following symbols apply.

ε	total corrected emissivity at 283 K
ε_n	total normal emissivity at 283 K
E	reading of the spectrophotometer with the specimen placed on the specimen support of the reflectance accessory
E_0	instrument reading without placing anything on the specimen support
E_{st}	instrument reading with the reference mirror replacing the specimen

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