International Standard

ISO 10292

Glass in building — Determination of thermal transmittance (*U* value) — Calculation method

Verre dans la construction — Détermination du coefficient de transmission thermique (valeur U*) — Méthode de calcul*

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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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).

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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 160, *Glass in building.*

This second edition cancels and replaces the first edition (ISO 10292:1994), which has been technically revised.

The main changes are as follows:

— changes to some of the gas properties;

— introduction of a linear approximation for determining gas properties at different temperatures;

— modification of the calculation of the internal heat transfer coefficient for vertical glazing for consistency with ISO 6946;

— provision of more details on heat transfer coefficients for glazing at angles other than vertical, for consistency with ISO 6946 and ISO 10077-1;

— additional clarification provided on the iteration procedure for an insulating glass unit with more than one gas space.

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

For the purposes of this document, the term glass has been used in the context of a material or surface property, whereas the term glazing has been adopted to refer to either monolithic glass or an insulating glass unit.

The primary purpose of this document is product comparison, for which a vertical position of the glazing is specified. In addition, *U* values are calculated using the same procedure for other purposes, in particular for predicting:

— heat loss through glass;

— conduction heat gains in summer;

— condensation on glass surfaces;

— the effect of the absorbed solar radiation in determining the solar factor (see ISO 9050).

Reference can be made to ISO 6946, ISO 52016-1 and ISO 10211 or other European Standards dealing with heat loss calculations for the application of glazing *U* values determined by this document.

Reference can be made to ISO 15099 for detailed calculations of *U* values of glazing, including shading devices.

A procedure for the determination of emissivity is given in ISO 20589.

The rules have been made as simple as possible consistent with accuracy.

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Glass in building — Determination of thermal transmittance (*U* value) — Calculation method

1 Scope

This document specifies a calculation method to determine the thermal transmittance (*U* value) of glass with flat and parallel surfaces.

This document applies to uncoated glass (including glass with structured surfaces, e.g. patterned glass), coated glass and materials not transparent in the far infrared which is the case for soda lime glass products, borosilicate glass, glass ceramic, alkaline earth silicate glass and alumino silicate glass. It applies also to multiple glazing comprising such glasses or materials, or both. It does not apply to multiple glazing which include in the gas space sheets or foils that are far infrared transparent.

Vacuum insulating glass (VIG) is excluded from the scope of this document. To determine the *U* value of VIG, reference can be made to ISO 10291 or ISO 19916-1.

The procedure specified in this document determines the *U* value in the central area of glazing.

The edge effects due to the thermal bridge through the spacer of an insulating glass unit or through the window frame are not included. Furthermore, energy transfer due to solar radiation is not taken into account. The effects of Georgian and other bars are excluded from the scope of this document.

NOTE ISO 10077-1 provides a methodology for calculating the overall *U* value of windows, doors and shutters, taking account of the *U* value calculated for the glass components according to this document.

Also excluded from the calculation methodology are any effects due to gases that absorb infrared radiation in the 5 µm to 50 µm range.

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 20589, *Glass in building — Determination of the emissivity*

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 https://www.iso.org/obp

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

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3.1
thermal transmittance
***U* value**
parameter of glazing which characterizes the heat transfer through the central part of the glazing, i.e. without edge effects, and states the steady-state density of heat transfer rate per temperature difference between the environmental temperatures on each side

Note 1 to entry: The *U* value is given in watts per square metre kelvin [W/(m^2 · K)].

3.2
declared value
U value (3.1) obtained under standardized boundary conditions

4 Symbols, dimensionless numbers and subscripts

A	constant	–
c	specific heat capacity of gas	J/(kg · K)
d	nominal thickness of material layer (glass or alternative glazing material)	m
F	volume fraction	–
h	heat transfer coefficient	W/(m^2 · K)
Λ	thermal conductance	W/(m^2 · K)
M	number of material layers	–
n	exponent	–
N	number of spaces	–
r	thermal resistivity of glass (or alternative glazing material)	m · K/W
P	gas property	–
s	width of gas space	m
T	absolute temperature	K
U	thermal transmittance	W/(m^2 · K)
ΔT	temperature difference	K
ε	corrected emissivity	–
ε_n	normal emissivity (perpendicular to the surface)	–
ρ	gas density	kg/m^3
σ	Stefan-Boltzmann's constant 5,67 × 10^{-8}	W/(m^2 · K^4)
μ	dynamic viscosity of gas	kg/(m · s)
λ	thermal conductivity of gas in space	W/(m · K)
ϑ	temperature on the Celsius scale	°C
Gr	Grashof number	

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