INTERNATIONAL STANDARD

ISO 12567-1

Second edition
2010-07-01

Thermal performance of windows and doors — Determination of thermal transmittance by the hot-box method —

Part 1:
Complete windows and doors

Isolation thermique des fenêtres et portes — Détermination de la transmission thermique par la méthode à la boîte chaude —

Partie 1: Fenêtres et portes complètes

Reference number
ISO 12567-1:2010(E)

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 12567-1 was prepared by Technical Committee ISO/TC 163, *Thermal performance and energy use in the built environment*, Subcommittee SC 1, *Test and measurement methods*.

This second edition cancels and replaces the first edition (ISO 12567-1:2000), which has been technically revised.

ISO 12567 consists of the following parts, under the general title *Thermal performance of windows and doors — Determination of thermal transmittance by the hot-box method*:

— *Part 1: Complete windows and doors*

— *Part 2: Roof windows and other projecting windows*[1)]

1) It is intended that, upon revision, the main element of the title of Part 2 will be aligned with the main element of the title of Part 1.

Introduction

The method specified in this part of ISO 12567 is based on ISO 8990. It is designed to provide both standardized tests, which enable a fair comparison of different products to be made, and specific tests on products for practical application purposes. The former specifies standardized specimen sizes and applied test criteria.

The determination of the aggregate thermal transmittance is performed for conditions which are similar to the actual situation of the window and door in practice.

Thermal performance of windows and doors — Determination of thermal transmittance by the hot-box method —

Part 1: Complete windows and doors

1 Scope

This part of ISO 12567 specifies a method to measure the thermal transmittance of a door or window system. It is applicable to all effects of frames, sashes, shutters, blinds, screens, panels, door leaves and fittings.

It is not applicable to

— edge effects occurring outside the perimeter of the specimen,

— energy transfer due to solar radiation on the specimen,

— effects of air leakage through the specimen, and

— roof windows and projecting products, where the external face projects beyond the cold side roof surface.

NOTE For roof windows and projecting units, see the procedure given in ISO 12567-2.

Annex A gives methods for the calculation of environmental temperatures.

2 Normative references

The following referenced documents are indispensable for the application 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 7345, *Thermal insulation — Physical quantities and definitions*

ISO 8301, *Thermal insulation — Determination of steady-state thermal resistance and related properties — Heat flow meter apparatus*

ISO 8302, *Thermal insulation — Determination of steady-state thermal resistance and related properties — Guarded hot plate apparatus*

ISO 8990:1994, *Thermal insulation — Determination of steady-state thermal transmission properties — Calibrated and guarded hot box*

ISO 9288, *Thermal insulation — Heat transfer by radiation — Physical quantities and definitions*

ISO 10211, *Thermal bridges in building construction — Heat flows and surface temperatures — Detailed calculations*

EN 12898, *Glass in building — Determination of the emissivity*

IEC 60584-1, *Thermocouples — Part 1: Reference tables*

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 7345, ISO 8990 and ISO 9288 apply.

3.2 Symbols

For the purposes of this document, the physical quantities given in ISO 7345 and ISO 9288 apply, together with those given in Tables 1 and 2.

Table 1 — Symbols and units

Symbol	Physical quantity	Unit
A	Area	m^2
d	Thickness (depth)	m
F	Fraction	—
f	View factor	—
h	Surface coefficient of heat transfer	$W/(m^2 \cdot K)$
H	Height	m
L	Perimeter length	m
q	Density of heat flow rate	W/m^2
R	Thermal resistance	$m^2 \cdot K/W$
T	Thermodynamic temperature	K
U	Thermal transmittance	$W/(m^2 \cdot K)$
v	Air speed	m/s
w	Width	m
α	Radiant factor	—
ΔT, $\Delta \theta$	Temperature difference	K
ε	Total hemispherical emissivity	—
θ	Temperature	°C
λ	Thermal conductivity	$W/(m \cdot K)$
σ	Stefan-Boltzmann constant	$W/(m^2 \cdot K^4)$
Φ	Heat flow rate	W
Ψ	Linear thermal transmittance	$W/(m \cdot K)$

Table 2 — Subscripts

Subscript	Significance
b	Baffle
c	Convection (air)
cal	Calibration
e	External, usually cold side
i	Internal, usually warm side
in	Input
m	Measured
me	Mean
n	Environmental (ambient)
ne	Environmental (ambient) external
ni	Environmental (ambient) internal
p	Reveal of surround panel
r	Radiation (mean)
s	Surface
se	Exterior surface, usually cold side
si	Interior surface, usually warm side
sp	Specimen
st	Standardized
sur	Surround panel
t	Total
W	Window
WS	Window with closed shutter or blind
D	Door

Table 3 — Symbols for uncertainty analysis for hot boxes

A_{sp}	Test specimen projected area	m^2
A_{sur}	Surround panel projected area	m^2
H_{sp}	Test specimen height	m
H_{sur}	Surround panel height	m
λ_{sur}	Surround panel thermal conductivity	W/m·K
d_{sp}	Test specimen thickness (depth)	m
d_{sur}	Surround panel thickness (depth)	m
P	Confidence level	%
Φ_{EXTR}	Extraneous heat transfer in the metering chamber	W
$\Phi_{FL,sp}$	Test specimen flanking heat transfer	W
Φ_{IN}	Total power input to the metering chamber	W
Φ_{sp}	Heat transfer through the test specimen	W
Φ_{sur}	Heat transfer through the surround panel	W
R	Dependent variable	
s_y	Sample standard deviation of measured values of variable	y
θ_n	Hot-box ambient air temperature	°C
θ_e	Cold side (climatic chamber) external air temperature	°C
θ_i	Warm side (metering room) internal air temperature	°C
$t_{v,P}$	t value of v's degree of freedom and P's confidence level	
U_{CTS}	Calibration transfer standard (CTS) thermal transmittance	$W/m^2 \cdot K$

Table 3 (*continued*)

U_{sp}	Test specimen thermal transmittance	W/m²·K
U_{st}	Standardized test specimen thermal transmittance	W/m²·K
V	Metering chamber wall thermopile voltage	mV
w_{sp}	Test specimen width	m
w_{sur}	Surround panel width	m
x_i	Independent variable, i = 1, 2, …, N	
y_c	Calculated value of dependent variable y	
z	Independent variable	
θ_{AMB}	External ambient temperature	°C
$\theta_{me,sur}$	Surround panel mean temperature	°C
σ	Stefan-Boltzmann constant, 5.669×10^{-8}	W/m²·K⁴
Δ	Uncertainty, difference	
$\delta\theta$	Temperature, difference	°C
$\delta\theta_{ie}$	Air temperature difference between warm and cold side chambers	°C
∂	Partial derivative	
υ	Degree of freedom	
$\delta\theta_{sur}$	Surround panel surface temperature difference	°C
The uncertainty analysis for hot boxes is given in Annex F.		

4 Principle

The thermal transmittance, U, of the specimen is measured by means of the calibrated or guarded hot-box method in accordance with ISO 8990.

The determination of the thermal transmittance involves two stages. Firstly, measurements are made on two or more calibration panels with accurately known thermal properties, from which the surface coefficient of the heat transfer (radiative and convective components) on both sides of the calibration panel with surface emissivities on average similar to those of the specimen to be tested and the thermal resistance of the surround panel are determined. Secondly, measurements are made with the window or door specimens in the aperture and the hot-box apparatus is used with the same fan settings on the cold side as during the calibration procedure.

The surround panel is used to keep the specimen in a given position. It is constructed with outer dimensions of appropriate size for the apparatus, having an aperture to accommodate the specimen (see Figures 1 to 4).

The principal heat flows through the surround panel and the calibration panel (or test specimen) are shown in Figure 5. The boundary edge heat flow due to the location of the calibration panel in the surround panel is determined separately by a linear thermal transmittance, Ψ.

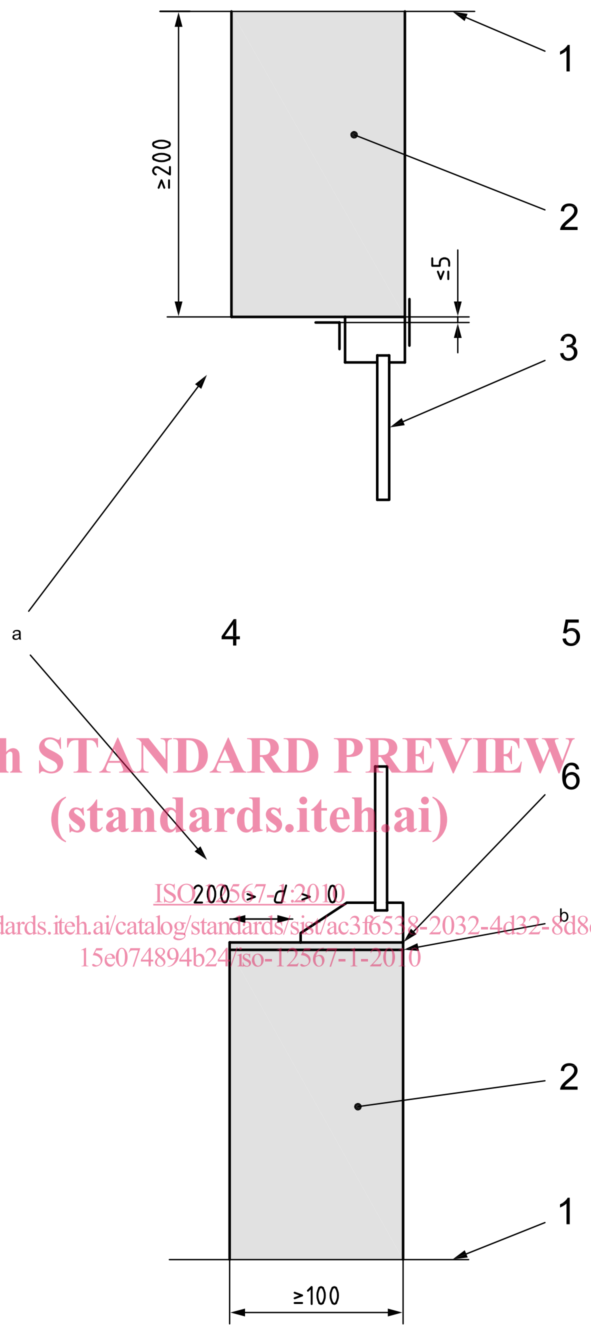
The procedure in this part of ISO 12567 includes a correction for the boundary edge heat flow, such that standardized and reproducible thermal transmittance properties are obtained.

The magnitude of the boundary edge heat flow as a function of geometry, calibration panel thickness and thermal conductivity is determined by tabulated values given in Annex B or is calculated in accordance with ISO 10211.

Measurement results are corrected to standardized surface heat transfer coefficients by an interpolation or analytical iteration procedure, derived from the calibration measurements.

Measurements are taken (e.g. pressure equalization between the warm and cold side or sealing of the joints on the inside) to ensure that the air permeability of the test specimen does not influence the measurements.

Dimensions in millimetres



The total gap width between the top and bottom of the specimen and the surround panel aperture shall not exceed 5 mm. It shall be sealed with non-metallic tape or mastic material. The total gap width on both sides between the specimen and the surround panel aperture shall not exceed 5 mm.

Key

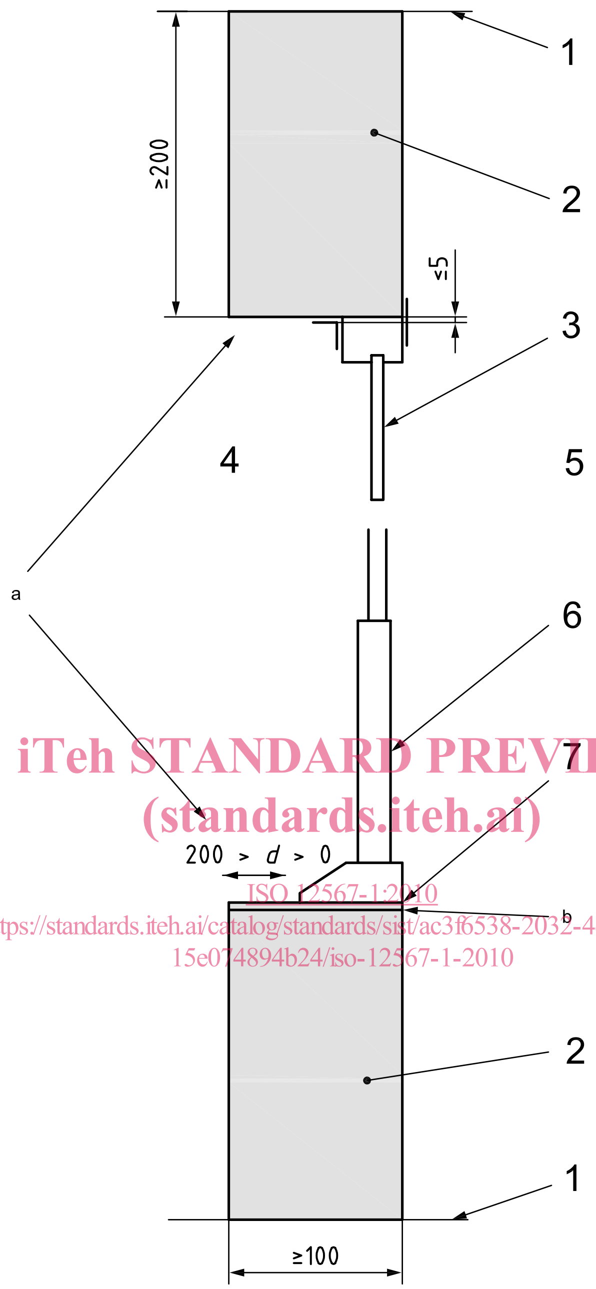
1 border of metering area
2 surround panel, $\lambda \leqslant 0{,}04$ W/(m·K)
3 glazing
4 cold side
5 warm side
6 flush sill

a Metering area, centrally located in the surround panel, is recommended.

b Use fill material with same thermal properties as surround panel core.

Figure 1 — Window system in surround panel

Dimensions in millimetres



The total gap width between the top and bottom of the specimen and the surround panel aperture shall not exceed 5 mm. It shall be sealed with non-metallic tape or mastic material. The total gap width on both sides between the specimen and the surround panel aperture shall not exceed 5 mm.

Key

1 border of metering area

2 surround panel, $\lambda \leqslant 0{,}04$ W/(m·K)

3 infill (glass, panel)

4 cold side

5 warm side

6 door leaf

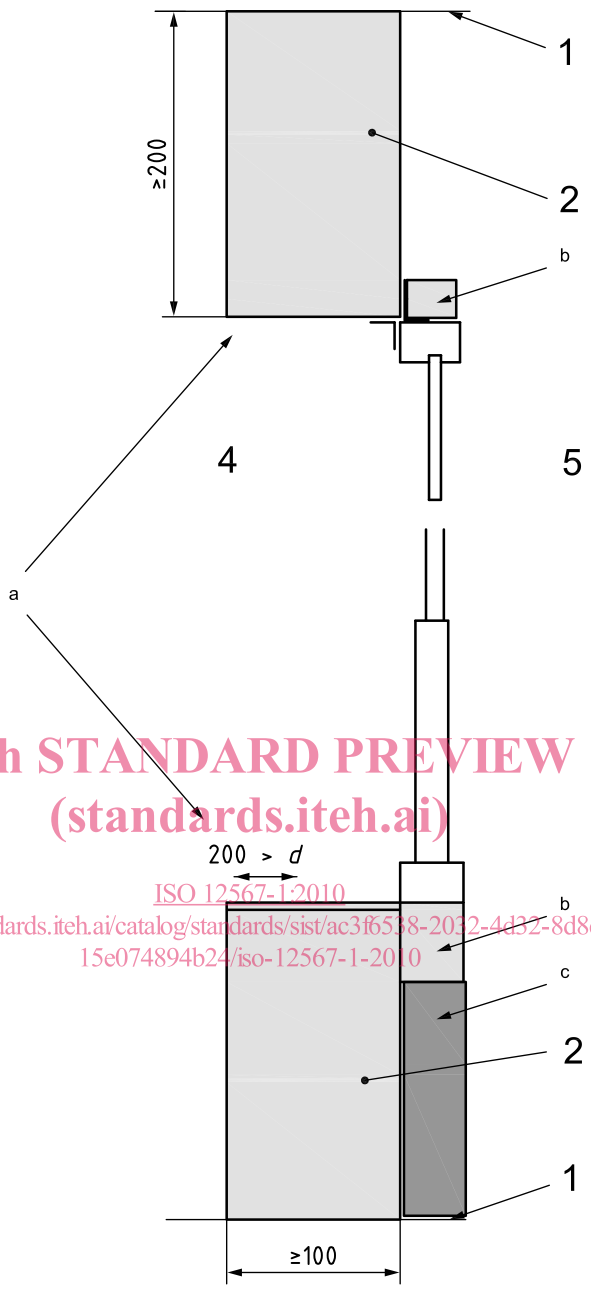
7 flush frame/threshold

[a] Metering area, centrally located in the surround panel, is recommended.

[b] Use fill material with same thermal properties as surround panel core.

Figure 2 — Door system in surround panel — Insert mounting

Dimensions in millimetres



Key

1 border of metering area

2 surround panel, λ ⩽ 0,04 W/(m·K)

4 cold side

5 warm side

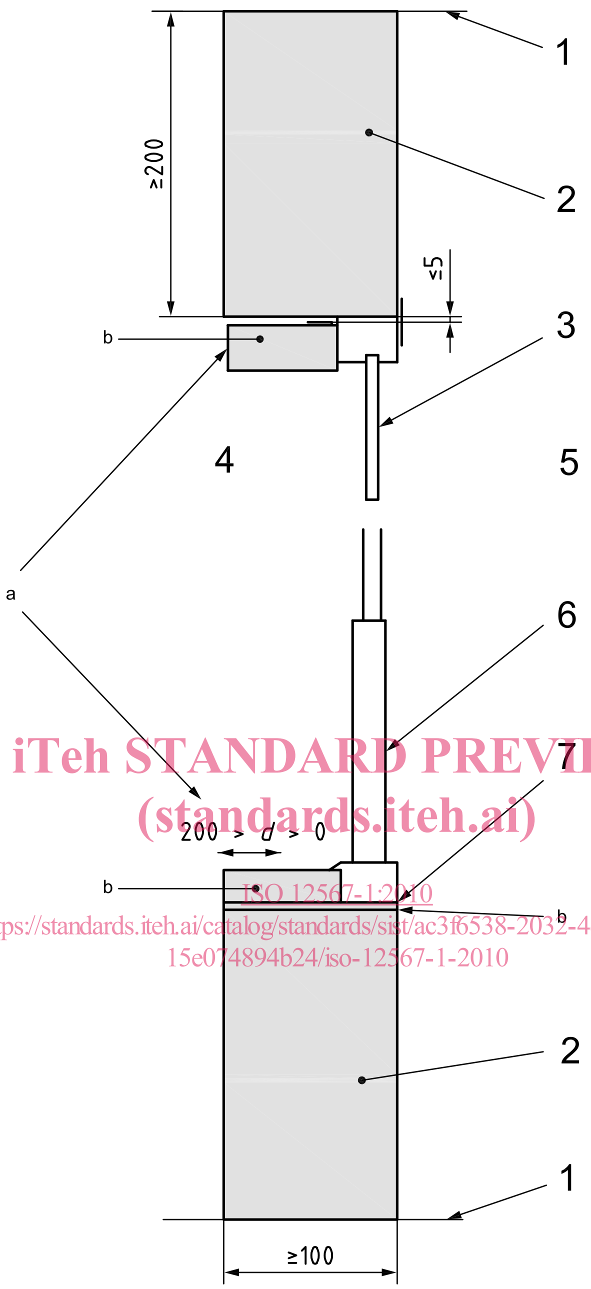
a Metering area, centrally located in the surround panel, is recommended.

b Material with same thermal properties as surround panel core, minimum size equal to the frame width.

c Supporting structure for taking the load of the door.

Figure 3 — Door system in surround panel — Warm surface mounting

Dimensions in millimetres



Key

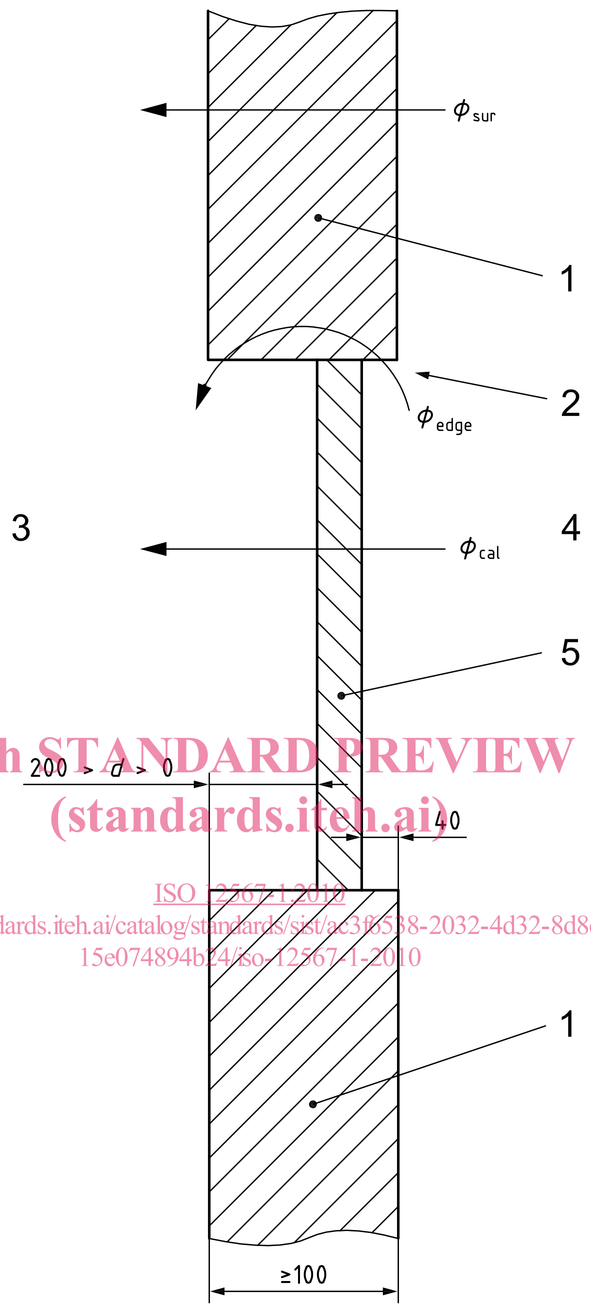
1 border of metering area
2 surround panel, $\lambda \leqslant 0,04$ W/(m·K)
3 infill (glass, panel)
4 cold side
5 warm side
6 door leaf
7 flush frame/threshold

a Metering area, centrally located in the surround panel, is recommended.

b Use fill material with same thermal properties as surround panel core.

Figure 4 — Door system in surround panel — Inside mounting

Dimensions in millimetres



Key

1 surround panel

2 boundary effect

3 cold side

4 warm side

5 calibration panel

Figure 5 — Mounting of calibration panel in aperture