INTERNATIONAL STANDARD

ISO 12567-1

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Thermal performance of windows and doors — Determination of thermal transmittance by 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 12567-1:2000(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 3.

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 International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 12567-1 was prepared by Technical Committee ISO/TC 163, *Thermal insulation*, Subcommittee SC 1, *Test and measurement methods*.

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

— *Part 1: Complete windows and doors*

— *Part 2: Roof windows and other projecting windows*

Annexes A and B are a normative part of this International Standard. Annexes C, D and E are for information only.

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 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. This includes all effects of frames, sashes, shutters, door leaves and fittings.

It does not include:

— 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;

— roof windows and projecting products, where the glass layer projects beyond the cold side roof surface.

NOTE For roof windows and projecting units, the procedure given in ISO 12567-2 (under preparation, see Bibliography [4]) should be used.

Annex A gives methods for the calculation of environmental temperatures.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 12567. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 12567 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

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*.

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

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

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this part of ISO 12567 the terms and definitions given in ISO 7345, ISO 8990 and ISO 9288 apply.

3.2 Symbols

For the purposes of this part of ISO 12567 the 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	$W/(m^2 \cdot K)$
w	width	m
α	radiant factor	—
ΔT, $\Delta \theta$	temperature difference	K
ε	total hemispherical emissivity	—
θ	Celsius 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
sp	specimen
st	standardized
sur	surround panel
t	total

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. First, 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 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 and 2).

The principal heat flows through the surround panel and the calibration panel (or test specimen) are shown in Figure 3. 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.

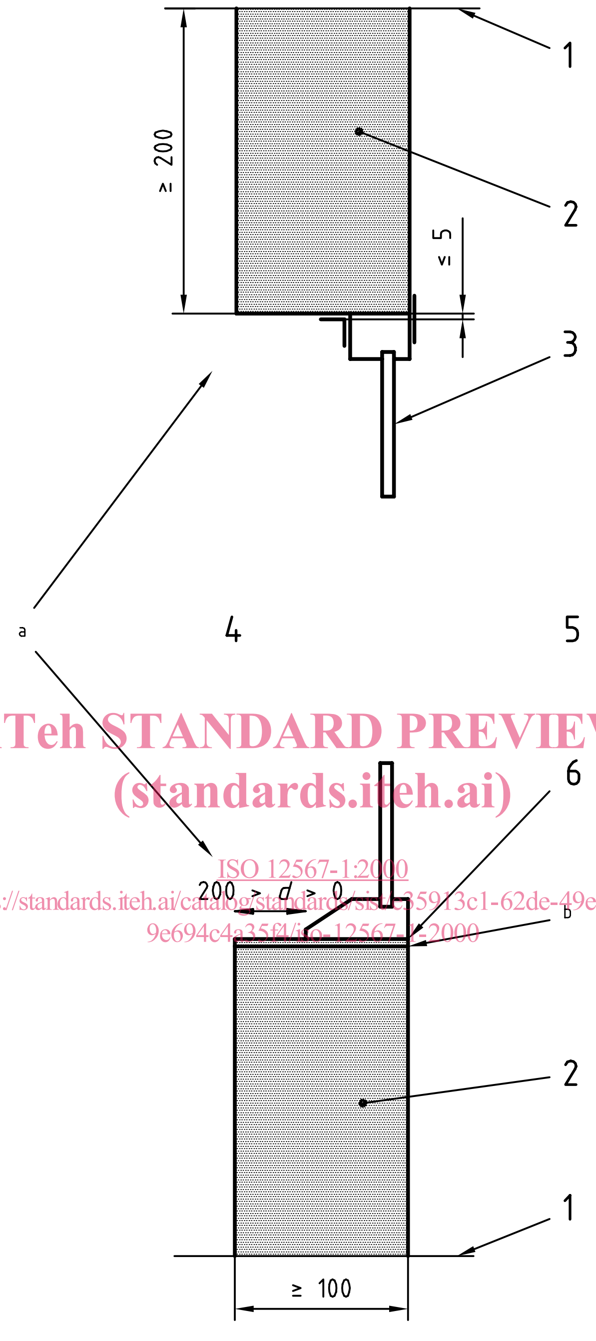
The procedure in this part of ISO 12567 includes a correction for the boundary edge heat flow, so that standardized and reproducible thermal transmittance properties are obtained.

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.

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

Measures 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.

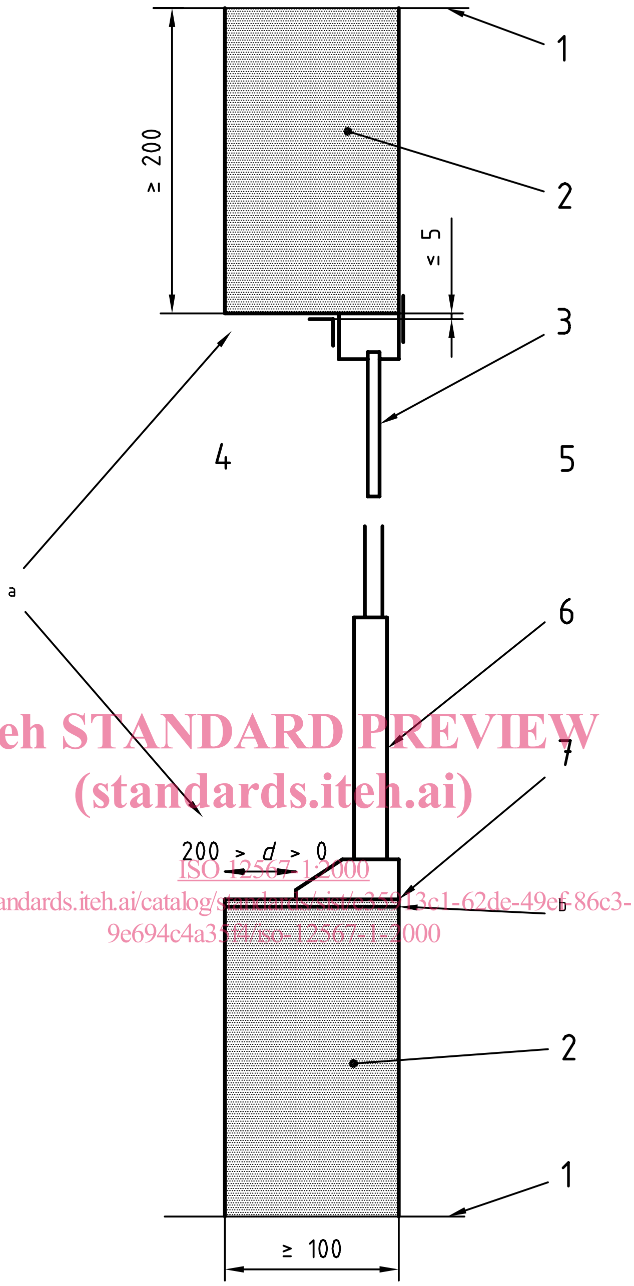
Key

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 Recommended to be centrally located.
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

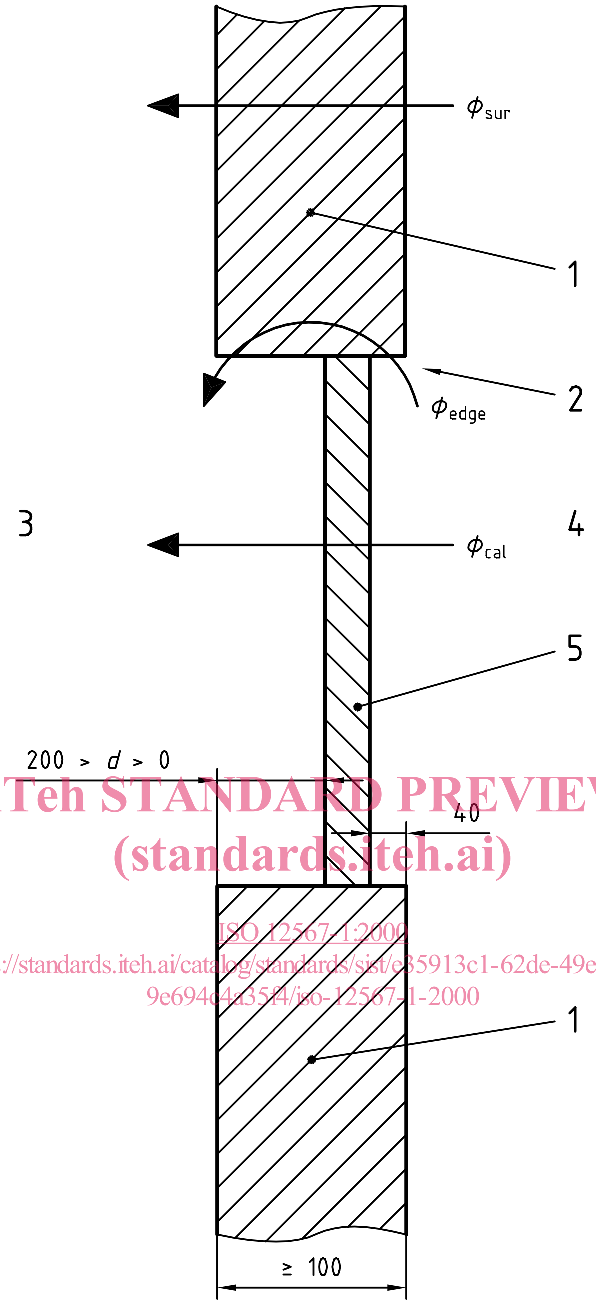
6 Door leaf

7 Flush frame/threshold

a Recommended to be centrally located.

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

Figure 2 — Door system in surround panel



Key

1 Surround panel
2 Boundary effect
3 Cold side
4 Warm side
5 Calibration panel

Figure 3 — Mounting of calibration panel in aperture

5 Requirements for test specimens and apparatus

5.1 General

The construction and operation of the apparatus shall comply with the requirements specified in ISO 8990, except where modified by this part of ISO 12567. To make heat transfer measurements on the specimen, it is necessary to mount it in a suitable surround panel and deduce the heat flow through it by subtracting that through the surround panel from the total heat input. Also, the test element and the surround panel will usually be of different thickness, so that there will be disturbance of heat flow paths and temperatures in the region of the boundary between the two. The test shall be carried out so that edge corrections can be applied.

5.2 Surround panels

The surround panel acts as an idealized wall with high thermal resistance and holds the window or door in the correct position and separates the warm box from the cold box. The surround panel shall be large enough to cover the open face of the guard box in the case of a guarded hot box apparatus, or the open face of the hot box in the case of a calibrated hot box apparatus.

The surround panel shall be not less than 100 mm thick or the maximum thickness of the specimen, whichever is the greater, and it shall be constructed with core material of stable thermal conductivity not greater than 0,04 W/(m·K). An appropriate aperture shall be provided to accommodate the calibration panel or test specimen (see Figures 1, 2, 3 and 4). Sealed plywood facing or plastic sheet on either side of the surround panel to provide rigidity is permitted. No material of thermal conductivity higher than 0,04 W/(m·K) (other than non-metallic thin tape) shall bridge the aperture. The surfaces of the surround panel and baffle plates shall have a high emissivity (> 0,8).

5.3 Test specimens

For general applications, specimen sizes may be typical of those found in practice. To ensure consistency of measurement, the specimen should be located as follows. The window or door system shall fill the surround panel aperture. The internal frame face shall be as close to the face of the surround panel as possible, but no part shall project beyond the surround panel faces on either the cold or warm sides, except for handles, rails or fittings which normally project (see Figures 1 and 2).

It is recommended that the aperture should be placed centrally into the surround panel and at least 200 mm from the inside surfaces of the cold and hot boxes to avoid or limit edge heat flow corrections related to the perimeter of the surround panel.

For standardized test applications, the overall sizes recommended are indicated in Table 3, or they shall conform with the size required by national standards or other regulations.

In any case the area of aperture shall be not less than 0,8 m^2, for reasons of accuracy. The perimeter joints between the surround panel and the specimen shall be sealed on both sides with tape, caulking or mastic material.