



SLOVENSKI STANDARD
SIST EN 13947:2007

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Thermal performance of curtain walling - Calculation of thermal transmittance

Wärmetechnisches Verhalten von Vorhangfassaden - Berechnung des Wärmedurchgangskoeffizienten

Performances thermiques des façades légères - Calcul du coefficient de transmission thermique

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ICS:

91.060.10	Stene. Predelne stene. Fasade	Walls. Partitions. Facades
91.120.10	Toplotna izolacija stavb	Thermal insulation

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ICS 91.060.10; 91.120.10

English Version

Thermal performance of curtain walling - Calculation of thermal transmittance

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Wärmetechnisches Verhalten von Vorhangfassaden - Berechnung des Wärmedurchgangskoeffizienten

This European Standard was approved by CEN on 9 November 2006.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This document (EN 13947:2006) has been prepared by Technical Committee CEN/TC 89 “Thermal performance of buildings and building components”, the secretariat of which is held by SIS.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2007, and conflicting national standards shall be withdrawn at the latest by June 2007.

This European Standard is one of a series of standards on calculation methods for the design and evaluation of the thermal performance of buildings and building components.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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Introduction

The design and construction of curtain wall systems is complex. This European Standard specifies a procedure for calculating the thermal transmittance of curtain wall structures.

Curtain walls often contain different kinds of materials, joined in different ways, and can exhibit numerous variations of geometrical shape. With such a complex structure, the likelihood of producing thermal bridges across the curtain wall envelope is quite high.

The results of calculations, carried out following the procedures specified in this European Standard, can be used for comparison of the thermal transmittance of different types of curtain wall or as part of the input data for calculating the heat used in a building. This European Standard is not suitable for determining whether or not condensation will occur on the structure surfaces nor within the structure itself.

Two different methods are given in this European Standard:

- single assessment method (see 6.2);
- component assessment method (see 6.3).

Guidance on the use of these two methods is given in Annex A. Calculation examples for these two methods are given in Annex E and Annex F.

Testing according to EN ISO 12567-1 is an alternative to this calculation method.

The thermal effects of connections to the main building structure as well as fixing lugs can be calculated according to prEN ISO 10211.

The thermal transmittance of the frame, U_f , is defined according to EN ISO 10077-2 or EN 12412-2 together with Annex A. The thermal transmittance of glazing units, U_g , is defined according to EN 673, EN 674 or EN 675 which do not include the edge effects. The thermal interaction of the frame and the filling element is included in the linear thermal transmittance Ψ which is derived using the procedures specified in EN ISO 10077-2.

1 Scope

This European Standard specifies a method for calculating the thermal transmittance of curtain walls consisting of glazed and/or opaque panels fitted in, or connected to, frames.

The calculation includes:

- different types of glazing, e.g. glass or plastic; single or multiple glazing; with or without low emissivity coating; with cavities filled with air or other gases;
- frames (of any material) with or without thermal breaks;
- different types of opaque panels clad with metal, glass, ceramics or any other material.

Thermal bridge effects at the rebate or connection between the glazed area, the frame area and the panel area are included in the calculation.

The calculation does not include:

- effects of solar radiation;
- heat transfer caused by air leakage;
- calculation of condensation;
- effect of shutters;
- additional heat transfer at the corners and edges of the curtain walling;
- connections to the main building structure nor through fixing lugs;
- curtain wall systems with integrated heating.

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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.

EN 673:1997, *Glass in building — Determination of thermal transmittance (U value) — Calculation method*

EN 674, *Glass in building — Determination of thermal transmittance (U value) — Guarded hot plate method*

EN 675, *Glass in building — Determination of thermal transmittance (U value) — Heat flow meter method*

EN 12412-2, *Thermal performance of windows, doors and shutters — Determination of thermal transmittance by hot box method — Part 2: Frames*

prEN ISO 6946:2005, *Building components and building elements — Thermal resistance and thermal transmittance — Calculation method (ISO/DIS 6946:2005)*

EN ISO 7345:1995, *Thermal insulation — Physical quantities and definitions (ISO 7345:1987)*

EN ISO 10077-1:2006, *Thermal performance of windows, doors and shutters — Calculation of thermal transmittance — Part 1: General (ISO 10077-1:2006)*

EN ISO 10077-2:2003, *Thermal performance of windows, doors and shutters — Calculation of thermal transmittance — Part 2: Numerical method for frames (ISO 10077-2:2003)*

prEN ISO 10211, *Thermal bridges in building construction — Heat flows and surface temperatures — Detailed calculations (ISO/DIS 10211:2005)*

EN ISO 12567-1, *Thermal performance of windows and doors — Determination of thermal transmittance by hot box method — Part 1: Complete windows and doors (ISO 12567-1:2000)*

3 Terms and definitions, symbols and units

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 673:1997, EN ISO 7345:1995, prEN ISO 6946:2005 and the following apply.

NOTE Clause 4 includes descriptions of a number of geometrical characteristics of glazing units, frame sections and panels.

3.2 Symbols and units

Table 1 — Symbols and units

Symbol	Quantity	Unit
A	area	m^2
T	thermodynamic temperature	K
U	thermal transmittance	$W/(m^2 \cdot K)$
l	length	m
d	depth	m
Φ	heat flow rate	W
Ψ	linear thermal transmittance	$W/(m \cdot K)$
Δ	difference	
Σ	summation	
ε	emissivity	

3.3 Subscripts

cw	curtain walling
d	developed
e	external
eq	equivalent
f	frame
f,g	frame/glazing
FE	filling element
g	glazing
i	internal
j	joint
m	mullion

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m,f	mullion/frame
m,g	mullion/glazing
n	normal
p	panel (opaque)
s	screw
t	transom
t,f	transom/frame
t,g	transom/glazing
tot	total
TJ	thermal joint at a connection between two filling elements
W	window

3.4 Superscripts

- * definition of areas for length-related treatment of thermal joints (see 6.2.2.3)

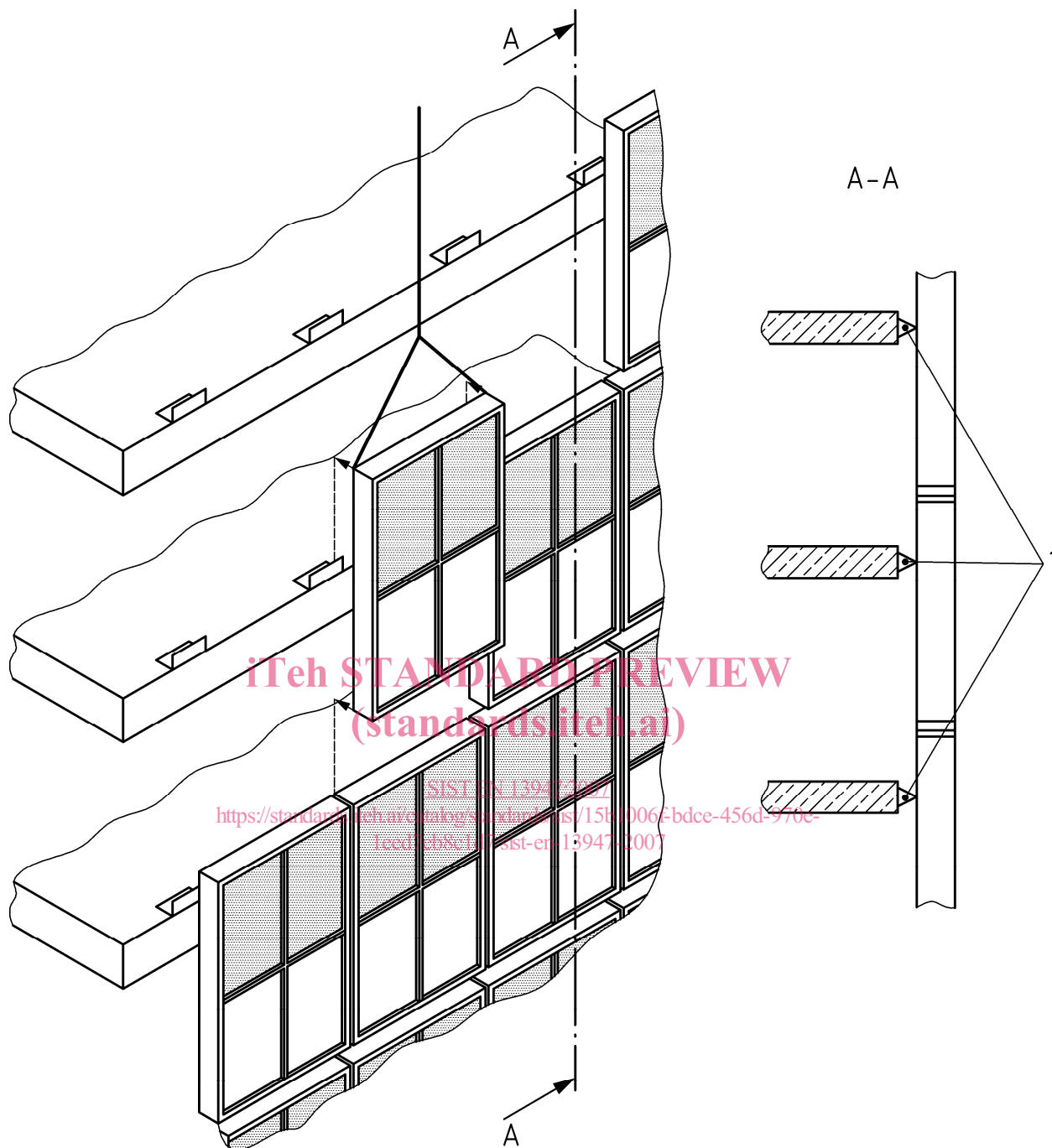
4 Geometrical characteristics

4.1 Main principles

The main principles of curtain walling are shown in Figures 1 and 2.

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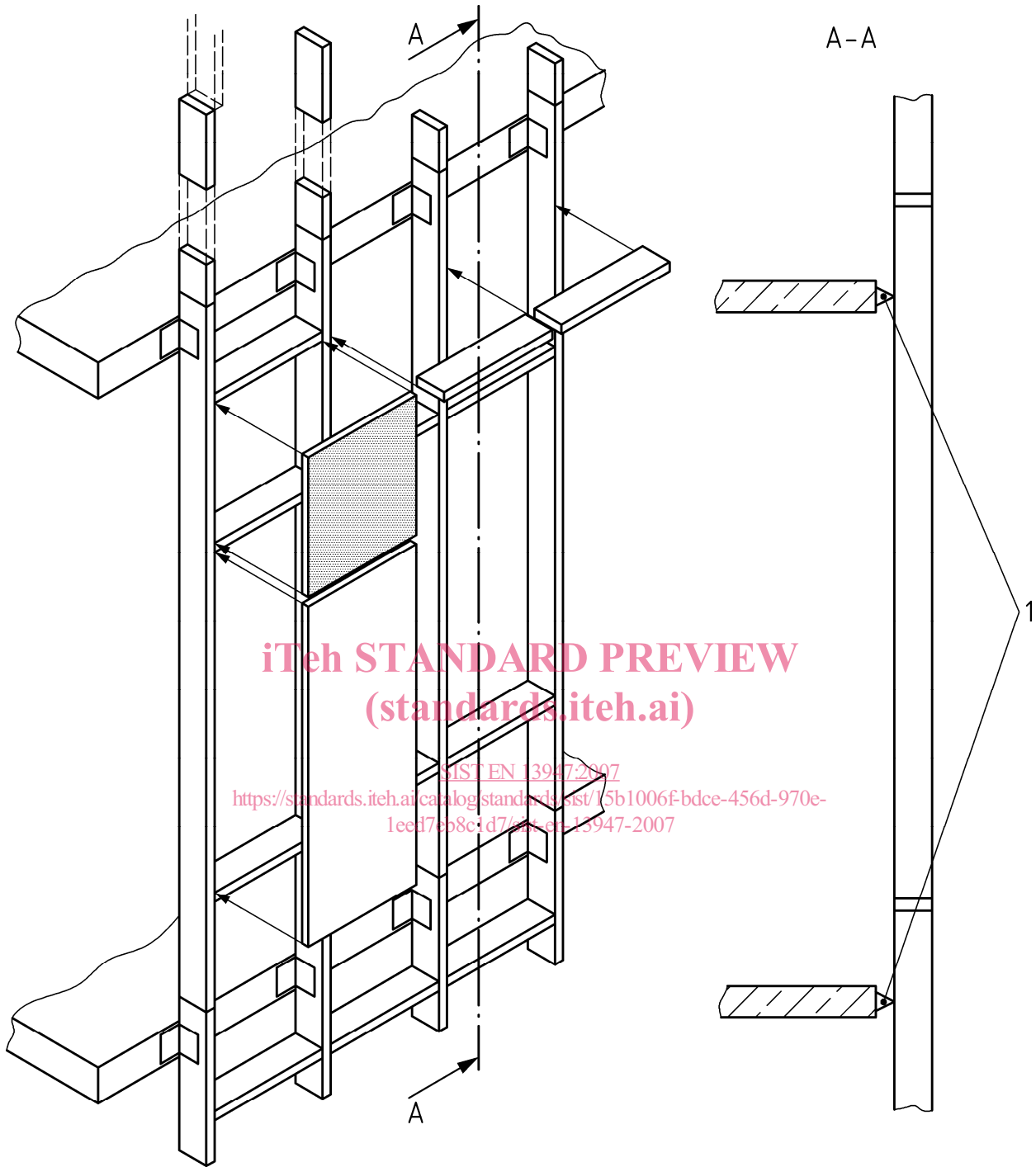
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Key

- 1 structure fixing bracket
- A-A vertical section

Figure 1 — Principle of curtain walling construction: unitised construction



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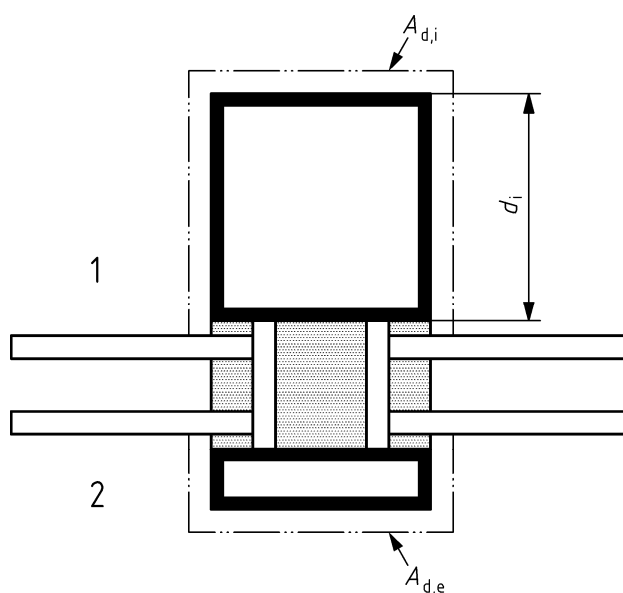
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- Key**
- 1 structure fixing bracket
 - A-A vertical section

Figure 2 — Principle of curtain walling construction: stick construction

4.2 Developed areas and internal depth

Internal and external developed areas and internal depth are defined as shown in Figure 3.



Key

- 1 internal
2 external

d_i internal depth of mullion or transom

$A_{d,i}$ internal developed area

$A_{d,e}$ external developed area

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Figure 3 — Internal and external developed area, internal depth

4.3 Boundaries of curtain wall structures

4.3.1 General

To evaluate the thermal transmittance of façades representative reference areas should be defined. The following subclauses define the various areas.

4.3.2 Boundaries of a representative reference element

The boundaries of the representative reference element shall be chosen according to the principles shown in Figure 4.

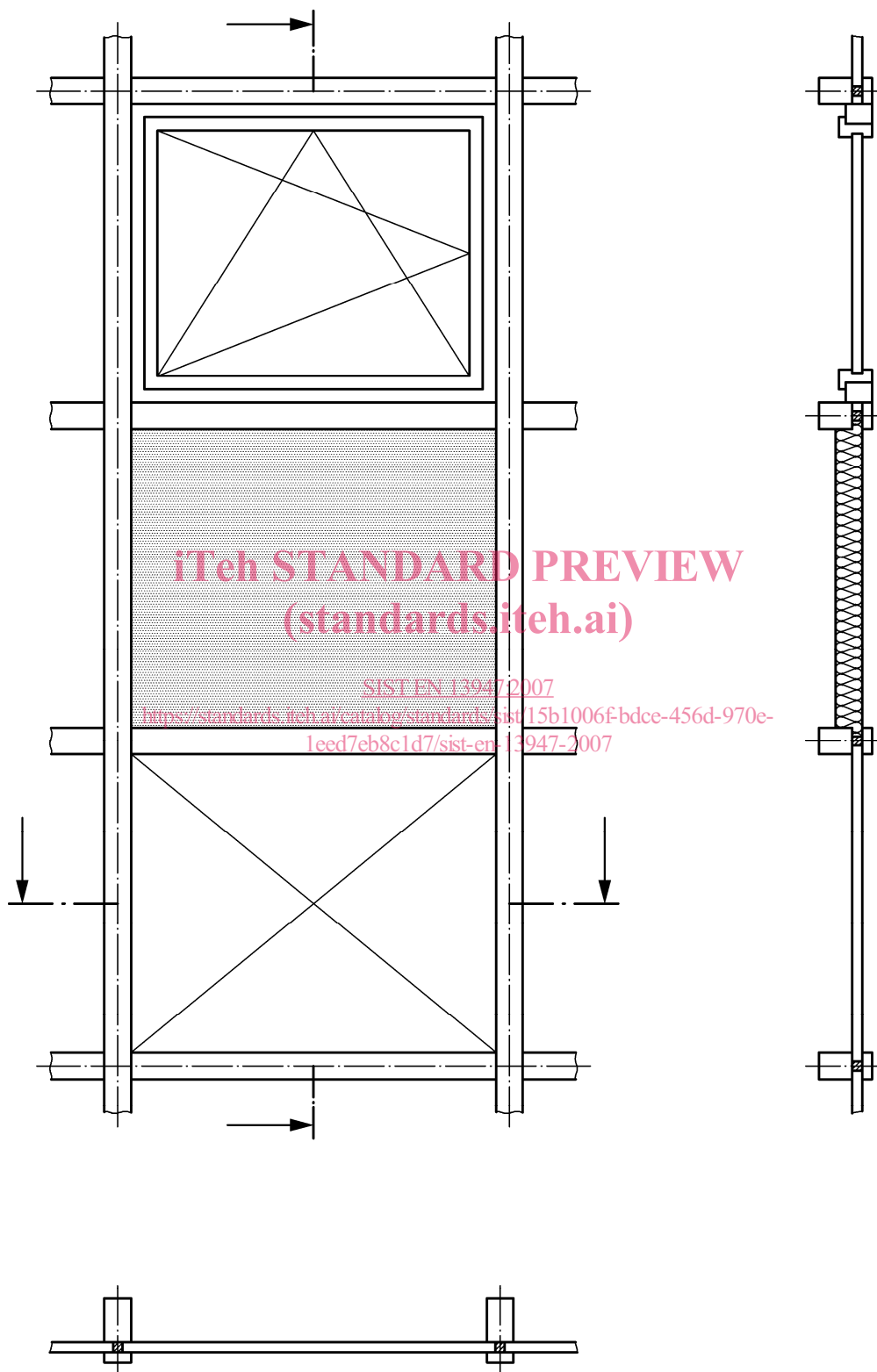
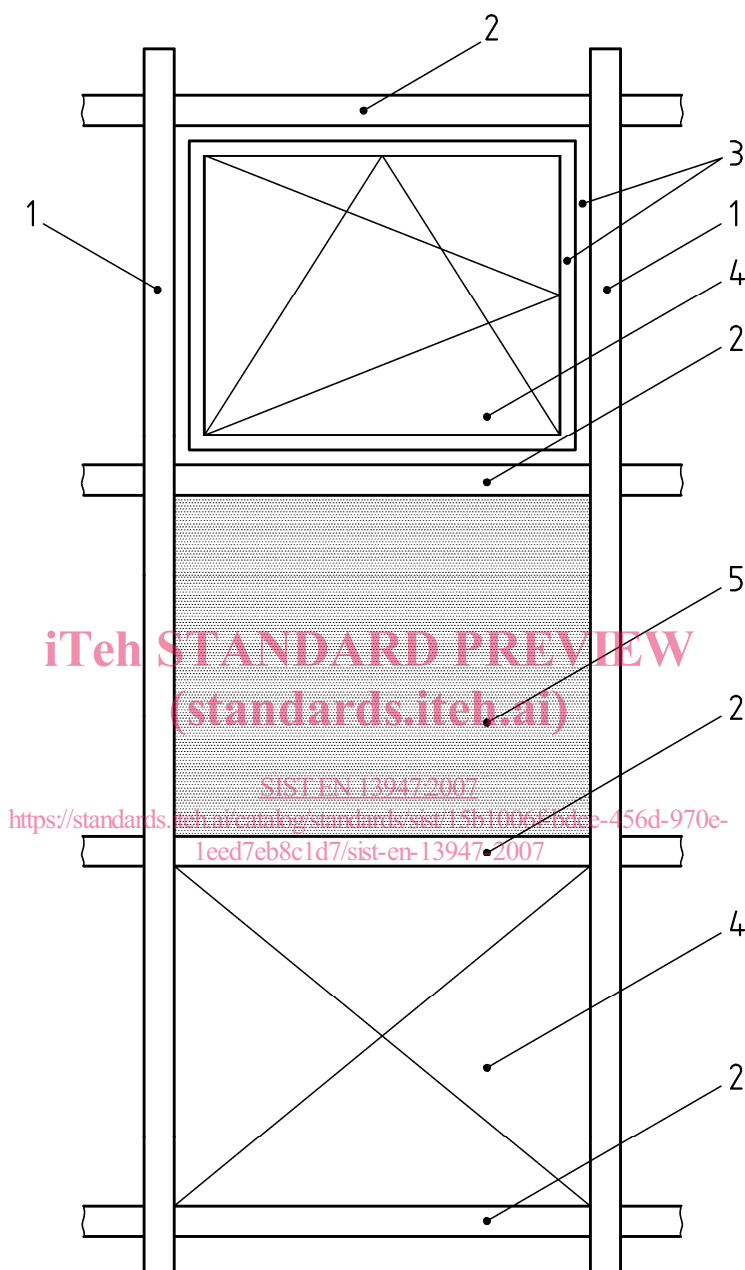


Figure 4 — Boundaries of a representative reference element of a façade

4.3.3 Curtain wall areas

The representative reference element is divided into areas of different thermal properties (sash, frame, mullion, transom, glazing units and panel sections) (see Figure 5).



Key

- 1 mullion
- 2 transom
- 3 sash and frame
- 4 glazing
- 5 panel

Figure 5 — Areas with different thermal properties