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Byggkomponenter och byggnadsdelar – Värmemotstånd och värmegenomgångskoefficient – Beräkningsmetod (ISO 6946:2007)

Building components and building elements – Thermal resistance and thermal transmittance – Calculation method (ISO 6946:2007)

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Denna standard ersätter SS-EN ISO 6946, utgåva 1 och SS-EN ISO 6946/A1, utgåva 1.

The European Standard EN ISO 6946:2007 has the status of a Swedish Standard. This document contains the official English version of EN ISO 6946:2007.

This standard supersedes the Swedish Standards SS-EN ISO 6946, edition 1 and SS-EN ISO 6946/A1, edition 1.

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN ISO 6946

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ICS 91.060.01; 91.120.10

Supersedes EN ISO 6946:1996

English Version

Building components and building elements - Thermal resistance and thermal transmittance - Calculation method (ISO 6946:2007)

Composants et parois de bâtiments - Résistance thermique et coefficient de transmission thermique - Méthode de calcul (ISO 6946:2007)

Bauteile - Wärmedurchlasswiderstand und Wärmedurchgangskoeffizient - Berechnungsverfahren (ISO 6946:2007)

This European Standard was approved by CEN on 7 December 2007.

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Foreword

This document (EN ISO 6946:2007) has been prepared by Technical Committee ISO/TC 163 "Thermal performance and energy use in the built environment" in collaboration with 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of an identical text or by endorsement, at the latest by June 2008, and conflicting national standards shall be withdrawn at the latest by June 2008.

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Endorsement notice

The text of ISO 6946:2007 has been approved by CEN as a EN ISO 6946:2007 without any modification.

Introduction

This International Standard provides the means (in part) to assess the contribution that building products and services make to energy conservation and to the overall energy performance of buildings.

Building components and building elements — Thermal resistance and thermal transmittance — Calculation method

1 Scope

This International Standard provides the method of calculation of the thermal resistance and thermal transmittance of building components and building elements, excluding doors, windows and other glazed units, curtain walling, components which involve heat transfer to the ground, and components through which air is designed to permeate.

The calculation method is based on the appropriate design thermal conductivities or design thermal resistances of the materials and products for the application concerned.

The method applies to components and elements consisting of thermally homogeneous layers (which can include air layers).

This International Standard also provides an approximate method that can be used for elements containing inhomogeneous layers, including the effect of metal fasteners, by means of a correction term given in Annex D. Other cases where insulation is bridged by metal are outside the scope of this International Standard.

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 10456, *Building materials and products — Hygrothermal properties — Tabulated design values and procedures for determining declared and design thermal values*

ISO 13789, *Thermal performance of buildings — Transmission and ventilation heat transfer coefficients — Calculation method*

3 Terms, definitions, symbols and units

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 7345 and ISO 10456 and the following apply.

3.1.1
building element
major part of a building such as a wall, floor or roof

3.1.2
building component
building element or a part of it

NOTE In this International Standard, the word “component” is used to indicate both element and component.

3.1.3
thermally homogeneous layer
layer of constant thickness having thermal properties which may be regarded as being uniform

3.2 Symbols and units

Symbol	Quantity	Unit
A	area	m^2
d	thickness	m
h	surface heat transfer coefficient	$W/(m^2 \cdot K)$
R	design thermal resistance (surface to surface)	$m^2 \cdot K/W$
R_g	thermal resistance of airspace	$m^2 \cdot K/W$
R_{se}	external surface resistance	$m^2 \cdot K/W$
R_{si}	internal surface resistance	$m^2 \cdot K/W$
R_T	total thermal resistance (environment to environment)	$m^2 \cdot K/W$
R'_T	upper limit of total thermal resistance	$m^2 \cdot K/W$
R''_T	lower limit of total thermal resistance	$m^2 \cdot K/W$
R_u	thermal resistance of unheated space	$m^2 \cdot K/W$
U	thermal transmittance	$W/(m^2 \cdot K)$
λ	design thermal conductivity	$W/(m \cdot K)$

4 Principles

The principle of the calculation method is as follows:

— to obtain the thermal resistance of each thermally homogeneous part of the component;

— to combine these individual resistances so as to obtain the total thermal resistance of the component, including (where appropriate) the effect of surface resistances.

Thermal resistances of individual parts are obtained in accordance with 5.1.

The values of surface resistance given in 5.2 are appropriate in most cases. Annex A gives detailed procedures for low emissivity surfaces, specific external wind speeds and non-planar surfaces.

Air layers may be regarded as thermally homogeneous for the purposes of this International Standard. Values of the thermal resistance of large air layers with high emissivity surfaces are given in 5.3. Annex B provides procedures for other cases.

The resistances of the layers are combined as follows:

a) for components consisting of thermally homogeneous layers, obtain the total thermal resistance in accordance with 6.1 and the thermal transmittance in accordance with Clause 7;

b) for components having one or more thermally inhomogeneous layers, obtain the total thermal resistance in accordance with 6.2 and the thermal transmittance in accordance with Clause 7;

c) for components containing a tapered layer, obtain the thermal transmittance and/or the total thermal resistance in accordance with Annex C.

Finally, corrections are applied to the thermal transmittance, if appropriate, in accordance with Annex D, in order to allow for the effects of air voids in insulation, mechanical fasteners penetrating an insulation layer and precipitation on inverted roofs.

The thermal transmittance calculated in this way applies between the environments on either side of the component concerned, e.g. internal and external environments, two internal environments in the case of an internal partition, an internal environment and an unheated space. Simplified procedures are given in 5.4 for treating an unheated space as a thermal resistance.

NOTE Calculation of heat flow rates are commonly undertaken using operative temperature (usually approximated to the arithmetic mean of air temperature and mean radiant temperature) to represent the environment inside buildings, and air temperature to represent the external environment. Other definitions of the temperature of an environment are also used when appropriate to the purpose of the calculation. See also Annex A.

5 Thermal resistances

5.1 Thermal resistance of homogeneous layers

Design thermal values can be given as either design thermal conductivity or design thermal resistance. If thermal conductivity is given, obtain the thermal resistance of the layer from

$$R = \frac{d}{\lambda} \tag{1}$$

where

d is the thickness of the material layer in the component;

λ is the design thermal conductivity of the material, either calculated in accordance with ISO 10456 or obtained from tabulated values.

NOTE The thickness, d, can be different from the nominal thickness (e.g. when a compressible product is installed in a compressed state, d is less than the nominal thickness). If relevant, it is advisable that d also make appropriate allowance for thickness tolerances (e.g. when they are negative).

Thermal resistance values used in intermediate calculations shall be calculated to at least three decimal places.

5.2 Surface resistances

Use the values in Table 1 for plane surfaces in the absence of specific information on the boundary conditions. The values under “horizontal” apply to heat flow directions $\pm$ 30° from the horizontal plane. For non-planar surfaces or for specific boundary conditions, use the procedures in Annex A.