

Building materials and products — Hygrothermal properties - Tabulated design values and procedures for determining declared and design thermal values

ICS 91.120.10

National foreword

This British Standard is the UK implementation of EN ISO 10456:2007. It is identical to ISO 10456:2007, incorporating corrigendum December 2009. It supersedes BS EN ISO 10456:2000 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee B/540, Energy performance of materials components and buildings.

A list of organizations represented on this committee can be obtained on request to its secretary.

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28 February 2010	Implementation of ISO corrigendum December 2009, Table 4 amended

English Version

Building materials and products - Hygrothermal properties -
Tabulated design values and procedures for determining
declared and design thermal values (ISO 10456:2007)

Matériaux et produits pour le bâtiment - Propriétés
hygrothermiques - Valeurs utiles tabulées et procédures
pour la détermination des valeurs thermiques déclarées et
utiles (ISO 10456:2007)

Baustoffe und Bauprodukte - Wärme- und
feuchtetechnische Eigenschaften - Tabellierte
Bemessungswerte und Verfahren zur Bestimmung der
wärmeschutztechnischen Nenn- und Bemessungswerte
(ISO 10456:2007)

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Foreword

This document (EN ISO 10456:2007) 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of an identical text or by endorsement, at the latest by June 2008, and conflicting national standards shall be withdrawn at the latest by June 2008.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 10456:2007 has been approved by CEN as a EN ISO 10456:2007 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.

Heat and moisture transfer calculations require design values of thermal and moisture properties for materials used in building applications.

Design values can be derived from declared values that are based on measured data on the product concerned, which is usually the case for thermal insulation materials. Where the design conditions differ from those of the declared value, the data needs to be converted to the applicable conditions. This International Standard provides the methods and data for making this conversion.

For materials for which measured values are not available, design values can be obtained from tables. This International Standard provides such tabulated information based on the compilation of existing data (see reference documents listed in the Bibliography).

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

1 Scope

This International Standard specifies methods for the determination of declared and design thermal values for thermally homogeneous building materials and products, together with procedures to convert values obtained under one set of conditions to those valid for another set of conditions. These procedures are valid for design ambient temperatures between $-30\text{ }^{\circ}\text{C}$ and $+60\text{ }^{\circ}\text{C}$.

This International Standard provides conversion coefficients for temperature and for moisture. These coefficients are valid for mean temperatures between $0\text{ }^{\circ}\text{C}$ and $30\text{ }^{\circ}\text{C}$.

This International Standard also provides design data in tabular form for use in heat and moisture transfer calculations, for thermally homogeneous materials and products commonly used in building construction.

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

ISO 12572, *Hygrothermal performance of building materials and products — Determination of water vapour transmission properties*

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 the following apply.

3.1.1

declared thermal value

expected value of a thermal property of a building material or product assessed from measured data at reference conditions of temperature and humidity, given for a stated fraction and confidence level, and corresponding to a reasonable expected service lifetime under normal conditions

3.1.2

design thermal value

design thermal conductivity or design thermal resistance

NOTE A given product can have more than one design value, for different applications or environmental conditions.

3.1.3

design thermal conductivity

value of thermal conductivity of a building material or product under specific external and internal conditions, which can be considered as typical of the performance of that material or product when incorporated in a building component

3.1.4

design thermal resistance

value of thermal resistance of a building product under specific external and internal conditions, which can be considered as typical of the performance of that product when incorporated in a building component

3.1.5

material

piece of a product irrespective of its delivery form, shape and dimensions, without any facing or coating

3.1.6

product

final form of a material ready for use, of given shape and dimensions and including any facings or coatings

3.2 Symbols and units

Symbol	Quantity	Unit
c_p	specific heat capacity at constant pressure	J/(kg·K)
F_a	ageing conversion factor	—
F_m	moisture conversion factor	—
F_T	temperature conversion factor	—
f_T	temperature conversion coefficient	K ⁻¹
f_u	moisture conversion coefficient mass by mass ^a	kg/kg
f_v	moisture conversion coefficient volume by volume ^a	m ³ /m ³
R	thermal resistance	m ² ·K/W
s_d	water vapour diffusion-equivalent air layer thickness	m
T	thermodynamic temperature	K
u	moisture content mass by mass	kg/kg
λ	thermal conductivity	W/(m·K)
μ	water vapour resistance factor	—
ρ	density	kg/m ³
v	moisture content volume by volume	m ³ /m ³
^a For conversion of thermal properties.		

4 Test methods and test conditions

4.1 Tests for thermal properties

4.1.1 Test methods

Measured values of thermal conductivity or thermal resistance shall be obtained using the following methods:

- guarded hot plate, in accordance with ISO 8302 or equivalent national method;
- heat flow meter, in accordance with ISO 8301 or equivalent national method;
- calibrated and guarded hot box, in accordance with ISO 8990.

4.1.2 Test conditions

To avoid conversions, it is recommended that measurements be conducted under conditions corresponding to the selected set of conditions given in Table 1.

The mean test temperature should be chosen so that the application of the temperature coefficients does not introduce a change of more than 2 % from the measured value.

The following testing conditions are required:

- measured thickness and density for identification;
- mean test temperature;
- moisture content of the specimen during test;
- (for aged materials) age of the specimen and conditioning procedures before testing.

4.2 Tests for moisture properties

Measured values of water vapour resistance factor or water vapour diffusion-equivalent air layer thickness shall be obtained using ISO 12572.

5 Determination of declared thermal values

A declared thermal value shall be given under one of the sets of conditions a) or b) in Table 1, with reference temperature I (10 °C) or II (23 °C).

Table 1 — Declared value conditions

Property	Sets of conditions			
	I (10 °C)		II (23 °C)	
	a)	b)	a)	b)
Reference temperature	10 °C	10 °C	23 °C	23 °C
Moisture	u_{dry} ^a	$u_{23,50}$ ^b	u_{dry} ^a	$u_{23,50}$ ^b
Ageing	aged	aged	aged	aged
^a u_{dry} is a low moisture content reached by drying according to specifications or standards for the material concerned. ^b $u_{23,50}$ is the moisture content when in equilibrium with air at 23 °C and relative humidity of 50 %.				

Either the declared value shall be determined at a thickness large enough to neglect the thickness effect, or the declared values for smaller thicknesses shall be based on measurements at those thicknesses.

The data used shall be either

- directly measured values according to the test methods given in Clause 4, or
- obtained indirectly by making use of an established correlation with a related property such as density.

When all data have not been measured under the same set of conditions, they shall first be brought to one set of conditions (see Clause 7). A statistical single value estimate shall then be calculated. Annex C refers to International Standards on statistics that may be used.

During calculations, no value shall be rounded to less than three significant figures.

The declared value is the estimated value of the statistical single value, rounded according to either or both of the following rules:

- a) for thermal conductivity, λ , expressed in W/(m·K):
- if $\lambda \leq 0,08$: rounding to nearest higher 0,001 W/(m·K);
 - if $0,08 < \lambda \leq 0,20$: rounding to nearest higher 0,005 W/(m·K);
 - if $0,20 < \lambda \leq 2,00$: rounding to nearest higher 0,01 W/(m·K);
 - if $2,00 < \lambda$: rounding to nearest higher 0,1 W/(m·K);
- b) for thermal resistance, R , expressed in m²·K/W, as the nearest lower value rounded to not more than two decimals or three significant figures.

Rules for determining declared values for specific products may be specified in applicable product standards.

6 Determination of design thermal values

6.1 General

Design values can be obtained from declared values, measured values or tabulated values (see Clause 8).

Measured data shall be either

- directly measured values in accordance with the test methods given in Clause 4, or
- obtained indirectly by making use of an established correlation with a related property, such as density.

If the set of conditions for declared, measured or tabulated values can be considered relevant for the actual application, those values can be used directly as design values. Otherwise, conversion of data shall be undertaken according to the procedure given in Clause 7.

6.2 Rounding of design values

The design value shall be rounded in accordance with the rules given in Clause 5:

- for thermal conductivity, as the nearest higher value, in W/(m·K);
- for thermal resistance, as the nearest lower value, in m²·K/W.