

SVENSK STANDARD

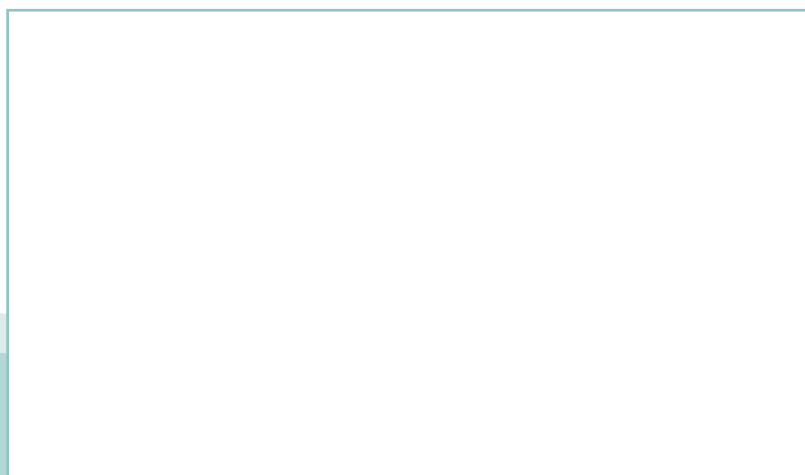
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Byggprodukters och byggkomponenters termiska egenskaper – Speciella kriterier för bedömning av laboratorier som mäter värmetekniska egenskaper – Del 4: Provning med varm låda

Thermal performance of building products and components – Specific criteria for the assessment of laboratories measuring heat transfer properties – Part 4: Measurements by hot box methods



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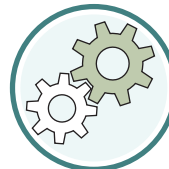
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EUROPEAN STANDARD

EN 1946-4

NORME EUROPÉENNE

EUROPÄISCHE NORM

April 2000

ICS 91.100.01; 91.120.10

English version

Thermal performance of building products and components -
Specific criteria for the assessment of laboratories measuring
heat transfer properties - Part 4: Measurements by hot box
methods

Performance thermique des produits et composants pour le
bâtiment - Critères particuliers pour l'évaluation des
laboratoires mesurant les propriétés de transmission
thermique - Partie 4: Mesurages selon les méthodes de la
boîte chaude

Wärmetechnisches Verhalten von Bauprodukten und
Bauteilen - Technische Kriterien zur Begutachtung von
Laboratorien bei der Durchführung der Messungen von
Wärmeübertragungseigenschaften - Teil 4: Messungen
nach dem Heizkasten-Verfahren

This European Standard was approved by CEN on 4 March 2000.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

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.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.



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

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

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Foreword

This European Standard 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 October 2000, and conflicting national standards shall be withdrawn at the latest by October 2000.

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

No existing European Standard is superseded.

This European Standard is divided into parts. The first part covers common criteria applicable to all heat transfer property measurements; each subsequent part covers the specific technical criteria applicable to each heat transfer property measurement method described in appropriate standards.

The following parts have been developed:

- Part 1: Common criteria
- Part 2: Measurements by the guarded hot plate method
- Part 3: Measurements by the heat flow meter method
- Part 4: Measurements by hot box methods
- Part 5: Measurements by the pipe test methods

Basic information on heat transfer in hot box apparatus and related temperature non-uniformities may be found in the CEN Technical Report "Heat transfer and errors in hot box apparatus", see [2] in the bibliography.

Annex A of this European Standard is normative, annex B is informative.

1 Scope

This part 4 of this standard provides specific technical criteria for the assessment of laboratories to undertake steady-state heat transfer property measurements on products and components using calibrated or guarded hot box apparatus in accordance with EN ISO 8990:1996, including its application to doors and windows in accordance with EN ISO 12567, or using a heat flow meter in a hot box apparatus in accordance with EN 1934:1998.

It complements the common criteria in part 1. Guidance is given on the organization and contents of the equipment manual, the calibration and maintenance files and the measurement procedure document.

It provides information on mandatory equipment performance specifications and equipment description. It supplements error analysis and calculations for the equipment design not supplied in EN ISO 8990:1996, EN 1934:1998 and related standards.

It provides information on experimental procedures suitable for the assessment of instrument accuracy.

2 Normative references

This standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 1934:1998	Thermal performance of buildings - Determination of thermal resistance by hot box method using heat flow meter - Masonry
EN 1946-1:1999	Thermal performance of building products and components - Specific criteria for the assessment of laboratories measuring heat transfer properties - Part 1: Common criteria
EN ISO 6946	Building components and building elements - Thermal resistance and thermal transmittance - Calculation method (ISO 6946:1996)
EN ISO 7345	Thermal insulation - Physical quantities and definitions (ISO 7345:1987)
EN ISO 8990:1996	Thermal insulation - Determination of steady-state thermal transmission properties - Calibrated and guarded hot box (ISO 8990:1994)
EN ISO 12567:- ¹⁾	Thermal performance of windows and doors- Determination of thermal transmittance by hot box method (ISO 12567:-)

3 Definitions, symbols and units

3.1 Definitions

For the purposes of this standard, the following terms and definitions and the definitions given in part 1 of this standard, in EN ISO 7345, in EN 1934:1998, in EN ISO 12567 and those of EN ISO 8990:1996 not given in this standard, apply.

¹ To be published

3.1.1 specimen surface-to-surface thermal resistance

Physical quantity defined by:

$$R_t = \frac{A(T_{si} - T_{se})}{\Phi_1} \quad \text{m}^2 \cdot \text{K/W}$$

3.1.2 thermal transmittance of a specimen

Physical quantity defined by:

$$U = \frac{\Phi_1}{A(T_{ni} - T_{ne})} \quad \text{W}/(\text{m}^2 \cdot \text{K})$$

or defined (when R_t can be defined) as;

$$U = \frac{1}{R_{si} + R_t + R_{se}} \quad \text{W}/(\text{m}^2 \cdot \text{K})$$

3.1.3 environmental temperature

Physical quantity defined by:

$$T_n = \frac{Eh_{ro}}{Eh_{ro} + h_c} T_r + \frac{h_c}{Eh_{ro} + h_c} T_a \quad \text{K}$$

3.2 Symbols and units

Symbol	Quantity	Unit
A	area perpendicular to the density of heat flow rate	m^2
E	emissivity factor dependent on surface emissivities and view factors, see EN ISO 8990:1996	
h_c	surface coefficient of heat transfer due to convection	$\text{W}/(\text{m}^2 \cdot \text{K})$
h_r	surface coefficient of heat transfer due to radiation	$\text{W}/(\text{m}^2 \cdot \text{K})$
h_{ro}	surface coefficient of heat transfer due to radiation between parallel black planes ($h_{ro} = 4 \sigma T_m^3$)	$\text{W}/(\text{m}^2 \cdot \text{K})$
p	metering area perimeter	m
R_s	surface resistance on one specimen surface	$\text{m}^2 \cdot \text{K/W}$
R_t	specimen thermal resistance (surface-to-surface)	$\text{m}^2 \cdot \text{K/W}$

Symbol	Quantity	Unit
T_a	mean temperature of the air surrounding one specimen surface	K
T_n	environmental temperature	K
T_r	mean radiant temperature of the surfaces "seen" by the specimen surface	K
U	thermal transmittance	W/(m ² ·K)
Φ	heat flow rate	W
Φ_1	heat flow rate through the metering area of the specimen	W
Φ_2	imbalance heat flow rate between guard area and metering area in the specimen	W
Φ_3	heat flow rate through the metering box walls	W
Φ_4	flanking heat flow rate through the specimen frame	W
Φ_5	heat flow rate at the edge of the specimen	W
σ_n	Stefan Boltzmann constant ($5,67 \times 10^{-8}$)	W/(m ² ·K ⁴)
λ	thermal conductivity	W/(m·K)

Subscripts

For the purpose of this standard, the following subscripts apply, see also 4.4.2.2:

a	air
b	metering box surface
i	internal, usually hot side
e	external, usually cold side
g	guard box
m	metering area or the air enclosed in the metering box
n	environmental
r	radiation
s	surface
sg	specimen-(guard box)
sm	specimen-(metering box)

4 Equipment manual

4.1 General

The equipment manual shall provide the information specified in 5.2.2 to 5.2.5 of part 1 of this standard and the information specified in this clause.

NOTE Information common to more than one piece of equipment need not be duplicated, e.g. the principle, details of the design and operation of two pieces of equipment built to a common design.

Annex A gives all limiting values indicated in EN ISO 8990:1996, EN 1934:1998 or EN ISO 12567 for apparatus performance and testing conditions. This annex shall be used as a check-list during the assessment process by the parties concerned to ensure compliance with all the requirements of those standards.

4.2 Equipment performance specification

The upper and lower limits of the relevant tested properties and testing conditions, including possible interactions between them, shall be specified:

- minimum and maximum specimen thickness to be tested in the apparatus;
- minimum and maximum specimen thermal resistance;
- minimum and maximum surface coefficients required during tests;
- minimum and maximum temperature difference across the specimen;
- dimensions of expected inhomogeneities in the specimens;
- minimum cold side temperature;
- maximum hot side temperature;
- overall equipment accuracy and maximum acceptable error on measured property in a defined worst-case condition;
- requirements on the control of relative humidity on the hot and cold side;
- maximum mass for a specimen to be accommodated in a frame.

4.3 Equipment description

The following information shall be documented and made available for examination during the assessment:

- principle of operation (see 1.5 of EN ISO 8990:1996 or 4.1 of EN 1934:1998);
- type of apparatus: guarded hot box, see 1.5.2 of EN ISO 8990:1996, or calibrated hot box, see 1.5.3 of EN ISO 8990:1996;
- principal dimensions of apparatus, in particular height and width of the metering box or of the metering area of the heat flow meter in a hot box with a heat flow meter, height and width of the guard box for guarded hot boxes;
- simple diagrams illustrating the design of the equipment with special attention to the heat supply and air circulation (see 2.3.2 of EN ISO 8990:1996 or 6.2.3 of EN 1934:1998), the guard box (see 2.4 of EN ISO 8990:1996), the specimen frame and edge insulation (see in particular 2.5 of EN ISO 8990:1996) and the cold side chamber (see in particular 2.6 of EN ISO 8990:1996);
- position, connections and numbering of temperature sensors (see 2.7 of EN ISO 8990:1996 or 6.3 of EN 1934:1998);