SLOVENSKI STANDARD
SIST EN ISO 13789:2000

01-junij-2000

Toplotne znaļ ilnosti delov stavb - Specifiļ ne toplotne izgube zaradi prehoda toplote - Raļ unska metoda (ISO 13789:1999)

Thermal performance of buildings - Transmission heat loss coefficient - Calculation method (ISO 13789:1999)

Wärmetechnisches Verhalten von Gebäuden - Spezifischer Transmissionswärmeverlustkoeffizient - Berechnungsverfahren (ISO 13789:1999)

Performance thermique des bâtiments - Coefficient de déperdition par transmission - Méthode de calcul (ISO 13789:1999)

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ICS:

91.120.10	Toplotna izolacija stavb	Thermal insulation

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Thermal performance of buildings - Transmission heat loss coefficient - Calculation method (ISO 13789:1999)

Performance thermique des bâtiments - Coefficient de déperdition par transmission - Méthode de calcul (ISO 13789:1999)

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This European Standard was approved by CEN on 16 November 1997.

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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
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Contents

Foreword

The text of EN ISO 13789:1999 has been prepared by Technical Committee CEN/TC 89 "Thermal performance of buildings and building components", the secretariat of which is held by SIS, in collaboration with Technical Committee ISO/TC 163 "Thermal insulation".

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of an identical text or by endorsement, at the latest by March 2000, and conflicting national standards shall be withdrawn at the latest by March 2000.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.

This 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.

Introduction

The aims of this standard are:

a) to clarify the international market through the harmonised definition of an intrinsic characteristic of buildings,
b) to help in judging compliance with regulations,
c) to provide input data for calculation of annual energy use for heating buildings.

The result of the calculation can be used as input for calculation of annual energy use and heating load of buildings, for expressing the thermal transmission characteristic of a building or for judging compliance with specifications expressed in terms of transmission heat loss coefficient. The use of the transmission heat loss coefficient as defined by this standard for sizing heating systems may require appreciable corrections.

1 Scope

This standard specifies a method and provides conventions for the calculation of the transmission heat loss coefficient of whole buildings and parts of buildings. For the purpose of this standard, the heated space is assumed to be at uniform temperature.

Heat loss by ventilation is not within the scope of this standard. However, in order to evaluate transmission heat loss through unheated spaces, this standard gives conventional values of air change rates of such spaces.

Annex A provides a steady state method to calculate the temperature in unheated spaces adjacent to heated buildings.

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 ISO 6946	Building components and building elements - Thermal resistance and thermal transmittance - Calculation method (ISO 6946)
EN ISO 7345	Thermal insulation - Physical quantities and definitions (ISO 7345)
EN ISO 10077-1 [1)]	Thermal performance of windows, doors and shutters - Calculation of thermal transmittance - Part 1: Simplified method (ISO10077-1)
EN ISO 10211-1	Thermal bridges in building construction - Calculation of heat flows and surface temperatures - Part 1: General methods (ISO 10211-1)
EN ISO 10211-2 [1)]	Thermal bridges in building construction - Calculation of heat flows and surface temperatures - Part 2: Linear thermal bridges (ISO 10211-2)
EN ISO 13370	Thermal performance of buildings - Heat transfer via the ground - Calculation methods (ISO 13370)
EN ISO 14683	Thermal bridges in building construction - Linear thermal transmittance - Simplified methods and default values (ISO 14683)

3 Definitions

For the purposes of this standard, the definitions of EN ISO 7345 and those given below apply:

3.1 **heated space:** Room or enclosure which is heated at a given set-point temperature.

3.2 **transmission heat loss coefficient:** Heat flow rate from the heated space to the external environment by transmission divided by the temperature difference between internal and external environments.

NOTE Both temperatures being supposed uniform.

3.3 **ventilation heat loss coefficient:** Heat flow rate from the heated space to the external environment by ventilation divided by the temperature difference between internal and external environments.

3.4 **heat loss coefficient:** Sum of transmission and ventilation heat loss coefficients.

3.5 **internal dimension:** Length measured from wall to wall and floor to ceiling inside each room of the building.

3.6 **overall internal dimension:** Length measured on the interior of the building, ignoring internal partitions.

3.7 **external dimension:** Length measured on the exterior of the building.

[1)] To be published.

4 Transmission heat loss coefficient

4.1 Basic equation

The transmission heat loss coefficient, H_T, is calculated by:

$$H_T = L_D + L_s + H_U \tag{1}$$

where

- L_D is the direct coupling coefficient between the heated space and the exterior through the building envelope, defined by equation (2), in W/K;
- L_s is the steady state ground heat loss coefficient defined in 4.4, in W/K;
- H_U is the transmission heat loss coefficient through unheated spaces defined in equation (3), in W/K.

EN ISO 10211-1 gives a general procedure for the calculation of the total thermal coupling coefficient, L, of the complete envelope or any part of it, including ground loss. Where no unheated space is involved, it corresponds to the transmission heat loss coefficient as defined in this standard. EN ISO 10211-1 can then be used as an alternative or when a more accurate result is required.

4.2 Boundaries of heated space

Before calculation, the heated space of the building under consideration shall be clearly defined. The building elements to be considered in the calculations are the boundaries of the heated space.

The building envelope above ground is modelled by plane and beam-shaped elements as shown on figure 1.

Boundaries between the "underground" part, involving heat transmission through the ground, and the "above ground" part of the building, having direct loss to the external environment or loss to unheated spaces, are according to EN ISO 13370:

- for buildings with slab-on-ground floors, suspended floors and unheated basements: the level of the internal surface of the ground floor;
- for buildings with a heated basement: the external ground level.

Annex B provides information on the effect of using various types of dimensions when dividing the envelope into elements.

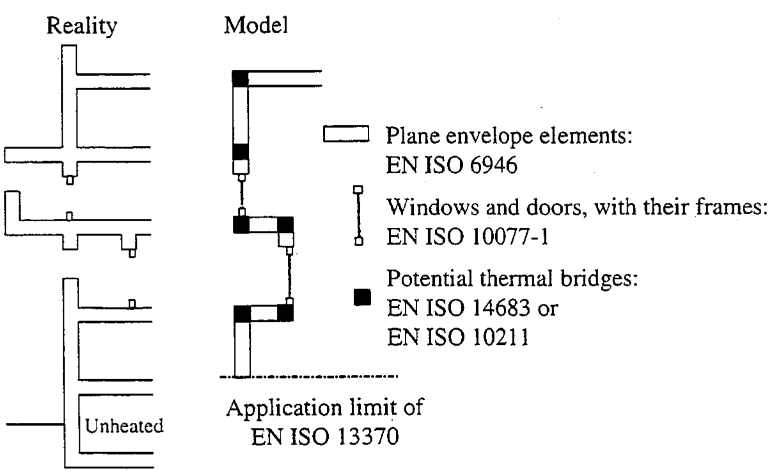

Figure 1 - Modelling the building envelope by plane and beam-shaped components

If calculations are performed for parts of buildings, the boundaries of these parts shall be clearly defined, so that the sum of the transmission heat loss coefficients of all parts equals that of the building.

4.3 Direct transmission to the exterior

The transmission heat loss coefficient through the building elements separating the heated space and the external air is calculated either by:

$$L_D = \Sigma_i A_i U_i + \Sigma_k l_k \Psi_k + \Sigma_j \chi_j \quad \text{or by} \quad L_D = \Sigma_i A_i U_i + \Sigma_k L_k^{2D} l_k + \Sigma_j L_j^{3D} \qquad (2)$$

where

- A_i is the area of element i of the building envelope, in m², (the dimensions of windows and doors are taken as the dimensions of the aperture in the wall);
- U_i is the thermal transmittance of element i of the building envelope, calculated according to EN ISO 6946 for opaque elements or according to EN ISO 10077-1 for glazed elements, in W/(m²·K);
- l_k is the length of linear thermal bridge k, in m;
- Ψ_k is the linear thermal transmittance of thermal bridge k, taken from EN ISO 14683 or calculated according to EN ISO 10211-2, in W/(m·K);
- χ_j is the point thermal transmittance of point thermal bridge j, calculated according to EN ISO 10211-1, in W/K (point thermal bridges which are normally part of plane building elements and already taken into account in their thermal transmittance shall not be added here);
- L_k^{2D} is a thermal coupling coefficient, obtained from a two-dimensional calculation according to EN ISO 10211-1, in W/(m·K);
- L_j^{3D} is a thermal coupling coefficient, obtained from a three-dimensional calculation according to EN ISO 10211-1, in W/K;

The summation shall be done over all the building components separating the internal and the external environments.

For situations not covered by EN ISO 6946, EN ISO 10077-1, EN ISO 14683 or EN ISO 10211-2, EN ISO 10211-1 shall be referred to.

When the main insulation layer is continuous and of uniform thickness, the linear and point thermal transmittances may be neglected if external dimensions are used. The main insulation layer is the layer with the highest thermal resistance in the elements flanking the potential thermal bridge.

If the thermal transmittance of a component varies (e.g. windows with shutters closed at night) both maximum and minimum values shall be computed.

4.4 Transmission heat loss coefficient through the ground

This coefficient, L_s is calculated according to EN ISO 13370.

4.5 Transmission heat loss coefficient through unheated spaces

The transmission heat loss coefficient, H_U, between heated space and external environments via unheated spaces is obtained by:

$$H_U = L_{iu}\, b \qquad \text{with} \qquad b = \frac{H_{ue}}{H_{iu} + H_{ue}} \qquad (3)$$

where

- L_{iu} is the thermal coupling coefficient between the heated space and the unheated space, calculated according to 4.3 and 4.4, in W/K ($L_{iu} = L_{Diu} + L_{siu}$);
- H_{iu} is the heat loss coefficient from the heated space to the unheated space, in W/K;

H_{ue} is the heat loss coefficient from the unheated space to the external environment, in W/K.

NOTE In equation (3), the reduction factor, b, allows for the unheated space being at different temperature to the external environment (see annex A).

H_{iu} and H_{ue} include the transmission and ventilation heat losses. They are calculated by:

$$H_{iu} = L_{iu} + H_{V,iu} \quad \text{and} \quad H_{ue} = L_{ue} + H_{V,ue} \tag{4}$$

The thermal coupling coefficients, L_{ue} and L_{iu} are calculated according to 4.3 and 4.4 ($L_{ue} = L_{Due} + L_{sue}$) and the ventilation heat loss coefficients, $H_{V,ue}$ and $H_{V,iu}$, by:

$$H_{V,iu} = \rho c \dot{V}_{iu} \quad \text{and} \quad H_{V,ue} = \rho c \dot{V}_{ue} \tag{5}$$

where

ρ is the density of air, in kg/m^3;

c is the specific heat capacity of air, in Wh/(kg·K);

$\dot{V}_{ue}$ is the air flow rate between the unheated space and the external environment, in m^3/h;

$\dot{V}_{iu}$ is the air flow rate between the heated and unheated spaces, in m^3/h.

NOTE EN ISO 6946 provides approximate methods for some particular unheated spaces.

5 Additional conventions

5.1 General

If the purpose of the calculation is to provide data for estimation of annual energy requirement, the best available data should be used as input for the calculations.

If the purpose is to express the thermal transmission characteristic of a building considered as a product or for judging compliance with specifications expressed in terms of transmission heat loss coefficient, the values defined below shall be used. The result of the calculations is then independent of location and use of the building.

5.2 Transmission heat loss coefficient through the ground

This coefficient is the steady state component, L_s ,calculated according to EN ISO 13370, the thermal conductivity of the ground being taken as 2 W/(m·K).

5.3 Variable thermal transmittance

Where thermal transmittance may vary, the maximum value shall be used.

5.4 Air change rates of unheated spaces

In order not to underestimate the transmission heat loss, the air flow rate between heated space and unheated space shall be assumed to be zero.

$$\dot{V}_{iu} = 0 \tag{6}$$

The air flow rate between the unheated space and the external environment is calculated by:

$$\dot{V}_{ue} = V_u n_{ue} \tag{7}$$