SLOVENSKI STANDARD
SIST EN ISO 14683:2000
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Toplotni mostovi v stavbah - Linearna toplotna prehodnost - Poenostavljena metoda in privzete vrednosti (ISO 14683:1999)

Thermal bridges in building construction - Linear thermal transmittance - Simplified methods and default values (ISO 14683:1999)

Wärmebrücken im Hochbau - Längenbezogener Wärmedurchgangskoeffizient - Vereinfachte Verfahren und Anhaltswerte (ISO 14683:1999)

Ponts thermiques dans les bâtiments - Coefficient de transmission thermique linéique - Méthodes simplifiées et valeurs par défaut (ISO 14683:1999)

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Foreword

The text of EN ISO 14683:1999 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of an identical text or by endorsement, at the latest by December 1999, and conflicting national standards shall be withdrawn at the latest by December 1999.

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

Thermal bridges in building constructions give rise to changes in heat flow rates and surface temperatures compared with those of the unbridged structure. These heat flow rates and temperatures can be precisely determined by numerical calculation in accordance with EN ISO 10211-1 (three-dimensional heat flow) or prEN ISO 10211-2 (two-dimensional heat flow). However, for linear thermal bridges, it is convenient to use simplified methods to obtain an estimate of their linear thermal transmittance.

The effect of repeating thermal bridges which are part of the otherwise uniform building element, such as wall ties penetrating the thermal insulation layer or mortar joints in lightweight blockwork, should be included in the calculation of the thermal transmittance of the particular building element in accordance with EN ISO 6946, Building components and building elements - Thermal resistance and thermal transmittance - Calculation method (ISO 6946:1996).

Although not covered by this standard, it should be borne in mind that thermal bridges can also give rise to low internal surface temperatures, with an associated risk of surface condensation or mould growth.

1 Scope

This standard deals with simplified methods for determining heat flows through linear thermal bridges which occur at junctions of building elements. It is not applicable to thermal bridging associated with window and door frames or curtain walling.

It specifies requirements relating to thermal bridge catalogues and manual calculation methods, and provides a limited number of tabulated default values of linear thermal transmittances.

2 Normative references

This European 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 these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN ISO 7345	Thermal insulation - Physical quantities and definitions (ISO 7345:1987)
EN ISO 10211-1	Thermal bridges in building construction - Heat flows and surface temperatures - Part 1: General calculation methods (ISO 10211-1:1995)
prEN ISO 10211-2	Thermal bridges in building construction - Calculation of heat flows and surface temperatures - Part 2: Linear thermal bridges (ISO/FDIS 10211-2:1999)
EN ISO 13370	Thermal performance of buildings - Heat transfer via the ground - Calculation method (ISO 13370:1998)
prEN ISO 13789	Thermal performance of buildings - Transmission heat loss coefficient - Calculation method (ISO/DIS 13789:1997)

3 Definitions, symbols and units

3.1 Definitions

For the purposes of this standard the definitions given in EN ISO 7345 and the following definitions apply:

3.1.1 linear thermal bridge: Thermal bridge with a uniform cross section in one direction.

3.1.2 point thermal bridge: Thermal bridge with no uniform cross section in any direction.

3.1.3 thermal coupling coefficient: Heat flow rate divided by temperature difference between two environments which are thermally connected by the construction under consideration.

3.1.4 linear thermal coupling coefficient: Thermal coupling coefficient obtained from a two-dimensional calculation.

3.1.5 linear thermal transmittance: Heat flow rate in the steady state divided by length and by the temperature difference between the environments on either side of the thermal bridge.

NOTE: The linear thermal transmittance is used as a correction term for the linear influence of a thermal bridge when calculating the thermal coupling coefficient from one-dimensional calculations.

3.2 Symbols and units

Symbol	Physical quantity	Unit
A	area	m²
H_T	transmission heat loss coefficient	W/K
L	thermal coupling coefficient	W/K
L^{2D}	linear thermal coupling coefficient	W/(m·K)
R	thermal resistance	m²·K/W
R_{se}	external surface resistance	m²·K/W
R_{si}	internal surface resistance	m²·K/W
U	thermal transmittance	W/(m²·K)
b	width	M
d	thickness	M
h	surface coefficient of heat transfer	W/(m²·K)
l	length	M
θ	Celsius temperature	°C
λ	design thermal conductivity	W/(m·K)
Φ	heat flow rate	W
Ψ	linear thermal transmittance	W/(m·K)
χ	point thermal transmittance	W/K

List of subscripts:

e	external
i	internal
oi	overall internal

4 Influence of thermal bridges on overall heat loss

4.1 Transmission heat loss coefficient

Between internal and external environments with temperatures θ_i and θ_e respectively, the transmission heat flow rate through the building envelope, Φ, can be calculated from the equation:

$$\Phi = H_T (\theta_i - \theta_e) \qquad (1)$$

The transmission heat loss coefficient, H_T, is calculated from the equation:

$$H_T = L + L_s + H_U \qquad (2)$$

where:

L is the thermal coupling coefficient through the building envelope defined by equation (3);

L_s is the ground thermal coupling coefficient calculated in accordance with EN ISO 13370;

H_U is the heat loss coefficient through unheated spaces calculated in accordance with prEN ISO 13789.

4.2 Linear thermal transmittance

When calculating the thermal coupling coefficient, L, the effect of thermal bridges is often ignored. However, buildings can contain significant thermal bridges, one effect of which is to increase the overall heat loss from the building. In this case, to obtain the correct thermal coupling coefficient, it is necessary to add correction terms involving linear and point thermal transmittances as follows:

$$L = \Sigma\, U_i A_i + \Sigma\, \Psi_k l_k + \Sigma\, \chi_j \qquad (3)$$

where:

L is the thermal coupling coefficient;

U_i is the thermal transmittance of part i of the building envelope;

A_i is the area over which the value of U_i applies;

Ψ_k is the linear thermal transmittance of the linear thermal bridge k;

l_k is the length over which the value of Ψ_k applies;

χ_j is the point thermal transmittance of the point thermal bridge j.

Generally the influence of point thermal bridges (insofar as they result from the intersection of linear thermal bridges) can be neglected and so the correction term involving point thermal bridges can be omitted from equation (3). If, however, there are significant point thermal bridges then the point thermal transmittances should be calculated in accordance with EN ISO 10211-1.

Linear thermal transmittance values depend on the system of building dimensions used in calculating the areas of one-dimensional heat flow [i.e. in the calculation of $\Sigma\ U_i A_i$ in equation (3)].

The linear thermal transmittance, Ψ, can be calculated from the equation:

$$\Psi = L^{2D} - \Sigma\ U_i l_i \qquad (4)$$

where:

L^{2D} is the linear thermal coupling coefficient obtained from a two-dimensional calculation of the component separating the two environments being considered;

U_i is the thermal transmittance of the one-dimensional component i separating the two environments being considered;

l_i is the length within the two-dimensional geometrical model over which the value of U_i applies.

Any calculation of linear thermal transmittance, Ψ, shall state the system of dimensions on which it is based.

Table 2 in 5.4 gives default values of Ψ [rounded to the nearest 0,05 W/(m·K)] based on three systems of building dimensions:

- internal dimensions, measured between the finished internal faces of each room in a building (thus excluding the thickness of internal partitions);
- overall internal dimensions, measured between the finished internal faces of the external elements of a building (thus including the thickness of internal partitions);
- external dimensions, measured between the finished external faces of the external elements of a building.

NOTE: These three common dimension systems are described in prEN ISO 13789.

Table 2 also gives, for each detail, the linear thermal coupling coefficient, L^{2D}, so that for any other dimension system, the appropriate default value of Ψ can be calculated using equation (4), with the values of U taken from annex A and the lengths l according to the chosen dimension system.

5 Determination of linear thermal transmittance

5.1 Available methods and expected accuracy

When selecting a particular method, its accuracy should reflect the accuracy required in calculating the overall heat loss, taking into account the lengths of the linear thermal bridges. Table 1 shows the available methods for determining Ψ, together with their expected uncertainty. Thermal bridge catalogues, manual calculations, and default values are given in 5.2, 5.3, and 5.4 respectively.

Table 1: Methods for calculating linear thermal transmittance

Methods	Expected uncertainty of Ψ
Numerical calculation	± 5 %
Thermal bridge catalogue	± 20 %
Manual calculation	± 20 %
Default values	0 % to + 50 %

Where the details are not yet designed but the size and main form of the building is defined, such that the areas of the different elements of the building envelope such as roofs, walls and floors are known, only a rough estimate of the contributions of thermal bridges to the overall heat loss can be made. This rough estimate can be made using the default values of linear thermal transmittance given in table 2.

When at a later stage global details are available, more accurate values of Ψ for each of the linear thermal bridges can be obtained by comparing the particular detail with the best fitting example from a thermal bridge catalogue and using that value of Ψ. Manual calculation methods can also be used at this stage.

When full details are known, all the methods to determine Ψ may be used, including numerical calculations which give the most precise value for Ψ.

5.2 Thermal bridge catalogues

Examples of building details in thermal bridge catalogues have essentially fixed parameters (e.g. fixed dimensions and materials) and so are less flexible than calculations. In general, the examples given in a catalogue do not exactly match the actual detail being considered, and so applying the value of Ψ specified in the catalogue to an actual detail introduces an uncertainty. Nevertheless, the value of Ψ from the catalogue may be used, provided that both dimensions and thermal properties of the catalogue example are either similar to those of the detail being considered or are such that they are thermally less favourable than that of the detail being considered.