
International Standard



6946/2

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Thermal insulation — Calculation methods — Part 2: Thermal bridges of rectangular sections in plane structures

Isolation thermique — Règles de calcul — Partie 2: Ponts thermiques en forme de poutre rectangulaire en partie courante des structures

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 6946/2 was prepared by Technical Committee ISO/TC 163, *Thermal insulation*.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

Thermal insulation — Calculation methods —

Part 2: Thermal bridges of rectangular sections in plane structures

0 Introduction

The presence of a thermal bridge in a plane building structure, in winter and under steady state conditions, causes two phenomena which are linked to one another:

- a) the temperature of the internal surface at the location of the thermal bridge is lower than the internal surface temperature at other locations;
- b) the areal density of the heat transfer rate at the location of the thermal bridge is higher than that at other locations.

To judge the practical consequences of these two phenomena (risks of condensation and extra heat losses), a quantitative analysis is necessary. This can be done by analytical or numerical methods with the aid of a computer. However, in the early "sketching" stages of structural design, this method has the disadvantage that, in many cases, the designer has neither the time nor the skill to use computer programs.

This part of ISO 6946 presents simple, basic formulae which can be used to determine in the sketching stage whether or not the performance of a given building structure will meet given requirements. In these formulae, quantities are introduced that are characteristic of the thermal bridge concerned. For the numerical determination of these quantities, different methods are possible.

A simple, approximate method of calculation is given in annex A. This method is based on the results of numerous computer calculations.

Some numerical examples are given in annex B.

1 Scope and field of application

This part of ISO 6946 gives basic formulae for the calculation of

- a) the zone of influence of a thermal bridge, i.e. the area in which the heat flow has a noticeable component parallel to the surfaces of the structure;
- b) the lowest internal surface temperature at the location of a thermal bridge under steady state winter conditions and under given internal and external ambient temperatures;
- c) the value of the areal thermal transmittance of a building structure containing a thermal bridge.

It is applicable only to thermal bridges with rectangular sections in plane structures.

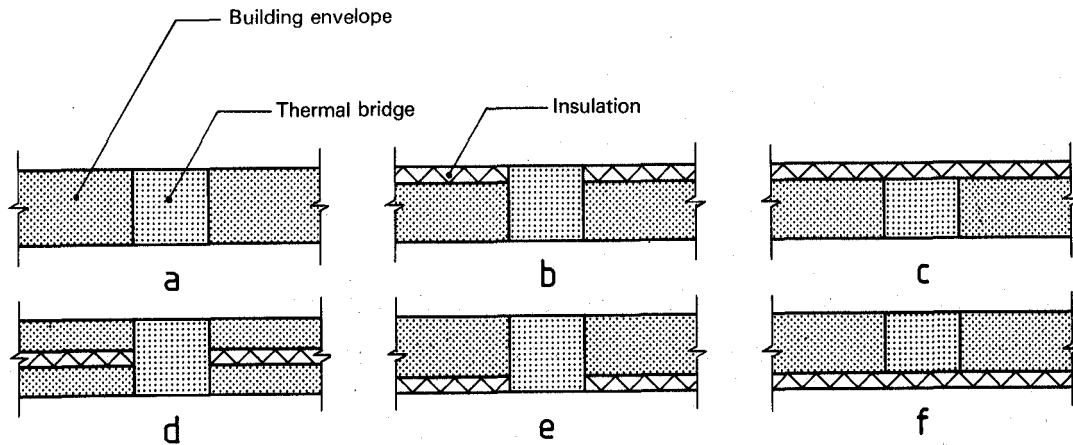
2 Reference

ISO 7345, *Thermal insulation — Physical quantities and definitions*.

3 Definitions and symbols

For the purposes of this part of ISO 6946, the definitions and symbols given in ISO 7345, together with the following, apply.

thermal bridge (in a plane building structure) (part of a building envelope): Location at which the composition differs from that of the adjacent surroundings and at which, in winter and under steady state conditions, the internal surface temperature is lower than that on the adjacent surfaces.

Figure 1 — Cross-sections of basic types of thermal bridge¹⁾

4 Types of thermal bridge

With the limitations mentioned in clause 1, six basic types of thermal bridge are distinguished, as shown in figure 1.

The geometrical parameters of thermal bridges are shown in figure 2,

where

- l is the length of the structure and of the thermal bridge;
- b is the width of the thermal bridge;
- d is the thickness of the structure;
- B is the width of the structure.

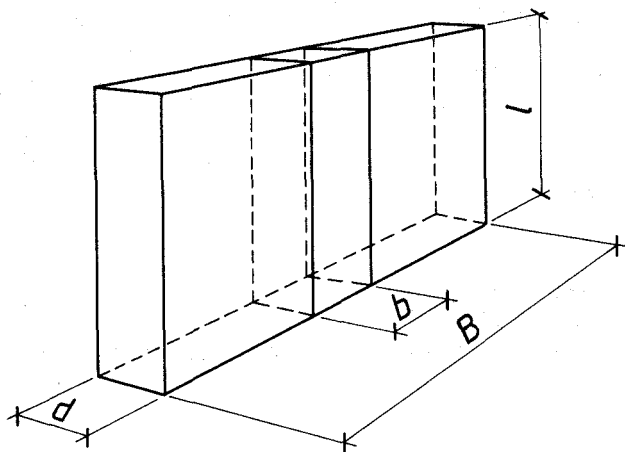


Figure 2 — Geometrical parameters (view)

The total area A is equal to Bl , while the area of the thermal bridge (A_{TB}) is equal to bl .

5 Calculation method

5.1 Auxiliary quantities

In the formulae given in 5.3 and 5.4, the auxiliary quantities U_0 , U_{TB} and $\bar{U}$ are used. These are defined by formulae (1), (2) and (3) respectively.

5.1.1 Auxiliary quantity U_0 [W/(m²·K)]

$$U_0 = [(\sum R)_0 + R_i + R_e]^{-1} \quad \dots(1)$$

where

$(\sum R)_0$ is the sum of the thermal resistances, in square metre kelvins per watt, from surface to surface, of the subsequent layers at locations other than the thermal bridge;

R_i is the surface thermal resistance, in square metre kelvins per watt, at the interior surface;

R_e is the surface thermal resistance, in square metre kelvins per watt, at the exterior surface.

5.1.2 Auxiliary quantity U_{TB} [W/(m²·K)]

$$U_{TB} = [(\sum R)_{TB} + R_i + R_e]^{-1} \quad \dots(2)$$

where

$(\sum R)_{TB}$ is the sum of the thermal resistances, in square metre kelvins per watt, from surface to surface, of the subsequent layers at the location of the thermal bridge;

R_i and R_e are as defined in 5.1.1.

1) In this part of ISO 6946, when cross-sections of structures that are part of the building envelope are illustrated, the outdoor climate is always presumed to be on the top (or the left-hand side) and the indoor climate on the bottom (or the right-hand side).