

# Selected aspects of design for internal partitions and construction joints in low energy consumption buildings – a case study

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**Abstract.** Sustainable building is construction approach which is friendly to both humans and the environment, saving natural resources and counteracting pollution. The most essential design and execution features in this kind of construction approach include: the use of renewable energy sources to preserve natural resources; lowering the energy consumption of technological processes; decreasing the amount of material waste (by changing or modernising the building material technologies used); limiting of energy consumption of existing buildings and those being designed; modern installations in buildings; computer aid in sustainable building design.

This paper presents principles for the design of external partitions and their joints using innovative thermal and insulation materials regarding their thermal and humidity requirements. Integral design elements in this range include certified computer programs which use numerical calculations allowing for parameters of external and internal air. The introduction of new thermal and insulation materials has a crucial impact on processes inside partitions and building joints. That is why the choice of a material layers system should be based on individual calculations considering ‘the specifics of the situation in which it will be applied. Based on the performed calculations and analyses, certain recommendation regarding design and execution were formulated in this paper for design of low energy buildings.

## 1. Introduction

The national plan for low-energy building development [1] contains a definition recommended for use in practice: a ‘**low-energy building**’ is a building which fulfils the requirements for energy saving and isolation contained in the technical regulations mentioned in article 7, paragraph 1, point 1 of the Regulation – Construction law [2], especially Chapter X and Appendix 2 for Regulation [3] from 31 Dec 2020 (in the case of buildings owned and occupied by public authorities – from 1 Jan 2019).

On 13 Aug 2013 a regulation by Ministry of Transportation, Building and Marine Economy was published in Government Monitor on 5 July 2013, changing the regulation on technical requirements for buildings and their location [3]. In this legal act, lower maximum values for heat transfer coefficient  $U_{c(max)}$  [W/(m<sup>2</sup>·K)] were defined concerning external partitions of buildings and the lower limit values of annual demand for non-renewable primary energy  $PE_{(max)}$  [kWh/(m<sup>2</sup>·year)] for periods **2014-2016**, **2017-2020** and after **31.12.2020**. Requirements concerning the thermal insulation of external walls, roofs, floors, and doors are more stringent. Additionally, the type of partition does not matter anymore (multi- or single-layer) as well as building’s designation (housing, public use, warehouse, outbuilding and others). For example, the maximum permitted value of the heat transfer coefficient for external walls of heated rooms ( $t_i \geq 16^\circ\text{C}$ ) will be 0.20 W/(m<sup>2</sup>·K) from 31.12.2020, but for windows, this will be 0.90 W/(m<sup>2</sup>·K). It must be stressed that the values of  $U_{c(max)}$  and  $U_{max}$  do not allow for the impact of heat bridges that exist in the buildings in reality.



Based on the analysis of legal regulations, it can be stated that the amount of heating energy needed for building usage according to its designation may be kept at a reasonably low level; two methods were predicted to be able to fulfil this requirement in new building projects. The first method consists of the design of partitions in the building that enable heat transfer coefficient values of  $U$  [ $W/(m^2 \cdot K)$ ] for external partitions, windows, doors and installation technology, which conforms to the requirements of thermal isolation. However, heat flow resulting from the occurrence of linear and spatial heat bridges which are created, for example, by the connection of a few partitions in the building must be allowed for in both two-dimensional (2D) and three-dimensional fields (3D).

In this work, an analysis has been undertaken concerning the optimisation of the physical parameters of a building's external partitions and joints of low energy consumption. According to regulation [3], a series of options for the calculation of heat transfer coefficient  $U$  was allowed for specific external partitions. Apart from the PN-EN ISO 6946 standard [4], there were other parallel standards mentioned which fundamentally enhance instruments serving for specifying the basic calculation method for the heat transfer coefficient for linear (2D) and spatial (3D) heat bridges. The procedure requires information regarding the linear heat transfer coefficient  $\Psi$  [ $W/(m \cdot K)$ ] in the case of linear heat bridges and spot heat transfer coefficient  $X$  [ $W/K$ ] in the case of spatial heat bridges. Additional heat fluxes resulting from improperly or insufficiently insulated bridges can even exceed the values of basic fluxes present in a continuous (full) partition without heat bridges. The numerical procedure (using computer software) required by the PN-EN ISO 10211 standard [5] causes an essential objection; it is difficult in application and is unclear. The  $\Psi$  coefficient gives linear (for 1m of length) heat losses by a bridge, usually assumed in extending the calculation area for distance of two partition widths from the edge of a bridge. It often happens that in a partition a few bridges overlay. In such a case, it is impossible to sum up the  $\Psi$  coefficients for this geometry, for instance a pillar: window – adjoining wall.

In studies concerning professional calculation of external partitions, the values of the  $\Psi$  coefficient are usually given in relation to a whole joint with a thermal bridge participating in heat transfer [6, 7]. To define the share amount of specific bridges in the total heat loss by a given partition, we need to discriminate the partial values of heat transfer coefficient corresponding to the branches of a joint within the partition in question. This can be achieved through additional numerical calculation by setting the values of a branch heat transfer coefficient. The calculation procedures are described in [8, 9].

## 2. Physical parameters of external partitions and joints in low-energy buildings

A building is a structure of building partitions and their joints of individual physical character, and it is subjected the external and internal environment influence. In most cases, the analysis of building partitions and joints concerning construction, material and technological aspects does not raise objections at the design stage. However, knowledge of physical parameters associated with heat and humidity exchange allows avoiding numerous mistakes regarding design and execution.

To define the temperature distribution and the additional heat loss resulting from the different materials and structures of partitions and joints, we need to perform detailed professional computer calculations of basic physical parameters regarding:

- heat flux  $\Phi$  [ $W$ ];
- heat transfer coefficient of the whole partition  $U$  ( $U_{1D}$ ) [ $W/(m^2 \cdot K)$ ];
- linear coefficient of thermal coupling  $L^{2D}$  [ $W/(m \cdot K)$ ];
- linear heat transfer coefficient (defining heat losses resulting from linear thermal bridges)  $\Psi$  [ $W/(m \cdot K)$ ], and in the case of heat loss calculations for a single partition, a branch coefficient of heat transfer related to part of a joint (for example, the connection of an external wall with a window – linear heat transfer coefficient for the window part  $\Psi_O$  and linear heat transfer coefficient for an external wall part  $\Psi_{sz}$ );
- minimum temperature of an external surface of a partition in the thermal bridge  $t_{min}$  [ $^{\circ}C$ ];
- temperature factor, defined from the minimum temperature of an internal surface of a partition in the thermal bridge  $f_{Rsi(2D)}$  [-].

Based on the tests and analyses performed, it is proposed to define the shape coefficient of the thermal bridge [10]. The graphic solution method for two-dimensional issues of stabilized heat flow is determined according to [11] so called the shape coefficient of the system, based on the properties of the orthogonal net of curvilinear squares, consisting of adiabats and isotherms. In a one-dimensional field, for example in a wall with a surface width equal to its thickness, the relation  $n_2/n_1$  is 1. However, in a two-dimensional field, this quantity has, in principle, a value greater than 1. Due to this fact, the shape coefficient of a thermal bridge defines how much the heat flow conducted through a tested two-dimensional area (2D) changes in relation to a one-dimensional field (1D) with other parameters influencing the heat transfer remaining unchanged. Using the above described rule of heat flux comparability, it is proposed to define the shape coefficient of a thermal bridge  $K$  for total heat exchange (with allowing for heat interception on the partition surface. Additional heat loss caused by the bridge are referred to the partition width equal to its thickness (or heat bridge range) and calculated on the inside surface of the partition. The  $K$  coefficient indicates the number of times the heat flux change which permeates the bridge area, flowing to its internal surface (per 1 m of length) in relation to analogical partition area without a heat bridge. This is a non-unit value which needs to be determined by numerical calculation allowing for various forms of resistance for heat interception on the internal area of bridges. The  $K$  coefficient is calculated from the linear heat transfer  $\Psi$  and heat transfer coefficient  $U$ :

$$K = (\Psi_i + U \cdot g) / (U \cdot g) = \Psi_i / (U \cdot g) + 1 \quad [-] \quad (1)$$

where:

$K$  – shape coefficient of a thermal bridge, [-]

$\Psi_i$  – linear heat transfer coefficient of a thermal bridge branch within the partition range, [W/(m·K)]

$U$  – heat transfer coefficient for a full partition far from a heat bridge ( $U_{1D}$  – heat transfer coefficient in a one-dimension field), [W/(m<sup>2</sup>·K)]

$g$  – partition thickness (or heat bridge range), [m].

Detailed calculation procedures for physical parameters of building partition joints are discussed in [8, 9, 10].

### 3. Calculations of physical parameters of external partition joints of a low-energy building

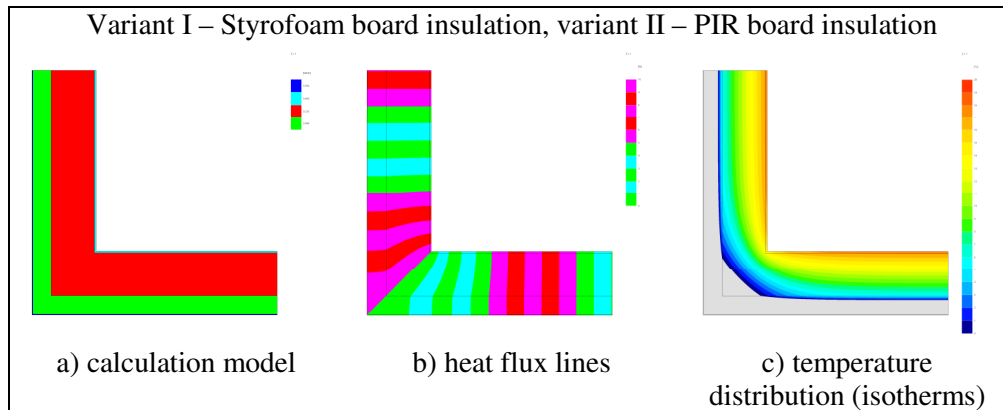
The calculation of the physical parameters of external partition joints using TRISCO was performed with the following assumptions:

- modelling of joints was performed according to the rules described in the PN-EN ISO 10211 standard [5] and articles [8] and [9];
- heat interception resistances ( $R_{si}$ ,  $R_{se}$ ) were assumed according to the PN-EN ISO 6946 standard [4] for the calculation of heat fluxes, and according to the PN-EN ISO 13788 standard [11] for the calculation of heat distribution and temperature factor  $f_{Rsi(2D)}$ ;
- internal air temperature  $t_i = 20$  °C (living-room), external air temperature  $t_e = -20$  °C (zone 3);
- values of heat transfer coefficient for building materials  $\lambda$  [W/(m·K)] assumed based on tables from [9];

Calculations were performed for the following cases:

- corner of two-layer external wall, external wall joint with a window in section through the casing (styrofoam boards with  $\lambda=0,04$  W/(m·K) – variant I;
- PIR boards with  $\lambda=0,021$  W/(m·K) of thickness 10, 12, 15, 20 cm – variant II,
- without a window jamb – variant III, IV,
- with a window jamb – variant V, VI.

Figures 1, 2, and 3 show graphic results of a computer simulation of the analysed joints using TRISCO software. The results of physical parameter calculations are presented in Tables 1 and 2.



**Fig. 1.** Exemplary graphic representation of computer simulation results for a corner joint of an external two-layer wall – own study

**Table 1.** Calculation of physical parameters for a corner joint of an external two-layer wall using TRISCO software

	Physical parameters						
	$U (U_{1D})$ [W/(m <sup>2</sup> ·K)]	$\Phi$ [W]	$L^{2D}$ [W/(m·K)]	$\Psi_i$ [W/(m·K)]	$K$ [-]	$t_{min.}$ [°C]	$f_{Rsi(2D)}$ [-]
$I_{(10)}$	0.260	24.11	0.603	0.082 <sup>a)</sup> 0.041 <sup>b)</sup>	1.432 <sup>c)</sup> 1.158 <sup>d)</sup>	14.08	0.851
$I_{(12)}$	0.230	21.55	0.539	0.078 <sup>a)</sup> 0.039 <sup>b)</sup>	1.440 <sup>c)</sup> 1.170 <sup>d)</sup>	14.57	0.864
$I_{(15)}$	0.196	18.63	0.466	0.073 <sup>a)</sup> 0.036 <sup>b)</sup>	1.449 <sup>c)</sup> 1.186 <sup>d)</sup>	15.18	0.879
$I_{(20)}$	0.158	15.25	0.381	0.066 <sup>a)</sup> 0.033 <sup>b)</sup>	1.449 <sup>c)</sup> 1.209 <sup>d)</sup>	15.91	0.898
$II_{(10)}$	0.164	15.64	0.391	0.063 <sup>a)</sup> 0.031 <sup>b)</sup>	1.526 <sup>c)</sup> 1.192 <sup>d)</sup>	15.88	0.897
$II_{(12)}$	0.142	13.66	0.342	0.058 <sup>a)</sup> 0.029 <sup>b)</sup>	1.530 <sup>c)</sup> 1.204 <sup>d)</sup>	16.33	0.908
$II_{(15)}$	0.118	11.51	0.288	0.052 <sup>a)</sup> 0.026 <sup>b)</sup>	1.531 <sup>c)</sup> 1.220 <sup>d)</sup>	16.84	0.921
$II_{(20)}$	0.092	9.15	0.229	0.045 <sup>a)</sup> 0.022 <sup>b)</sup>	1.526 <sup>c)</sup> 1.245 <sup>d)</sup>	17.41	0.935

- variant I and PIR boards with  $\lambda=0.021$  W/(m·K) – variant II of thickness: 10, 12, 15, 20 cm

- linear coefficient of thermal coupling:  $L^{2D}=\Phi/(\Delta t \cdot l)$  [W/(m·K)], according to [8, 9]

- linear heat transfer coefficient:  $\Psi=L^{2D} \cdot (\Sigma U_i \cdot l_i)$  [W/(m·K)], according to [8, 9]

- shape coefficient of a thermal bridge:  $K=(\Psi_i+U \cdot g)/(U \cdot g)=\Psi_i/(U \cdot g)+1$  [-], according to [10]

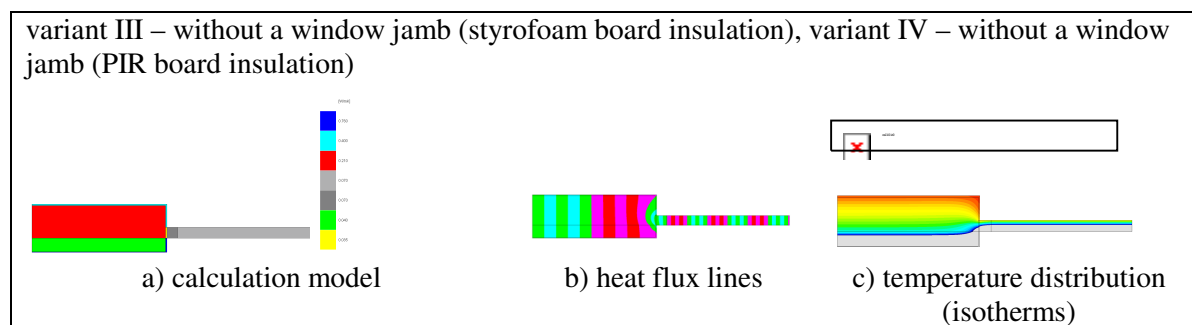
- temperature factor:  $f_{Rsi(2D)}=(t_{min.}-t_e)/(t_i-t_e)$  [-], according to [12]

<sup>a)</sup> – value of heat transfer coefficient for overall joint

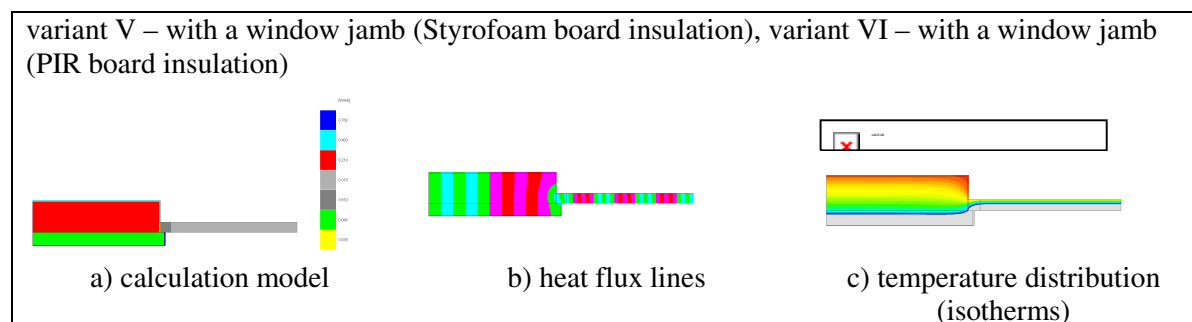
<sup>b)</sup> – value of linear heat transfer coefficient for a single corner branch

<sup>c)</sup> – value of shape coefficient for a heat bridge related to partition thickness

<sup>d)</sup> – value of shape coefficient for a heat bridge related to 1m bridge branch length



**Fig. 2.** Graphic representation for a joint of an external two-layer wall with a window in section through the casing (without nib) – own study



**Fig. 3.** Graphic representation for a joint of an external two-layer wall with a window in section through the casing (with nib) – own study

**Table 2.** Physical parameters for a joint of an external two-layer wall with a window in section through the casing (TRISCO software)

	Physical parameters						
	$U (U_{1D})$ [W/(m <sup>2</sup> ·K)]	$\Phi$ [W]	$L^{2D}$ [W/(m·K)]	$\Psi_i$ [W/(m·K)]	$K$ [-]	$t_{min.}$ [°C]	$f_{Rsi(2D)}$ [-]
<b>III<sub>(10)</sub></b>	0.260 0.762	45.33	1.133	0.043 <sup>a)</sup> 0.064 <sup>b)</sup> / -0.021 <sup>c)</sup>	1.674 <sup>d)</sup> 0.656 <sup>e)</sup>	14.72	0.868
<b>III<sub>(12)</sub></b>	0.230 0.762	44.52	1.113	0.046 <sup>a)</sup> 0.066 <sup>b)</sup> / -0.021 <sup>c)</sup>	1.745 <sup>d)</sup> 0.656 <sup>e)</sup>	14.83	0.871
<b>III<sub>(15)</sub></b>	0.196 0.762	43.06	1.077	0.050 <sup>a)</sup> 0.072 <sup>b)</sup> / -0.022 <sup>c)</sup>	1.885 <sup>d)</sup> 0.639 <sup>e)</sup>	14.90	0.873
<b>III<sub>(20)</sub></b>	0.158 0.762	41.64	1.041	0.053 <sup>a)</sup> 0.075 <sup>b)</sup> / -0.022 <sup>c)</sup>	2.021 <sup>d)</sup> 0.639 <sup>e)</sup>	15.03	0.876
<b>IV<sub>(10)</sub></b>	0.164 0.762	41.59	1.040	0.046 <sup>a)</sup> 0.068 <sup>b)</sup> / -0.022 <sup>c)</sup>	1.485 <sup>d)</sup> 0.639 <sup>e)</sup>	15.08	0.877
<b>IV<sub>(12)</sub></b>	0.142 0.762	40.81	1.020	0.048 <sup>a)</sup> 0.070 <sup>b)</sup> / -0.022 <sup>c)</sup>	1.542 <sup>d)</sup> 0.639 <sup>e)</sup>	15.12	0.878
<b>IV<sub>(15)</sub></b>	0.118 0.762	39.98	1.000	0.051 <sup>a)</sup> 0.074 <sup>b)</sup> / -0.023 <sup>c)</sup>	1.627 <sup>d)</sup> 0.623 <sup>e)</sup>	15.16	0.879
<b>IV<sub>(20)</sub></b>	0.092 0.762	39.00	0.975	0.053 <sup>a)</sup> 0.076 <sup>b)</sup> / -0.023 <sup>c)</sup>	1.721 <sup>d)</sup> 0.623 <sup>e)</sup>	15.27	0.882
<b>V<sub>(10)</sub></b>	0.260 0.762	43.98	1.100	0.034 <sup>a)</sup> 0.037 <sup>b)</sup> / -0.003 <sup>c)</sup>	1.390 <sup>d)</sup> 0.951 <sup>e)</sup>	15.72	0.893
<b>V<sub>(12)</sub></b>	0.230 0.762	42.83	1.071	0.037 <sup>a)</sup> 0.038 <sup>b)</sup> / -0.001 <sup>c)</sup>	1.429 <sup>d)</sup> 0.984 <sup>e)</sup>	15.82	0.896

$V_{(15)}$	0.196 0.762	41.55	1.039	0.040 <sup>a)</sup> 0.041 <sup>b)</sup> / -0.001 <sup>c)</sup>	1.504 <sup>d)</sup> 0.984 <sup>e)</sup>	15.99	0.900
$V_{(20)}$	0.158 0.762	40.09	1.002	0.044 <sup>a)</sup> 0.043 <sup>b)</sup> / -0.001 <sup>c)</sup>	1.585 <sup>d)</sup> 0.984 <sup>e)</sup>	16.14	0.904
$VI_{(10)}$	0.164 0.762	39.94	0.999	0.034 <sup>a)</sup> 0.031 <sup>b)</sup> / 0.001 <sup>c)</sup>	1.327 <sup>d)</sup> 1.016 <sup>e)</sup>	16.30	0.908
$VI_{(12)}$	0.142 0.762	39.10	0.978	0.037 <sup>a)</sup> 0.035 <sup>b)</sup> / 0.002 <sup>c)</sup>	1.395 <sup>d)</sup> 1.033 <sup>e)</sup>	16.37	0.909
$VI_{(15)}$	0.118 0.762	38.21	0.955	0.039 <sup>a)</sup> 0.037 <sup>b)</sup> / 0.002 <sup>c)</sup>	1.455 <sup>d)</sup> 1.033 <sup>e)</sup>	16.44	0.911
$VI_{(20)}$	0.092 0.762	37.22	0.931	0.042 <sup>a)</sup> 0.039 <sup>b)</sup> / 0.003 <sup>c)</sup>	1.531 <sup>d)</sup> 1.049 <sup>e)</sup>	16.55	0.914

- variant III, V – styrofoam board insulation with  $\lambda=0.04$  W/(m·K),

- variant IV, VI – polyurethane board with  $\lambda=0.021$  W/(m·K)

- linear coefficient of thermal coupling:  $L^{2D}=\Phi/(\Delta t \cdot l)$  [W/(m·K)], according to [8, 9]

- linear heat transfer coefficient:  $\Psi=L^{2D} \cdot (\sum U_i \cdot l_i)$  [W/(m·K)], according to [8, 9]

- shape coefficient of a thermal bridge:  $K=(\Psi_i+U \cdot g)/(U \cdot g)=\Psi_i/(U \cdot g)+1$  [-], according to [10]

- temperature factor:  $f_{Rsi(2D)}=(t_{min}-t_e)/(t_i-t_e)$  [-], according to [12]

<sup>a)</sup> – value of heat transfer coefficient for overall joint

<sup>b)</sup> – value of linear (branch) heat transfer coefficient related to external wall

<sup>c)</sup> – value of linear (branch) heat transfer coefficient related to a wall

<sup>d)</sup> – value of shape coefficient for a heat bridge related to external wall

<sup>e)</sup> – value of shape coefficient for a heat bridge related to window

#### 4. Calculation analysis of physical parameters for external partitions and their joints

In choice of material sets for construction of external partitions and their joints for a **low-energy building** using various insulation materials, we must limit additional heat loss. It can be done with the linear heat transfer coefficient  $\Psi$  [W/(m·K)] or by the shape coefficient of heat transfer  $K$  [-], and the risk of the occurrence of surface humidity (to define the minimal temperature on internal surface of a partition and temperature factor  $f_{Rsi(2D)}$ ), and the risk of the occurrence of inter-layer condensation. The values of physical parameters for external partitions and their joints depend on the type and thickness of insulation material (heat conduction coefficient  $\lambda$  [W/(m·K)]), and the shape of the joint between these two various partitions (for instance, an external wall and window). The location of a window casing in contact of construction layer and insulation with a nib allows lower heat loss (Table 2). It must be noticed that extending the insulation over the casing causes the temperature of the external surface of the partition (in contact with the external wall and the casing) is higher than in the case without insulation on the casing (Table 2). In the case of these types of joints, it is a good practice to define the branch coefficient of heat transfer separately for a part of the external wall  $\Psi_{sc}$  [W/(m·K)] and for a part of the window  $\Psi_o$  [W/(m·K)] because this enables defining additional heat loss separately for the external wall and the window (Table 2). Using approximate or rough values, for example, based on the PN-EN ISO 14683 standard [7] becomes unfounded because they do not allow for changes of material sets, or insulation type and thickness. However, in heat loss evaluation, we must also analyse other parameters:  $\Phi$  (amount of heat flux flowing through a joint) [W];  $L^{2D}$  (heat-coupling coefficient) [W/(m·K)] reflecting the heat loss in a joint, or the heat bridge shape  $K$  [-].

The fulfilment of the criterion for avoiding surface condensation risk (mildew and fungi development):  $f_{Rsi(2D)} \geq f_{Rsi(critical)}$ , requires defining the value of  $f_{Rsi(2D)}$  based on the minimum temperature on the internal surface of the partition at the location of the heat bridge (2D)  $t_{min}$  [°C] and the value of  $f_{Rsi(critical)}$ , accounting for the internal and external air parameters (humidity and air temperature). According to the PN-EN ISO 13788 standard [12], the temperature factor  $f_{Rsi(critical)}$  is calculated or assumed, depending on the ventilation type used in the building (for gravity ventilation – dominant in housing buildings, or mechanical ventilation being often a part of conditioning systems allowing in nearly free way to shape properties of interior microclimate). The maximum value obtained over a 12-month relating to a building in Bydgoszcz, assuming humidity class III, amounts to  $f_{Rsi(max)}=f_{Rsi(critical)}=0.785$  (February). This means that in each month of the year and for any other values of limit temperatures, in order to avoid surface condensation  $f_{Rsi(2D)}$  it should be higher than 0.785. In regulation [3], despite from regarding PN-EN ISO 13788 standard [12] as the binding one in designing, there is a deviation from its requirements consisting in assuming monthly average of internal relative air humidity at a constant value of  $\phi_i=0.50$  (50 %) (point 2.2.2 of appendix No. 2 [3])



for rooms with internal temperature equal at least 20°C. Additionally, it was allowed (without calculation) for these rooms the assumption of factor value  $f_{Rsi(critical)} = 0.72$ , which practically means resignation from setting humidity classes of rooms equipped with gravity ventilation. This departure does not allow for humidity calculation of the real localization conditions (climatic) and microclimatic of the examined building, at least in relation to rooms with internal temperature  $t_i \geq 20^\circ\text{C}$ , quite drastically lowering the level of requirements in protection against fungi of buildings located in Poland in stricter climatic zones (zone IV and V). Based on the performed calculations (Table 1 and 2) it can be stated that in the analyzed joints, there is no risk of mildew because the condition  $f_{Rsi(2D)} \geq f_{Rsi(critical)} = 0.785$  is fulfilled.

## 5. Conclusion and final propositions

The quest for fulfilling the heat-humidity requirements for external partitions and joints for low-energy buildings should be based on clear and precise rules resulting from a broad understanding of the internal and external air parameters of the analysed building; this understanding can be acquired by use of modern numerical tools for the analysis of the construction physics involved.

The selection of a system of material layers for external partitions and their joints should consider the following criteria: isolation (Tables 1 and 2); inter-layer surface condensation (Tables 1 and 2); acoustic isolation; fire protection, construction load bearing, and duration capacity. Some sets of material layers fulfil the requirements for thermal insulation ( $U_e \leq U_{e(max)}$ ); however, after analyses concerning requirements for humidity, acoustics, or fire protection, the location of heat insulation inside the partition is unacceptable.

It is necessary to restore the calculation of authoritative values of heat transfer coefficients  $U_e$  of singular partitions of a building, regarding two-dimensional fluxes (2D), and for partitions in contact with ground, with 3D fluxes. The lowering of the limit coefficients for heat transfer  $U_{max}$  without taking heat bridges into account, i.e. heat flows in 2D and 3D fields causes allowing higher heat loss through construction partitions and their joints. The definition of shape coefficients for the heat bridges analysed in this work confirms the need to consider additional heat losses resulting from the connection of a minimum of two partitions of the building (Table 1 and 2). Additionally, it is correct to define limit values of the linear heat transfer  $\Psi_{max}$  at level of 0.05-0.10 W/(m·K) depending on the specifics of the analysed joint.

It is also correct to use the PN-EN ISO 13788 standard [12] in the analysis of partitions and their joints regarding humidity. It is a conclusion, in regulation [3], the paragraph about allowing the application of the limit value of  $f_{Rsi}$  at a level of 0.72 should be removed. The author believes that there is a need to develop new design guidelines in regarding humidity, including the definition of critical values for  $f_{Rsi}$  and accounting for specific parameters of internal and external air.

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