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**Marcela HALÍŘOVÁ<sup>1</sup>****HEAT PASSAGE COEFFICIENT STANDARD OF PARTITION WALL****Abstract**

Engineering structures are subjected to many substantial requirements. Requirements laid on construction elements and structures are of civil engineering, technological, economic, aesthetic, and social characters, bearing in mind their larger context.

**Keywords**

Building constructions, separating walls, heat passage coefficient.

**Abstrakt**

Na stavební konstrukce klademe mnoho závažných nároků. Požadavky kladené na stavební prvky a konstrukce jsou stavebně technické, technologické, ekonomické, estetické i celospolečenské, a to ve všech svých širších souvislostech. Součinitel prostupu tepla je jedním z významných požadavků.

**Klíčová slova**

Stavební konstrukce, příčky, součinitel prostupu tepla.

**1 INTRODUCTION**

Inside non-bearing walls divide interiors of building units according to the manner of their utilization. Neighbouring rooms have specified environments. Sometimes, when partition walls separate rooms with various requirements for inside air temperature, it is necessary to ensure the respective temperature protection.

Meeting the thermal requirements ensures users' comfort and prevents occurrence of thermal faults and failures (condensation, mould growth, etc.).

The required standards are set down by the standard ČSN 73 0540-2 Thermal protection of buildings – Part 2- Requirements [2] and they follow the technical regulations, i.e. Act no. 183/2006, Coll., on town and country planning and building code, incl. the implementing decrees of this act [6], and so on.

**2 THERMAL CRITERIA**

In order to set down thermal requirements, ČSN 73 0540-2 Thermal protection of buildings, part 2 – Requirements [2] shall be followed. In rooms with an inside air relative humidity of  $\varphi_i \leq 60\%$ ,

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building structures of heated or air-conditioned buildings must have the heat-passage coefficient  $U$  [ $\text{W.m}^{-2}.\text{K}^{-1}$ ] which meets the condition of:

$$U \leq U_N \quad (1)$$

where:  $U...$  is the actual heat-passage coefficient value, in [ $\text{W.m}^{-2}.\text{K}^{-1}$ ]

$U_N ...$  is the required heat-passage coefficient value, in [ $\text{W.m}^{-2}.\text{K}^{-1}$ ]

During designing of buildings and their structural parts, it is necessary to create the inner environment as good as possible, bearing in mind low operational energy demands and appropriately a low environmental impact in local, regional and global context, for the whole life cycle of the construction. Correctly applied knowledge on thermal protection of buildings can significantly contribute to the creation of high-quality interiors of designed buildings. Even the inside walls are subjects to this assessment in terms of the arrangements and concordance of heating modes, thermal zones, etc. The inside walls can divide differently heated or partially heated rooms etc.

Table no.1: The required and recommended values of the heat-passage coefficient  $U_N$  for inside walls of heated buildings with the prevailing design temperature of  $\theta_{mi} = 20^\circ\text{C}$ , in accordance with ČSN 73 0540-2 Thermal protection of buildings, part 2 – Requirements [2].

Structure description	Heat-passage coefficient $U_N$ [ $\text{W.m}^{-2}.\text{K}^{-1}$ ]	
	Required values	Recommended values
Inside wall from a heated to a partially heated room	0,75	0,50
Inside wall between the rooms with the difference in temperatures less or equal to $5^\circ\text{C}$	2,70	1,80
Inside wall between the rooms with the difference in temperatures less or equal to $10^\circ\text{C}$	1,30	0,90

In order to calculate thermal parameters according to ČSN 73 0540-4 Thermal protection of buildings, part 4 – Calculation methods for designing and verification [4], both the properties of individual building materials and the inside interior environment of the particular rooms which can be divided by the assessed inner non-bearing walls, must be specified.

The design value quantities of building materials and the design values of inside environment parameters are governed by the provisions of ČSN 73 0540-3 Thermal protection of buildings, part 3 – Design value quantities [3]

Table no.2: The used design values of inside environment parameters according to ČSN 73 0540-3 Thermal protection of buildings, part 3 – Design value quantities [3] according to the table I.1.

No.	Room type	Design inside temperature in winter $\theta_i$ , [°C]	Design inside air temperature in winter $\theta_{ai}$ , [°C]	Design inside air relative humidity $\varphi_i$ , [%]
1	Dwelling rooms, offices, canteens, toilets, gym cloakrooms, waiting rooms at a doctor's office, sales rooms, hotel rooms, hotel lounges, auditoriums and theatre halls, station and airport waiting rooms	20	21	50
2	Bathrooms, lavatories, showers	24	25	70
3	Corridors, auxiliary heated rooms, halls, main stairs in hotels, restaurants and theatres, exhibition halls and closed railway lobbies	15	16	50
4	Heated staircases, auxiliary staircases of residential buildings and hotels	10	11	60

The thermal assessment is focused on inside non-bearing walls (partition walls) from fine piece building materials, whose selection is set down in accordance with ČSN EN 1996 -1-1 Design of masonry structures, part 1-1: General rules for structural engineering constructions – rules for reinforced and non-reinforced structures [7], and made of gypsum plasterboard, according to ČSN EN 520 Gypsum plasterboards – Definitions, requirements and test methods [8].

Table no.3: Design value quantities of building materials used for the assessment of non-bearing walls according to ČSN 73 0540-3 Thermal protection of buildings, part 3 – Design value quantities [3] according to the table A.1.

No.	Building materials	Dry volume weight $\rho_{o,u}$ , [ kg.m <sup>3</sup> ]	Heat conductivity coefficient $\lambda$ , W.m <sup>-1</sup> .K <sup>-1</sup> ]
1	Solid burnt brick	1800	0,86
2	Partition block Supertherm Pk CD 65	1250	0,54
3	Partition block Supertherm CD 6 DF	1000	0,52
4	Sand-lime brick	1800	0,86
5	Concrete partition block TP 7-B	1100	0,56
6	Concrete partition block TP 12-B		
7	Partition block Liapor PS 70	850	0,26
8	Partition block Liapor M 115	1200	0,32
9	Ytong – partition panel	550	0,17
10	Gypsum plasterboard (GKB)	750	0,22
11	Orsil – heat insulation (stone wool)	50	0,048
12	Common mortar – lime	1600	0,87
13	Mortar for thin joints Ytong	1850	0,97

### 3 THERMAL ASSESSMENT OF INSIDE NON-BEARING WALLS (PARTITIONS) STRUCTURES. CRITERIA

The calculation of structural thermal properties has been carried out by means of the software Teplo 2007[5].

Table no.4: The selected thermal assessing criterion – the heat-passage coefficient  $U$  – for the assessed material options.

Assessment criterion: $U$ [W.m <sup>-2</sup> .K <sup>-1</sup> ]	Material option marking	Material option
2.81	<b>A</b>	Partition wall from solid burnt bricks, thickness 160 mm
2.41	<b>B</b>	Partition wall from hollow burnt partition blocks Supertherm CD 6 DF, thickness 135 mm
2.81	<b>C</b>	Partition wall from sand-lime bricks, thickness 160 mm
2.46	<b>D</b>	Partition wall from concrete partition blocks TP 12-B, thickness 140 mm
1.82	<b>E</b>	Partition wall from partition blocks Liapor M 115, thickness 135 mm
1.31	<b>F</b>	Partition wall from partition blocks Ytong, thickness 105 mm
2.20	<b>G</b>	Grid plasterboard partition wall without inserted heat insulation, thickness 125 mm
0.60	<b>H</b>	Grid plasterboard partition wall with inserted heat insulation, thickness 60 mm; the total partition wall thickness 125 mm

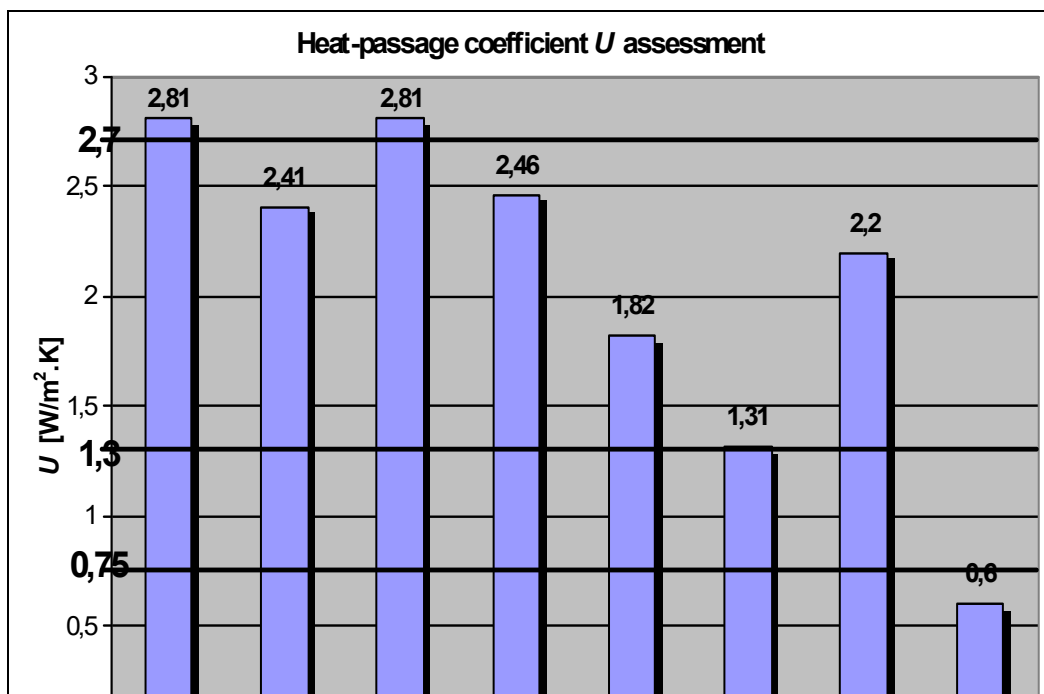


Chart. no.1 Graphical comparison of selected assessment criterion values – heat-passage coefficient  $U$  – of the assessed material options.

In chart no. 1,  $U$  heat-passage coefficient values required by the standard are shown; the recommended values, which are much stricter, have not been taken into account.

#### 4 ASSESSMENT

While assessing the thermal properties of buildings, various design inside air temperatures must be taken into account according to ČSN 73 0540 Thermal protection of buildings [1], [2], [3], and [4], and according to standard criteria, inside non-bearing walls must be responsibly designed.

The fact that inside non-bearing walls – partition walls – divide interiors of buildings into rooms with various inside air design temperatures must be taken into account.

##### 4.1 Assessment of Partition Walls for Inside Environment with the Difference in Temperatures over 10°C .

The required value for this environment is  $U_N=0.75 \text{ W m}^{-2}\text{K}^{-1}$  and the recommended value is  $U_N=0.50 \text{ W m}^{-2}\text{K}^{-1}$ . These standard requirements are met only by the material option H (grid plasterboard partition wall with inserted thermal insulation), but only for the required standard values.

##### 4.2 Assessment of the Partition Walls for the Inside Environment with the Difference in Temperatures to 10°C .

The required value for this environment is  $U_N=1.30 \text{ W m}^{-2}\text{K}^{-1}$  and the required value is  $U_N=0.90 \text{ W m}^{-2}\text{K}^{-1}$ . The requirements set down in this way are met only by the material option H (grid plasterboard partition wall with inserted thermal insulation) again, but this is the case when not only the required standard values, but also the recommended ones are met.

### 4.3 Assessment of Partition Walls for the Inside Environment with the Difference in Temperatures to 5°C .

For the inside environment with the difference in temperatures to 5°C, the material options B (the partition wall from hollow burnt partition blocks Supertherm), D (partition wall from concrete partition blocks), E (partition wall from Liapor partition blocks), F (partition wall from Ytong partition blocks), G and H (grid plasterboard partition wall with inserted heat insulation) meet the requirements.

### 4.4 Assessment of Partition Walls for the Inside Environment without Differences in Temperatures

If partition walls separate rooms with the same environment, there is no need to carry out thermal assessment. Despite of this, I would like to draw your attention to the fact that the partition wall A (partition wall from solid burnt bricks) and the partition wall C (partition wall from sand-lime bricks) can be designed only for separation of interiors with the same demands for the inside environment.

## 5 CONCLUSION

While assessing thermal properties of buildings, it is necessary to take various inside air design temperatures in accordance with ČSN 73 0540 Thermal protection of buildings [1], and in accordance with standard criteria, design not only cladding of building units, but also non-bearing walls into account. Even the inner non-bearing walls – partition walls – often divide the interior into rooms with various design temperatures of the inside environment. Only a responsible design can provide cosy inner environment without failures.

## REFERENCES

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