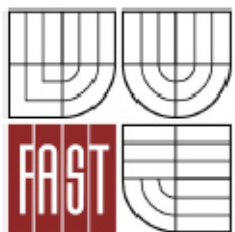




**VYSOKÉ UČENÍ TECHNICKÉ V BRNĚ**  
BRNO UNIVERSITY OF TECHNOLOGY



**FAKULTA STAVEBNÍ**  
**ÚSTAV POZEMNÍHO STAVITELSTVÍ**

FACULTY OF CIVIL ENGINEERING  
INSTITUTE OF BUILDING STRUCTURES

## **FOLDER NO. 6 - BUILDING PHYSICS**

### **EVALUATION FROM THERMAL AND ACOUSTIC RESISTANCE POINT OF VIEW**

**BAKALÁŘSKÁ PRÁCE**  
BACHELOR 'S THESIS

**AUTOR PRÁCE**  
AUTHOR

**VIKTOR GACH**

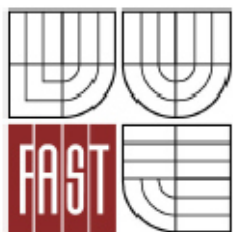
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**Ing. FRANTIŠEK VAJKAY, Ph.D.**

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## **CONTENT**

1. IDENTIFICATION DATA OF BUILDING .....	3
2. THE PURPOSE OF REVIEW .....	3
3. MATERIALS FOR ELABORATION .....	3
4. USED STANDARDS AND REGULATIONS .....	3
5. TECHNICAL DATA OF BUILDING .....	3
5.1 Climatic data of given locality, initial conditions in exterior and interior .....	3
5.2 Characteristics of individual constructions of envelope of the building - description and compositions.....	4
6. STANDARD REQUIREMENTS .....	4
6.1 Protection against noise.....	4
6.2 Heat transfer through the constructions and the envelope of building.....	5
7. INFORMATION ABOUT FULFILLING OF THE STANDARD REQUIREMENT .....	5
7.1 From the point of view of thermal protection ( according to standard ČSN 73 0540 ) ...	5
7.2 From the point of view of protection against noise ( according to the standard ČSN 73 0532).....	7
8. THE FINAL STATEMENT AND RECOMMENDED MEASURES .....	8
9. DATE, NAME, SIGNATURE .....	8

## **1. IDENTIFICATION DATA OF BUILDING**

The design documentation is carried out as a documentation for building works of family residence with design office in Vysoká nad Labem, cadastral area is Vysoká nad Labem. Number of plot 244/3. The new building of family house is intended for 4-5 people family.

The family residence with the design office is detached building without basement, with two floors. Foundations are design as concrete strips under the load bearing walls. The roof is designed as shed ( one sloped ) roof. The floor plan has rectangular shape of dimensions 10x 12 m. All compositions are solved in separate folder of this documentation.

## **2. THE PURPOSE OF REVIEW**

The purpose of the review is, at the basis of requirements of regulation no. 268/2009 Coll., about technical requirements for buildings in the version of regulation no. 20/2012, to prove if the individual constructions of building are complying requirements appointed in §16 of that regulation.

## **3. MATERIALS FOR ELABORATION**

These materials were used:

- the study of bachelor thesis including the text parts
- preparatory version of design documentation

## **4. USED STANDARDS AND REGULATIONS**

- regulation number 268/2009 Coll. about technical requirements for buildings in the version of regulation no. 20/2012
- ČSN 73 0540 - 1 Thermal protection of buildings - Part 1: Terminology
- ČSN 73 0540 - 2 Thermal protection of buildings - Part 2: Requirements
- ČSN 73 0540 - 3 Thermal protection of buildings - Part 3: Values for design and review
- ČSN 73 0540 - 4 Thermal protection of buildings - Part 4: Calculation methods
- ČSN 73 0532 Acoustics - Protection against noise in buildings and related acoustic properties of building materials - Requirements

## **5. TECHNICAL DATA OF BUILDING**

### **5.1 Climatic data of given locality, initial conditions in exterior and interior**

The intended locality is in the town Vysoká nad Labem in the altitude 262 meters above sea level . Design interior temperature in winter period is  $\theta_i = 20\text{ }^{\circ}\text{C}$ . Correcting additional value  $\Delta \theta_{a,i} = 0,6\text{ }^{\circ}\text{C}$  for heaters- the radiator type according to ČSN 73 0540 - 3.

The design value for exterior in the winter  $\theta_e = -15\text{ }^{\circ}\text{C}$ . As the design exterior temperature for soil the value  $+5\text{ }^{\circ}\text{C}$  was taken.

## 5.2 Characteristics of individual constructions of envelope of the building - description and compositions

To constructions of envelope of building are included:

- floor in the contact with soil - F1
- floor in the contact with soil - F2
- peripheral wall W1
- ceiling to the exterior R1

The individual compositions are described detail in the Folder - list of compositions of constructions

## 6. STANDARD REQUIREMENTS

### 6.1 Protection against noise

Evaluation of noise protective properties of constructions accord. to standard ČSN 73 0532.

#### Internal constructions

*Tab. 1 Requirements for noise protection between rooms in buildings*

Protected space (receiving )					
Item	Noisy space (emitting )	Requirements for sound insulation			
		Ceilings		Walls	Doors
		$R'_{w,D_{nT,w}}$ [dB]	$L'_{n,w},L'_{nT,w},$ [dB]	$R'_{w,D_{nT,w}},$ [dB]	$R_w,$ [dB]
A. Buildings for living, family houses- at least one room of apartment					
1.	All other rooms of the same apartment	42	68	42	27

## Peripheral structures

Tab.2 Requirements for noise protection of peripheral walls of buildings

Required air born noise resistance $R'_w$ [dB]							
Equivalent level of acoustic pressure 2 m at the front of the facade							
Night: 22:00- 6:00	40	41-45	46-50	51-55	56-60	61-65	66-70
Day: 6:00- 22:00	50	51-55	56-60	61-65	66-70	71-75	76-80
2. Rooms for living, rooms in accommodation facilities							
	30	30	30	33	38	43	48

## 6.2 Heat transfer through the constructions and the envelope of building

Requirement for the critical factor, the value is  $f_{Rsi,cr,stand} = 0,749$ .

The required thermal heat transfer coefficient  $U_i$  is given according to the type of construction and its locality in the building according to standard ČSN 73 0540 - 2.

Average heat transfer coefficient  $U$  is calculated by the means of reference building with required values of the standard ČSN 73 0540 - 2.

## 7. INFORMATION ABOUT FULFILLING OF THE STANDARD REQUIREMENT

### 7.1 From the point of view of thermal protection ( according to standard ČSN 73 0540 )

#### 7.1.1 The minimal surface temperature $\theta_{si,min}$

NO.	DESCRIPTION OF CONSTRUCTION	CALCULATED CRITICAL FACTOR $f_{Rsi}[-]$	CALCULATED CRITICAL FACTOR $f_{Rsi,cr,stand} [-]$	EVALUATION
R1	CEILING TO UNHEATED VENTILATED ATTIC	0,985	0,749	COMPLY

W1	PERIPHERAL WALL	0,978	0,749	COMPLY
F1	FLOOR OF HEATED SPACE IN CONTACT WITH SOIL	0,959	0,749	COMPLY
F2	FLOOR OF HEATED SPACE IN CONTACT WITH SOIL	0,959	0,749	COMPLY

#### 7.1.1 The minimal surface temperature in places of geometrical thermal bridges $\theta_{si,min}$

NO.	DESCRIPTION OF CONSTRUCTION	CALCULATED CRITICAL FACTOR $f_{Rsi}[-]$	CALCULATED CRITICAL FACTOR $f_{Rsi,cr,stand}[-]$	EVALUATION
R1-W1	CEILING TO UNHEATED VENTILATED ATTIC - PERIPHERAL WALL	0,872	0,749	COMPLY
W1-F1	PERIPHERAL WALL - FLOOR WITH CONTACT WITH SOIL	0,921	0,749	COMPLY
W1-W1	CORNER BETWEEN PERIPHERAL WALLS	0,875	0,749	COMPLY

### 7.1.2 Thermal heat transfer coefficient U

NO.	DESCRIPTION OF CONSTRUCTION	CALCULATED U [W/m <sup>2</sup> .K]	REQUIRED U <sub>N,20</sub> [W/m <sup>2</sup> .K]	RECOMMENDED U <sub>rec,20</sub> [W/m <sup>2</sup> .K]	EVALUATION
R1	CEILING TO UNHEATED VENTILATED ATTIC	0,15	0,30	0,20	COMPLY
W1	PERIPHERAL WALL	0,18	0,30	0,25	COMPLY
F1	FLOOR OF HEATED SPACE IN CONTACT WITH SOIL	0,24	0,45	0,30	COMPLY
F2	FLOOR OF HEATED SPACE IN CONTACT WITH SOIL	0,24	0,45	0,30	COMPLY

NOTE: Required and recommended values are taken from standard ČSN 730540 - 2: 2011

### 7.2 From the point of view of protection against noise ( according to the standard ČSN 73 0532)

No	Evaluated construction	Calculated value	Required value	Evaluation
W 01	Peripheral windows	36	30	COMPLY
F3,F4	Load bearing slab, 250 mm RC+ 50 of EPS	105	68	COMPLY

Note:

Due to the fact that requirements for acoustics are very low in intended area (< 30 dB ) and regarding the thicknesses of thermal insulation of peripheral constructions (see apex 3 - compositions ), all the other peripheral constructions are fulfilling this requirement.



## **8. THE FINAL STATEMENT AND RECOMMENDED MEASURES**

All the construction of envelope of the building are fulfilling requirements for the critical factor (  $f_{Rsi} < f_{Rsi,cr,stand}$  ) and simultaneously also comply requirement for the thermal heat transfer (  $U_i < U_{N,20}$  ). The critical places as the geometrical thermal bridges also complied the value of critical factor. See the point apex 2

## **9. DATE, NAME, SIGNATURE**

**20.5. 2015**

**VIKTOR GACH**