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**FACULTY OF CIVIL ENGINEERING**

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**INSTITUTE OF BUILDING STRUCTURES**

ÚSTAV POZEMNÍHO STAVITELSTVÍ

**HOUSE WITH TATTOO STUDIO**

RODINNÝ DOM S TETOVAČÍM ŠTÚDIOM

## **D.1.3 | TECHNICAL REPORT OF FIRE PROTECTION**

**BACHELOR'S THESIS**

BAKALÁRSKA PRÁCA

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**BRNO 2025**

# **D 1.3 FIRE SAFETY OF BUILDING SOLUTION**

## **TECHNICAL REPORT OF FIRE SAFETY**

The content and scope of the fire safety solution corresponds to the statutory regulation No. 246/2001 Coll., on fire prevention, issued to Act No. 133/1985 Coll., on fire protection.

**Name of the building:** **FAMILY HOUSE WITH TATTOO STUDIO**

**Location:** Krokočín

**Cadastral area, number of plots:** Krokočín 730/2, 728/4

**Project owner:** -

**Subject:** BHA009 – Fire safety of buildings

**Student:** Adela Chovanová

**Teacher:** Ing. Marie Rusinová

**Date:** Brno, 2025

**1 General information about the construction**

# 1 GENERAL INFORMATION ABOUT THE CONSTRUCTION

## 1.1 Building identification data

Construction name:	FAMILY HOUSE WITH TATTOO STUDIO
Location:	Krokočín
Cadastral location:	Krokočín [674826], 730/2, 728/4
Purpose & character of construction:	new building, permanent construction
Grade of the project:	Project documentation for building permit

## 1.2 Architectural and urban solution of the building

The subject of the documentation is fire safety solution of newly built family house in town Krokočín, in cadastral area Krokočín [674826] on parcels 730/2 and 728/4, in the built-up area of town.

The house is detached and includes a partial basement, two above-ground floors, and a garage for two cars. All roof surfaces are flat green roofs. The tattoo studio is a separate unit that shares one wall with the residential part of the house. It has its own entrance and dedicated parking for clients. The tattoo artist—who is also the homeowner—can access the studio directly from the house, ensuring both convenience and privacy for the family. The studio is designed with barrier-free access and complies with applicable standards for premises providing personal care services.

## 1.3 Layout solution of the building

The building is divided into 2 functionally separate units, family house and tattoo studio. This is a new construction of a two above ground floor with basement, designed as a detached building. The layout is tailored to meet the housing needs of a 4–5-member family. The building is covered with a flat green roof.

The main entrance is located on the front side of the building, with additional access from a terrace at the side. The internal layout separates the daytime living area and the quiet nighttime area as well as the business area through wall.

Entry is through a vestibule, leading into a hallway that serves as the central communication space of the house facing stair which goes to basement. And through this hall is possible to walk to studio. From the hallway, one can access the toilet, and a combined kitchen and living room area, which includes a pantry adjacent to the kitchen.

From living room which is open- without ceiling, goes 2nd stair to nighttime zone.

The nighttime zone on the second floor, corridor leads to two bedrooms, guestroom, and a bathroom. Each habitable room is equipped with its own built-in closet. The main room has its own walk-in closet and bathroom.

The attic space is accessible via a foldable staircase on second floor.

## 1.4 Structural solution of the building

The building is standing on strip foundation and foundation slab from plain concrete. Load-bearing system is designed as mixed from masonry blocks.

Peripheral walls in 1.PP are made of formwork concrete blocks, LxWxH

500x300x250mm, filled with concrete. They are insulated by XPS 300 L, thick 140 mm.

Peripheral walls in 1.NP and 2.NP are bricked, made of ceramic blocks

POROTHERM 30 PROFI, th. 300mm. Thermal insulation is made of EPS Greywall thick 140 mm, covered by thin-layered plaster. Interior loadbearing wall are also made of ceramic blocks POROTHERM 24, th. 240mm. Non-loadbearing partitions are made of ceramic block POROTHERM 11,5 PROFI thick 115 mm.

Ceiling structures are made of prefabricated concrete ceiling panels (BEST) placed on loadbearing walls and connected by concrete. Below beams on load-bearing walls are made reinforced concrete rings.

The roof structure is designed as a flat, green, simple intensive roof made of concrete BEST ceiling panels. The insulation is EPS with lowest thickness of 140 mm. Waterproofing is made of SBS asphalt felts.

Fillings of exterior windows and doors are wooden aluminium with triple glazing. Interior doors are mostly wooden placed in wooden frames.

## 2 Fire technical review

### 2.1. Sources used for creation of Fire safety Report

#### Technical sources of construction:

- Project documentation for building permit

#### Laws and other regulations:

- Law No. 133/1985 CL, fire protection law in amendments
- Law No. 320/2015 CL., about the FRC in the Czech Republic
- Regulation No. 23/2008 CL, technical requirements of fire safety of buildings in amendment No. 268/2011 CL., about technical conditions of fire safety of buildings – Regulation about fire prevention
- Regulation No. 146/2024 CL, determines requirements fire safety and performance of state fire supervision – regulation about fire prevention (about the determination of the conditions of fire safety and the performance of state fire supervision)
- Reg. No. 131/20246 CL about building documentation – fire safety solution of building

#### Standards ČSN including current changes on the given processing date:

- ČSN 73 0810/2016 + Opr. 1/03.2020 – FPB – General requirements
- ČSN 73 0802 ed. 2:2023 – FPB – Non-industrial buildings
- ČSN 73 0818/ 2002, Z1 K.č. 65763 – FPB – Person surface rate in building
- ČSN 73 0872/1996 – FPB – Protection of buildings to extension of fire by air distributing equipment (standard for ventilation)
- ČSN 73 0873/2003 – FPB – Equipment for fire-water supply
- ČSN 73 0833, ed. 2: 5.2007 – FPB – Fire resistance of engineering structures
- ČSN 73 0848 – Electrical equipment and installation
- ČSN 06 1008/ 1997 – Fire safety of thermal equipment
- ČSN 01 3495/1997 – Construction drawings in fire safety of buildings
- ČSN EN 12845+A1 – Fixed fire extinguishing equipment – Sprinkler equipment – design, installation and maintenance

**Other sources:**

- Zoufal and coll.: Values of structure's fire resistance according to the EC
- Beneš, Sedláková, Rusinová, Benešová, Švecová: Požární bezpečnost staveb – Czech textbook on intranet, also in printed form, 2021
- technical data sheets

**2.2. Fire technical characteristics**

Building will be solved according to the Regulation No.23/2008 comply ČSN 73 0810 – General requirements and other related standards, such as ČSN 73 0802 – Non-industrial buildings. The family house is classified as for dwelling and lodging ČSN 730833, building group OB1- might have business place if: - area to 50 m<sup>2</sup> ... SATISFIED

- fire risk  $p < 50 \text{ kg.m}^{-2}$ ... SATISFIED

building of group OB1- for dwelling: - 1 underground floor... SATISFIED (one UGF)

- max 3 above ground floor... SATISFIED (two AGF)
- max utility area of all floors 600 m<sup>2</sup> ... SATISFIED (313,48 m<sup>2</sup>)

**Fire technical characteristics of the building**

Building:	<b>2 AGF</b>	two above ground floors
	<b>1 PUGF</b>	one partial underground floor

Vertical fire barriers and load bearing structures:

<b>DP1</b>	peripheral brick load-bearing wall 300 mm, insulated
<b>DP1</b>	peripheral formwork block 300 mm, insulated
<b>DP1</b>	interior load-bearing brick wall 240 mm
<b>DP1</b>	partition wall 115 mm

Horizontal fire barriers and load bearing structures:

<b>DP1</b>	concrete ceiling - BEST slab th. 250 mm
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Structural system of the building: **non-combustible structural system**

Vertical and horizontal fire barriers and load bearing structures are from the structures part of

DP1- non-combustible structural system

Fire high:	<b><math>h = 3,125 \text{ m}</math></b>
Headroom:	<b><math>h_s = 2,390 \text{ m}</math> (1.PP)</b>
	<b><math>h_s = 2,875 \text{ m}</math> (1.NP)</b>
	<b><math>h_s = 2,820 \text{ m}</math> (2.NP)</b>

**Note - contact thermal insulation:**

Building has got contact insulation, insulating layer is proposed from EPS of the thickness 140 mm

Fire height of building is 3,125 m, i.e. less than 12 m, the following FSB conditions will be met:

- Euroclass of insulation must be no more than E ,
- contact insulation as a unit must have Euroclass B,

- surface of the contact insulating system shall not spread the flames on its surface, it means index of the spread of fire is  $i_s = 0 \text{ mm} \cdot \text{min}^{-1}$ ,
- it must to be certificated with the label ETICS, external thermal insulation composite system

Such a contact insulation system hasn't influence on type of structure part of the external wall, it stays structure part DP1.

The XPS insulation does not have, in accordance with Art. 3.1.3, ČSN 73 0810, influence on the type of structural part of the perimeter wall DP1, i.e. the structural system is possible classify as DP1.; for this reason, the structural system can be classified as **non-combustible**.

Structure system stays non-combustible regardless insulation.

## 2.3 Division of the object into fire compartments

### FC P01.1/N2 – II: Residential part with business part and double garage

OB1- according to Czech standard ČSN 730833/2010 – Family house and family recreational

building, it must satisfy these requirements:

- individual garage for a maximum of 3 vehicles of group 1 according to I.2.2a), I.2.3.1a), or I.2.3.1b1), Annex I, ČSN 730804
- max. 3 living units
- max. 1 underground floor
- max. 3 aboveground floor
- max. the total area of all floors is 600 m<sup>2</sup>

SATISFIES – 1 living unit, 1 underground floor, 2 above ground floor, total area 313,48 m<sup>2</sup>

In this case, the business part and the residential part can both form one fire compartment because it satisfies the requirements that these two parts have to be spatially related and the area of the business part can not be bigger than 50 m<sup>2</sup>. The business part of this house has 39,08 m<sup>2</sup> and with residential part has 2 mutual walls.

## 2.4. Assessment of FC, setting of theirs fire risk, review of area of the FC

### FC N01.1/N2 – I : Residential part with double garage and business part

#### Fire risk:

$$S = 313,48 \text{ m}^2$$

$$p_v = 40 \text{ kg} \cdot \text{m}^{-2} \text{ (table value – acc. ČSN 730802)}$$

$$p_s = 10 \text{ kg} \cdot \text{m}^{-2} > 5 \text{ kg} \cdot \text{m}^{-2}$$

$$\text{correction: } p_v' = (10 - 5) \cdot 1,15 = 5 \cdot 1,15 = 5,75 \text{ kg} \cdot \text{m}^{-2}$$

$$p_v = 40 + 5,75 = \mathbf{45,75 \text{ kg} \cdot \text{m}^{-2}}$$

#### Degree of fire risk:

$$h = 3,125 \text{ m}$$

$$p_v = 45,75 \text{ kg} \cdot \text{m}^{-2}$$

Structural system = non-combustible + 2AGF

Fire safety level → SPB II

## 2.5. Setting the required value of structures fire resistant with the assessment of the limited states, comparison with the actual fire resistance of the proposed structures

FC N01.1/N2 –I : Residential part with double garage and business part

		FIRE RESISTANCE REQUIRED			FIRE RESISTANCE	
ITEM	TYPE OF STRUCTURE	1 PP	1 NP	2 NP	REAL	ASSESSMENT
3.1	PERIPHERAL WALL with load bearing function	REW 30 DP1	REW 30	REW 15	wall blocks, th. 300 mm <b>REI 180 DP1</b>	satisfied
3.1	INTERNAL WALL with load- bearing function	R 30 DP1	R 30	R 15	wall blocks, th. 240 mm <b>REI 180 DP1</b>	satisfied
4.	LOAD BEARING STRUCTURE OF ROOF	-	-	REI 15	REI 30	satisfied
5.	Ceiling as LBS in FC	RE 30 DP1	RE 30	-	concrete beams with blocks <b>RE 120 DP1</b>	satisfied
8.	INTERNAL WALL without load-bearing function (underground)	-	-	-	wall from blocks, th. 115 mm <b>EI 120 DP1</b>	satisfied
8.	INTERNAL WALL with load- bearing function	-	-	-	wall from blocks, th. 115 mm <b>EI 120 DP1</b>	satisfied

### Notes:

Fire strips doesn't have to build, if the fire high of building is less than 12 m, her 3,0m .

Contact insulating system ETICS is on the external wall in the thickness 140 mm. Thermal insulation is on the building with fire height to 12 m, here 3,125. Insulation – EPS has the Euroclass E, contact insulation like the unit had classified Euroclass B,  $i_s = 0 \text{ mm.min}^{-1}$ .

If building structures meet described requirements, it will be consistent with the FSB's view.

Staircase without req.,  $\Leftrightarrow E = 4.1,5 = 6 < 40$

## 2.6. Escape ways

The building contains an unprotected escape route.

Requirements according to ČSN 73 0833:

- Width of the unprotected escape route (NÚC): min 900 mm
- Nominal width of doors on the NÚC: min 800 mm
- Length of the NÚC: Not assessed

**Evaluation** → **Satisfied**

Persons with reduced mobility are in the building only occasionally.

## 2.7. Standoff distances

$p_v = 45,75 \text{ kg} \cdot \text{m}^{-2}$ ; structural system non-combustible

FRONT PART (1NP- 1<sup>st</sup> part)

$$S_{po} = (2 \times 1,5) + (2 \times 0,75 \times 0,75) = 4,125 \text{ m}^2$$

$$S_p = (10,45 \times 2,875) = 30,04375 \text{ m}^2$$

$$p_o = S_{po} / S_p = 4,125 / 30,04375 = 0,137303199 \Rightarrow 13\%$$

d= 3,3 m

FRONT PART (1NP- 2<sup>st</sup> part)

$$S_{po} = (5,5 \times 2,2) = 12,1 \text{ m}^2$$

$$S_p = (6,80 \times 2,875) = 18,938 \text{ m}^2$$

$$p_o = S_{po} / S_p = 12,1 / 18,938 = 0,638927025 \Rightarrow 64\%$$

d= 5,0 m

RIGHT PART (1NP)

$$S_{po} = (3 \times 1,5 \times 1) + (1,5 \times 2,1) = 7,65 \text{ m}^2$$

$$S_p = (12,5 \times 2,875) = 35,9375 \text{ m}^2$$

$$p_o = S_{po} / S_p = 7,65 / 35,9375 = 0,212869565 \Rightarrow 22\%$$

d= 3,3m

BACK PART (1NP)

$$S_{po} = (1,5 \times 1) + (2 \times 1,5) = 4,5 \text{ m}^2$$

$$S_p = (11,25 \times 2,875) = 32,34375 \text{ m}^2$$

$$p_o = S_{po} / S_p = 4,5 / 32,34375 = 0,139130435 \Rightarrow 14\%$$

d= 3,3m

LEFT PART (1NP)

$$S_{po} = (1,5 \times 1) + (2,2 \times 3) = 8,1 \text{ m}^2$$

$$S_p = (9,5 \times 2,875) = 27,3125 \text{ m}^2$$

$$p_o = S_{po} / S_p = 8,1 / 27,3125 = 0,29656751 \Rightarrow 30\%$$

d= 3,3m

FRONT PART (2NP)

$$S_{po} = (1 \times 1,5) + (0,75 \times 0,75) = 2,0625 \text{ m}^2$$

$$S_p = (10,15 \times 2,82) = 28,623 \text{ m}^2$$

$$p_o = S_{po} / S_p = 2,0625 / 28,623 = 0,072057436 \Rightarrow 7\%$$

d= 3,3 m

RIGHT PART (2NP- 1<sup>st</sup> part)

$$S_{po} = (1 \times 2,2) = 2,2 \text{ m}^2$$

$$S_p = (1,75 \times 2,82) = 4,935 \text{ m}^2$$

$$p_o = S_{po} / S_p = 2,2 / 4,935 = 0,445795339 \Rightarrow 45\%$$

d= 3,4 m

RIGHT PART (2NP- 2<sup>nd</sup> part))



$S_{po} = (2 \times 1,5 \times 1) = 3,0 \text{ m}^2$   
 $S_p = (6,25 \times 2,82) = 17,625 \text{ m}^2$   
 $p_o = S_{po} / S_p = 3,0 / 17,625 = 0,170212766 \Rightarrow 18\%$

d= 3,1 m

BACK PART (2NP- 1<sup>st</sup> part)

$S_{po} = (3 \times 1,5 \times 2) = 9,0 \text{ m}^2$   
 $S_p = (11,25 \times 2,82) = 31,725 \text{ m}^2$   
 $p_o = S_{po} / S_p = 9,0 / 31,725 = 0,283687943 \Rightarrow 29\%$

d= 3,3m

BACK PART (2NP- 2<sup>st</sup> part)

$S_{po} = (2 \times 2,5) = 5,0 \text{ m}^2$   
 $S_p = (11,25 \times 2,82) = 16,92 \text{ m}^2$   
 $p_o = S_{po} / S_p = 5,0 / 16,92 = 0,295508274 \Rightarrow 30\%$

d= 3,3m

LEFT PART (2NP)

$S_{po} = (2 \times 2,5) + (1,5 \times 1) = 6,5 \text{ m}^2$   
 $S_p = (9,5 \times 2,82) = 26,79 \text{ m}^2$   
 $p_o = S_{po} / S_p = 6,5 / 26,79 = 0,242627846 \Rightarrow 25\%$

d= 3,3m

#### Conclusion - radiation:

Fire dangerous area from assessed fire opened areas achieve on own land of owner or to the public space, in there aren't other buildings. Assessed building isn't in fire dangerous area of other buildings. It will be complying with FSB point of view.

#### Fall of burning parts of structures:

There is no structural part DP3 on the building envelope, the distance from the impact of burning parts is not addressed.

## **2.8. Technical and technological equipment**

### **2.8.1. Pipelines pervade**

All pipelines from the house are connected to the main pipeline in the access road ( with dimension EP90).

### **2.8.2. Heating**

Heating is provided by *Acond PRO-N air-to-water inverter heat pump* with an internal hydrobox (5kW). This heat pump is located in the technical room in the basement. Because the power of the heat pump is not bigger than 70 kW there is no need to make a separate fire compartment for the technical room. Heat is transferred to the house through floor heating.

### **2.8.3. Ventilation**

Ventilation in this building is solved by natural ventilation through windows. Ventilation in the kitchen will be provided via a cooker hood with a carbon filter. < 40000 m2 which is satisfied.

### **2.8.4. Technical requirements to the technical equipment**

Technical equipment has to obey their legal and normative prescriptions.

## 2.9. Equipment for fire fighting

### 2.9.1. Access road and boarding area

Building is on the road with the width 5 m , it is more than 3 m as the minimum of width of access road.

Main entrance to the building is from the road in distance 10 m < 50 m, the longest distance of access road from the assessed building.

It will be complying with FSB point of view.

Fire high of building is less than 12 m, boarding area for fire machinery isn't required.

### 2.9.2. Fire water supply

A. Outdoor offtake place

Requirement of this according to ČSN 730873, tab. 1 a 2: = OB1

Types of offtake place	Distance from the building [m]	DN [mm]	v [m.s <sup>-1</sup> ]	Q [l.s <sup>-1</sup> ]
outdoor hydrant	150/300	100	4	7,5

In the distance of 210 m from the building is the outdoor hydrant on the pipeline DN100, which satisfies requirements.

#### B. Indoor offtake place

According to paragraph 4.4 ČSN 730873, indoor offtake places are not needed for the building of group OB1. The total number of escaping persons is 6, which means that condition  $E=6<20$  for building category OB1 is satisfied.

### 2.9.3. Proposal of the number of fire-extinguishers

In this building, there will be one extinguisher in the entrance hall to the residential part of the building, one in the entrance hall to the business part of the building. The total number of extinguishers in the whole building is 3 which satisfied the requirements of ČSN 730833 that in the family house, there has to be at least one fire extinguisher. The extinguishers in the entrance hall will have a capacity of 34A and are powder-based with the weight of the extinguishing agent 6 kg. One in garage 183A. They will be mounted on the wall at a height of 1,5 m from the floor.

### 2.9.4. Supply of electricity

The electricity will be solved according to the Czech technical standard ČSN 730848. According to Article 12.9.1. ČSN 73 0802 there are no requirements for electric devices which are not used for fire protection. Distances of electrical devices from combustible materials are determined according to No. 23/2008 Coll.

### 2.9.5. Fire safety equipment

In the building, there will be three autonomous and signalling smoke detectors. One of them will be located in the residential part of a building in hall and in the second floor in the hall. The business part of the building will have one more located in the studio. This division satisfied the requirements of Decree no.23/2008 Coll. According to which buildings with areas bigger than 150m<sup>2</sup> there should be more than one autonomous and signalling smoke detectors

## 4. Safety labels

The building will be marked according to the ČSN ISO 3864-1, ČSN 01 8013, NV 11/2002 Sb.:

- direction of escape
- fire-extinguishers
- indoor offtake places
- outdoor offtake places
- switchboard of electricity
- main water shut
- pipeline pervade seals

## 5. Conclusion

The design project for the building permit „Family house with tattoo studio “deals with the building with two above-ground floors and a basement, divided into two parts. The residential part of the building with area of 274,4 m<sup>2</sup> and the business part with area of 39,08 m<sup>2</sup>. There is one fire compartment **FC P01.1/N2 – II** the area of 313,48 m<sup>2</sup>, which is also the total area of the building. Fire resistance of the structures fulfils the requirements. Escape ways are sufficient and the fire danger area does not endanger surrounding buildings. The whole building is designed according to ČSN 730802 and meets all desired requirements.

## 6. APPENDIXES:

- D1.4.02 - Site plan
- D1.4.03 - Basement floor plan
- D1.4.04 - 1<sup>st</sup> floor plan
- D1.4.05 - 2<sup>nd</sup> floor plan