CZECH TECHNICAL UNIVERSITY IN PRAGUE

FACULTY OF CIVIL ENGINEERING

DEPARTMENT OF BUILDING STRUCTURES

TECHNICAL REPORT

FIRE SAFETY

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CONTENTS

1. GENERAL INFORMATION

Residential building in Letnany in Prague is designed. The building is located in the outer border area of Prague in a newly developed residential area. The residential building is designed economically and utilizing modern ways of design and construction. The project emphasizes on good quality. The project utilized orthogonal architecture to blend in with the surrounding. Czech and Euro codes were used during design.

The residential building has 1 underground floor and 5 upper ground floors. The size of the building is different in underground level and in upper floors. Underground level is 47,0 m long and 20,6 m. Height above the ground is 17.05 m. Height under the ground is 2,02 m. Total height is 19,07 m. The underground floor is equipped with a garage, technical room, washing machine room, drying room, rooms for storages. 16 parking spaces are located outside the building. Drive in to the building is from south. There are 10 apartments first level, 11 apartments in second till fourth level and 6 floor in fifth floor. Apartment is of different dispositions from 1+kc to 4+kc. The building consists of 49 apartment units in total. All the apartments are properly lighted. Underground level is bigger than upper floor, there is jump in the slab in the structural system of underground level to achieve the difference in section of first level terraces and apartments. Another recces of building shape is in the fifth level when the fifth level is smaller than others. The roof areas of fourth floor is used as terraces for fifth floor apartments. Building is also equipped with balconies. Entrance to the garage is from the level of outside street. There is no ramp. Underground level floor is in the same height as surrounding street level. Entrance to the building is from the intermediate level of staircase. It is one staircase wing downstairs to the garage and one staircase wing up to the apartment areas. In the entrance area there is common residential building equipment such as cleaning room and staller room. Underground floor is used mainly for parking, there is also storage areas and technical room. The building is not designed specifically for use of disabled people. Disabled people will be in the building not permanently, only occasionally.

The fire high of the building is 12,0 m. Load bearing construction and fire separation walls are all of type DP1. Doors between FC and NPEW are DP3, doors between NPEW and PEW are also DP3. They are made from reinforced concrete or masonry. Windows and balcony doors are from plastic. Entrance door are from aluminium. Garage entry gate is automatic. The garage is not suitable for gas-combustible cars. It is incombustible construction system.

2. FIRE COMPARTMENTS, FIRE RISK AND FIRE RESISTANT GRADE

All apartments create each fire compartment. Other fire compartment is protected escape way, unprotected escape way (corridor hall between apartment and PEW), elevator shaft, shaft for ventilation from underground, shaft for heating, storage areas in underground level, technical room, stroller room, cleaning room. In the garage, no flammable liquid material (oil, gasoline) is stored.

2.1. FIRE RISK AND FIRE RESISTANT GRADE

For fire compartment as apartent unit, with coefficient c = 1,0 (influence of fire safety apliences), fire load p_v = **45 kg.m^{-2}**, **III. FRG**

Stroller room fire load p_v = **45 kg.m^{-2}**, **II. FRG**

Storage rooms p_v = **45 kg.m^{-2}**, c = 1,0, **III. FRG**

Cleaning room is an are without fire risk

NPEW p_v = 7,5 kg.m^{-2}, **I. FRG**

PEW A, **II. FRG**

Elevator shaft, **II. FRG**

Ventilation shaft, heating shaft, **I. FRG**

Electricity shaft, **II. FRG**

3. **FIRE RESISTANCE**

FIRE, PERIMETER AND INNER LOAD BEARING WALLS

PERIMETER WALL POROTHERM 24 P+D REW 180 DP1 > REW 45 DP1

PERIMETER WALL POROTHERM 19 AKU REW 180 DP1 180 DP1 > REW 45 DP1

PERIMETER WALLS, REINFORCED CONCRETE THICKNESS: 240, 220 A 200 MM, CONCRETE COVER 25 MM 90 DP1 > 60 DP1

INNER WALLS – BETWEEN APARTMENTS POROTHERM 25 AKU 180 DP1 > REI 45 DP1

INNER WALLS, REINFORCED CONCRETE, CONCRETE COVER 25 MM 90 DP1 > 60 DP1

FIRE PARTITIONS, POROTHERM 11,5 120 DP1 > EI 60 DP1

OUTER THERMAL INSULATION OF PERIMETER WALLS (ETICS) EPS, MAXIMUMTHICKNESS 180 MM, REACTION TO FIRE CLASS E. CERTIFIED ETICS SYSTEMS, REACTION TO FIRE CLASS B, IS=0, Q = M . H = 3,6 . 39 = 140,4 $MJ.KG^{-1}$ < 150 $MJ.KG^{-1}$, FIRE CLOSED AREA

REINFORCED CONCRETE WALLS IN PEW ARE EQUIPPED WITH GYPSUMBOARD FOREWALLS WITH THICKNESS 12,5 MM ON ALUMINUM CD PROFILES WITH 40 MM OF MINERAL WOOL INSULATION. – DP1

Fire ceilings ad underceilings

REINFORCED CONCRET SLABS WITH REINFORCEMENT COVER OF 25 MM REI 60 DP1 = REI 60 DP1

GYPSUM BOARD UNDERCEILINGS IN STAIRCASE AREAS AND CORRIDORS COMPOSED OF FIRE BOARD AND MINERAL WOOL INSULTION

Roof

Reinforced concret slabs with reinforcement cover of 25 mm REI 60 DP1 > REI 30

4. **PROTECTED ESCAPE WAYS**

PEW description and number of people:

Corridors between PEW and apartments is non-protected escape way

Garage is an open space, from where you can reach all PEW, to escape from garage the entrance gate can be also used.

Ventilation of PEW A is forced with 10 times air volume exchange. Fresh air delivery will be secured for minimum 10 min. PEW doors will be equipped with automatic closing and doors to garage will be also smokeproofed

Fire openings reacting on signal from EPS

Maximum number of apartments connected to PEW in each floor is 11.

Apartments doesn't have floor area bigger than 250 m2, the escape way therefore starts at the entrance door to the apartment.

From the fire compartment of garage it is enough to have only one PEW, there is not more than 60 parking places.

PEW and NPEW are with minimum 1,75 m wide. The staircase wings are minimum 1,1 m wide ant the doors on the way are minimum 0,9 m wide. Escape line is therefore 1,5 m wide.

All the entrance doors are designed suitable for disable people and the elevator has a doors on both side that people can go to the elevator directly from intermediate landing of the main entrance door.

Number of evacuated people in building is calculated from 20 m2 for 1 evacuated person

	Living area [m^2]	Nr of people. E
1.NP	482,0	31
2.NP	556,8	33
3.NP	556,8	33
4.NP	556,8	33
5.NP	412,3	21
Σ E		**151 persons**

	1NP	
	Living area [m^2]	Nr of people. E
FC1.01	83	5
FC1.02	51	3
FC1.03	78	4
FC1.04	55	3
FC1.05	28	2
FC1.06	47	3
FC1.07	56	3
FC1.08	54	3
FC1.09	37	2
FC1.10	43	3
Σ E		**31 persons**

In the garage, the number of evacuated persons is calculated from number of parking places multiplied with coefficient 0.5

Number of parking places = 22, 22*0.5 = 11 persons

Complience of the PEW

Length of Escape way

PEW A – maximum length 50 m < maximum allowable length 120 m

NPEW from apartment – worst cases 1NP – 5NP – maximum length = 22 m, maximum allowable with c = 1,0 = 20 m – not suitable. There is going to be fire signaling appliance in the NPEW and will be equipped with siren signaling. Therefore 20 . (1 / 0,7) = 28,5 m > 22 m.

Critical point: PEW type A, II. SPB, first floor stairway, width 1200 mm, 129 evacuating persons, synchronized evacuation.

U = E*s/K = 162*1/120 = 1,35 = 2, required width = 2*0,55 = 1,1 m < real width =1,2 m **OK**

Equipment of escape ways

Doors in the escape ways will be opening to the direction of the escape except apartment doors and main entrance doors. Selfclosing doors will be installed on all the doors from NPEW and other FC to the PEW. Staircase will be equipped with rails.

PEW and NPEW are equipped witn emergency lighting which hold in the case of fire atleast 15 min.

Garage area is also equipped with emergency lighting Emergency lights will be equipped with their own power source.

Escape routes are permanently free area where will be nothing to block free movement of persons. In PEW there will be no fire load.

5. SEPARATION DISTANCES

FDS (Fire Dangerous Space) of External Walls

FDS (Fire Dangerous Space) of Roof, roof construction is classified DP1

Exterior wall of residential building is created with certified ETICS, it is FCA (fire closed area). It is construction of DP1, with external cladding with reaction to fire B-D, Q < 150 MJ/m2

Openings of residential building are FOA (fire open area)

Drawing of separation distances for north wall with calculation is enclosed to this part

6. FIRE-FIGHTING EQUIPMENT

Access road for fire fight vehicles are allowable through existing road. Communication is with two lines and with width of 6,5 m. There is no parking in the area of Access area.

Entrance to the roofs are allowable from the last landing of staircase. Starting area is located next to the entrance to the building. The fire height is 15,0 m. Access to technical room of EPS, fire ventilation, master switch of electricity is guaranteed in the underground level.

Supply of fire fight water

There is a new water pipeline DN150 constructed under new build communications. There is outer hydrant located next to the main road. There is a fire hydrant at every floor in PEW and NPEW. The length of the fire hoose is designed in a way that they will reach every place where the fire fight is supposed. The maximal distance is 40 m. Hydrants box in underground will be placed in the area of garage. The will be equipped with a 30 m hoose. Hydrant boxes will be placed in the way that their axis will be 1,2 m above floor. There will be overpressure 0,2 Mpa and Q=0,3 l/s in every place of fire water supply pipeline. Pipeline will be from nonflammable material (steel). Pipeline will be also protected from freeze, due to the non-heated underground level.

7. FIRE DESIGN APPLIENCES

Electrical fire appliances will be installed at every fire compartment. EFS will be installed in every fire compartment with fire load in underground area (storage areas, technical rooms) and stroller room in first level. EFS will not be installed in the apartments. There will be only smoke automatic detectors with battery located in the apartments. EFS will be installed in the corridors (NPEW) due to its length exceeding limit for NPEW without EPS. There will be button based signaling in every floor in

PEW. EFS will be connected to the EFS control room in the underground floor. The signal from EFS will be wirelessly connected to the firefight headquarters.

There will be forced ventilation of PEW connected to the EFS.

Fire compartments in apartments doesn't required installation of fire extinguisher. They will be installed in the common areas and corridors. In the underground area there will be fire extinguisher installed in every 20 m2 of storage and garage areas. For every 10 parking places.

Fire extinguisher will be installed on visible and accessible places.

8. CONCLUSION

The building is safely designed from the fire design point of view. All the appliances has to be regularly examined.

9. LIST OF ATTACHMENTS

1) Fire resistance table

10. LIST OF DRAWINGS

1) Fire design 1NP
2) Fire design UL
3) Fire design 2NP-4NP
4) Fire design 4NP