

Ministry of Education and Science of Ukraine
National University "Yuri Kondratyuk Poltava Polytechnic"
Educational and Scientific Institute of Architecture, Construction and Land Management
Department of Architecture of Buildings and Design

MULTI-STOREY SECTIONAL RESIDENTIAL BUILDING IN POLTAVA

Explanatory note

to the qualification work for the higher education degree of "Bachelor"
in the specialty "Architecture and Urban Planning"

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1.INTRODUCTION

The housing market in Ukraine continues to grow despite economic difficulties. In different periods to different degrees, but always in demand is a segment of comfortable housing relatively large area, located in the central part of the city or in close proximity to it. Therefore, the development of housing in the higher price segment remains relevant for Ukraine.

2. URBAN PLANNING SOLUTIONS

The design site is located in the Kyiv administrative district of the city in the quarter bounded on the southwest by Serhiia Sapiho Street, from the south-east – Sinna Street, from the north-east – Pushkina Street. The design area is located in the south-eastern part of the quarter. From the northwest it is limited by the territory of the Polytechnic College, from the northeast – by Pushkina Street, from the east – by Sinna Street, from the south-east – by the adjacent territory of the existing three-storey apartment building (26 Sinna Street), from the south-west – by the adjacent territory of the existing residential building (Serhiia Sapiho Street) with public premises located on the ground floor.

According to the existing master plan of the city, the territory of the design site (currently occupied by low-value low-rise housing of communal property, most of which is in unsatisfactory technical condition) is referred to the areas of promising urban development. A detailed plan of the territory has already been developed for a part of the territory, which envisages construction on the Serhiia Sapiho Street construction of a seven-storey one-section residential building. There are urban planning restrictions on the height of new objects not higher than seven floors in the design area.

Design proposals provide for the organization of the entire territory occupied by low-value housing, the organization of a luxury housing group with a restriction of buildings up to 6 floors (due to increased height of the first and typical floors), with the organization under the courtyard underground parking and using the first floors to accommodate offices and public service facilities.

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The design task in accordance with the project theme provides for the development of two sectional residential buildings. As the underground parking is not located under the houses, its development is not envisaged by the design task.

The designed housing group is formed by two houses. A six-storey residential building for 20 apartments with office premises on the ground floor is located on Serhiy Sapigo Street. At the corner of Pushkina and Sinna streets is a five-section six-storey residential building with 50 apartments and ground-floor service facilities.

Total estimated number of inhabitants – 210 people (average 2.5 people per 1 apartment).

Total number of apartments – 84 (number of 4 room apartment $9 \cdot 6 = 54$ + number of 3 room apartment $5 \cdot 6 = 30$).

Under the courtyard there is an underground parking for 90 cars. Guest parking is open, at ground level, for 42 cars, 6 of which are designed for cars of people with disabilities.

For loading goods into the five-section residential building of the trade enterprise located on the ground floor, two platforms of not less than 12x12 m in size with arrival according to the Pushkina Street and Sinna Street.

The site for garbage containers is located near the entrance to the residential group from Pushkina Street, and the distance from it to the windows of residential buildings, sports, playgrounds and recreation areas for adults is not less than 20 m.

Also on the territory of the courtyard there is a sports ground (volleyball and basketball), a children's playground, a workout area, a recreation area for adults. Due to the high level of comfort of the apartments, it was decided not to provide on the premises areas of laundry for drying clothes and cleaning carpets. Also on the territory of the housing group there is no playground for dogs. Due to the impossibility of maintaining a distance of 40 m from it to the windows of residential buildings, as well as to sports and playgrounds.

There are two entrances to the territory of the residential group, which do not happen to each other and are dead-end with 12x12 m turning areas at the end.

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One of them is provided from Pushkin Street, the other – from Sergei Sapigo Street. Arrival from the street. Sinna is intended only for loading service facilities located on the ground floor of the designed five-section residential building and it does not connect with the interior territory of the residential group.

The main entrance to the underground car parking is organized from Pushkina Street, the alternate exit from the underground car park leads to Serhiia Sapiho Street.

The one-section residential building on Serhiy Sapigo Street is located along the red line of the street, taking into account the fact that the already formed building is located in the same way and Sapigo Street is not transit, being essentially an inner-quarter passage.

The five-section residential building on the corner of Pushkin and Sinna streets is located 6 m from the red lines of the Sinna Street street – the main street of district significance and with a distance of 3 m from the red lines of the residential Pushkina Street in accordance with the requirements of the current norms.

All houses have a detour for a fire truck. The distance from the driveway to the wall of the house is from 5 to 7 m, the width of the driveway is not less than 3.5 m.

Main technical and economic indicators of master plan solution are as follow:

1. Total area of land plot 11559.75 m².
2. Area of buildings 2107.83m².
3. Total area of parkings 559.6 m².
4. Total area of driveways 1973.68 m².
5. Area of turning place and downloading place 576 m².
6. Area of platform for trash containers 35.93 m².
7. Total green area 1730.8 m².
8. Total area of playgrounds 823.54 m² (kids 193 m² + adult 630.54 m²)

3.ARCHITECTURAL AND PLANNING SOLUTION

The ground floor of a one-section residential building is occupied by two identical offices, each of which has a separate main entrance and a spare exit. All entrances to the offices are not organized from the courtyard of the house.

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The central part of the first floor is occupied by rooms that do not require natural light – toilets, archives, staff rooms.

The entrance to the residential part of the house is organized from the yard. An elevator with two doors located on opposite sides of the cabin is used, which ensures the accessibility of all floors of the house for people moving on wheelchairs. The width of the flight of stairs is 1.35 m, which ensures their suitability for evacuation of persons belonging to low mobility groups.

On a typical floor of the house there are 4 apartments: two three-room and two four-room. Each of the apartments is focused on two adjacent sides of the horizon, which provides regulatory insolation. The apartments have summer rooms – glazed loggias that meet the requirements for evacuation exits from the apartments of sectional houses: each loggia has a blank wall width of not less than 1.2 m, not less than 50% of the loggia glazing opens and open parts of glazing of appropriate width are located including and in front of a deaf wall, which provides the opportunity to evacuate a person who can wait for a fire on the loggia.

The five-section residential building consists of five sections: two end sections (their planning solutions are identical, but mirrored in relation to each other), two ordinary sections and one corner section with an angle of rotation other than 90 degrees. As the total length of the house is less than 100 m, it was decided not to arrange a through passage at the level of the first floor.

Given that the building is located along the streets with heavy traffic, it was decided to place in the section no more than two apartments with two-way orientation (in the end sections - with three-way), where the street is oriented kitchen-dining room, living room and no more than one additional residential room, and most bedrooms are oriented to the courtyard. The sections use both three-room and four-room apartments, but the use of a frame scheme and a clear division of sections into apartments create the possibility of redevelopment of apartments if necessary.

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persons belonging to low mobility groups. The ground floor of the house is divided into two spaces that can be used for shops, cafes, offices or other service facilities. Load from the ends of buildings for two service enterprises is provided. Inside there are zones of trade halls and zones of utility rooms. This solution provides the flexibility of planning solutions when using the lower floor to accommodate various service facilities.

The figurative solution of both houses is modern, stylization for historic buildings is not used. Contrast reception is used when combining old and new buildings. It is taken into account that in the immediate vicinity of the buildings there are no historic buildings with expressive stylistic features, and the building of the Polytechnic College is visually isolated from the new building by placing it in the depth of the site.

4.CONSTRUCTION AND ENGINEERING EQUIPMENT SOLUTIONS

The five-section residential building consists of two separate blocks separated by a deformation seam: the first consists of three sections in axes 1–11, the second – of two sections in axes 12 – 21 '.

Both buildings have a frame structural system with a monolithic reinforced concrete frame and crossbarless floors. In a one-section building, a grid of 6x6 m columns was used (with certain modifications in the area of vertical communications), in a five-section building – 7.2x6 m and 7.2x3 m, in the middle part of each section – 5.4x4.2 m located in the side walls of the stairwells. Section of columns 300x300 mm. The thickness of the floor is 140 – 160 mm. Balconies, bay windows and loggias are arranged due to the cantilever overhang of the floors (maximum – 2 m).

The buildings are six-storey. The 4.2 m high ground floor is used to accommodate office space and public service facilities. The height of the upper floors is 3.0 m. The building has a technical basement with a clear height of at least 1.9 m. There is no technical attic. Used so-called inversion roof with internal ventilation system.

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Exterior walls are not load-bearing multilayer. The inner layer – aerated concrete blocks with a thickness of 250 mm, the outer layer – insulation of mineral wool slabs with a thickness of 120 mm, which simultaneously serve as thermal insulation for columns and ends of monolithic reinforced concrete floors, preventing the formation of "cold bridges". The total thickness of the outer wall is 400 mm. Finishing – a layer of decorative plaster on the plates of insulation and painting with facade paints. Plinth – facing with ceramic tiles.

Engineering equipment.

The houses are provided with centralized water supply and sewerage, gas supply, electricity supply. Apartment heating from wall double-circuit boilers with air intake directly from the outside. Also provided with internet and cable TV networks.

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5. ARCHITECTURAL STRUCTURES

The designed residential group consists of a one-section house on the Serhiia Sapiho Street (Fig. 5.1) and a five-section residential building located at the corner of Pushkina Street and Sinna Street (Fig. 5.2).

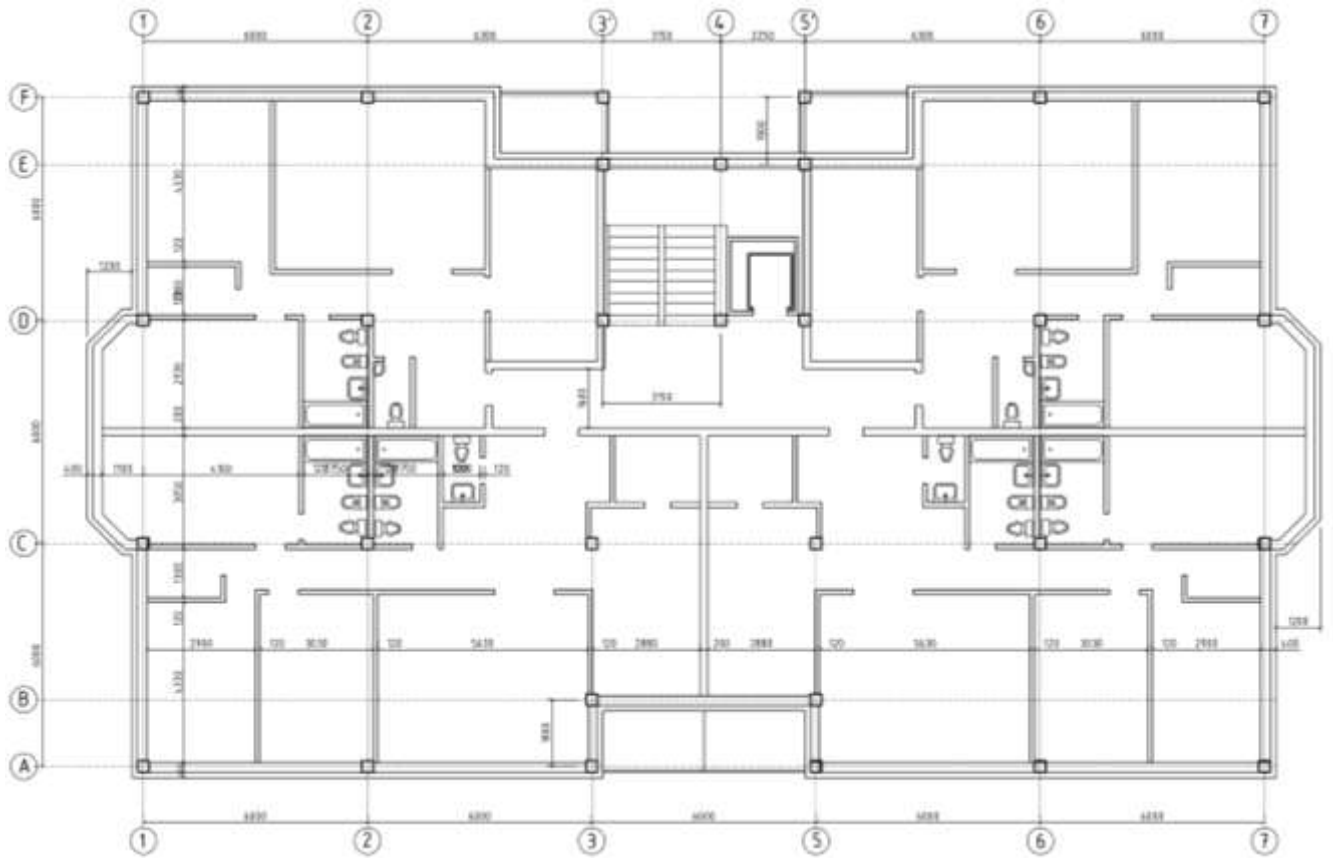


Fig. 5.1. Plan of a typical floor of a one-section residential building. Layout of the main structural elements.

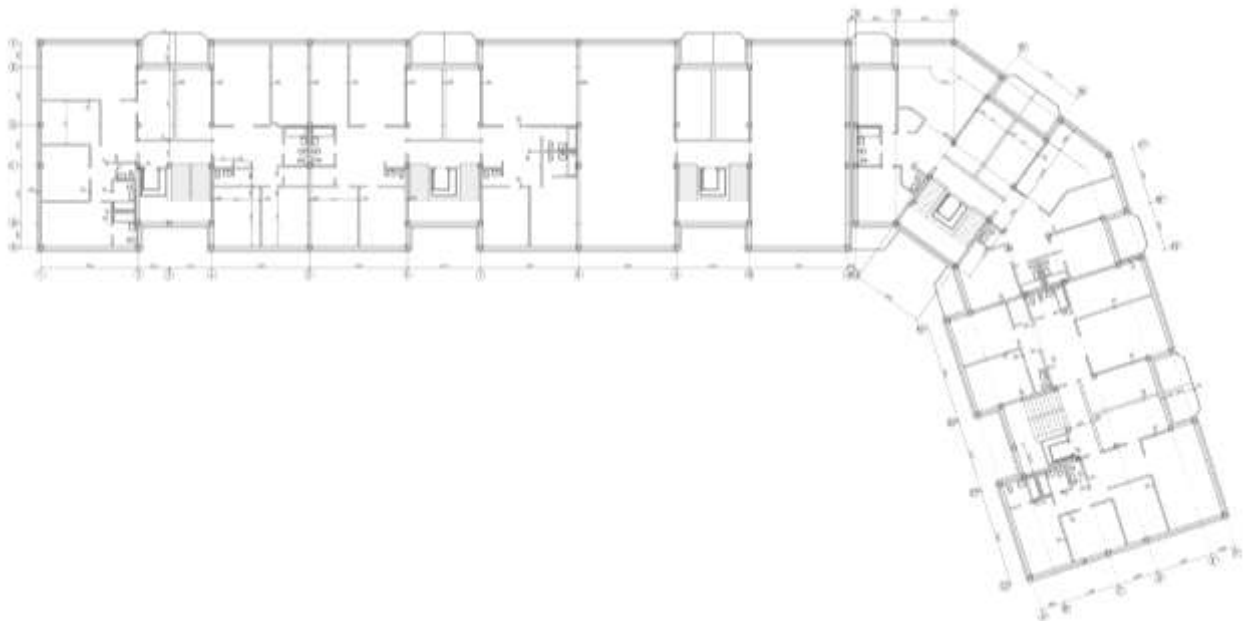


Fig. 5.2. Plan of a typical floor of a five-section residential building. Layout of the main structural elements.

The five-section residential building consists of two separate blocks separated by a deformation seam: the first consists of three sections in axes 1–11, the second – of two sections in axes 12 – 21 '.

Both buildings have a frame structural system with a monolithic reinforced concrete frame and crossbarless floors. In a one-section building, a grid of 6x6 m columns was used (with certain modifications in the area of vertical communications), in a five-section building – 7.2x6 m and 7.2x3 m, in the middle part of each section – 5.4x4.2 m located in the side walls of the stairwells. Section of columns 300x300 mm. The thickness of the floor is 140 – 160 mm. Balconies, bay windows and loggias are arranged due to the cantilever overhang of the floors (maximum – 2 m).

The buildings are six-storey. The 4.2 m high ground floor is used to accommodate office space and public service facilities. The height of the upper floors is 3.0 m. The building has a technical basement with a clear height of at least 1.9 m. There is no technical attic. Used so-called inversion roof with internal ventilation system.

Stairs are monolithic reinforced concrete. Elevator shafts are prefabricated reinforced concrete with a wall thickness of 100 mm. The elevator shaft is a multi-link vertical construction of flat panels with embedded and connecting parts. Elements (tubing) of prefabricated elevator shafts: the upper block of the elevator shaft, the upper floor slab, the main block of the elevator shaft (Fig. 4.3), a selective element or block-insert, the lower block (pit). The lower block for the elevator shafts of multi-storey buildings is made of high-strength concrete.

For the organization of natural ventilation prefabricated reinforced concrete ventilation blocks with a section of 300x900 mm are used (Fig. 5.4).

Exterior walls are not load-bearing multilayer. The inner layer – aerated concrete blocks with a thickness of 250 mm, the outer layer – insulation of mineral wool slabs with a thickness of 120 mm, which simultaneously serve as thermal insulation for columns and ends of monolithic reinforced concrete floors, preventing the formation of "cold bridges".

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Fig.5.3. The main element of the prefabricated reinforced concrete elevator shaft

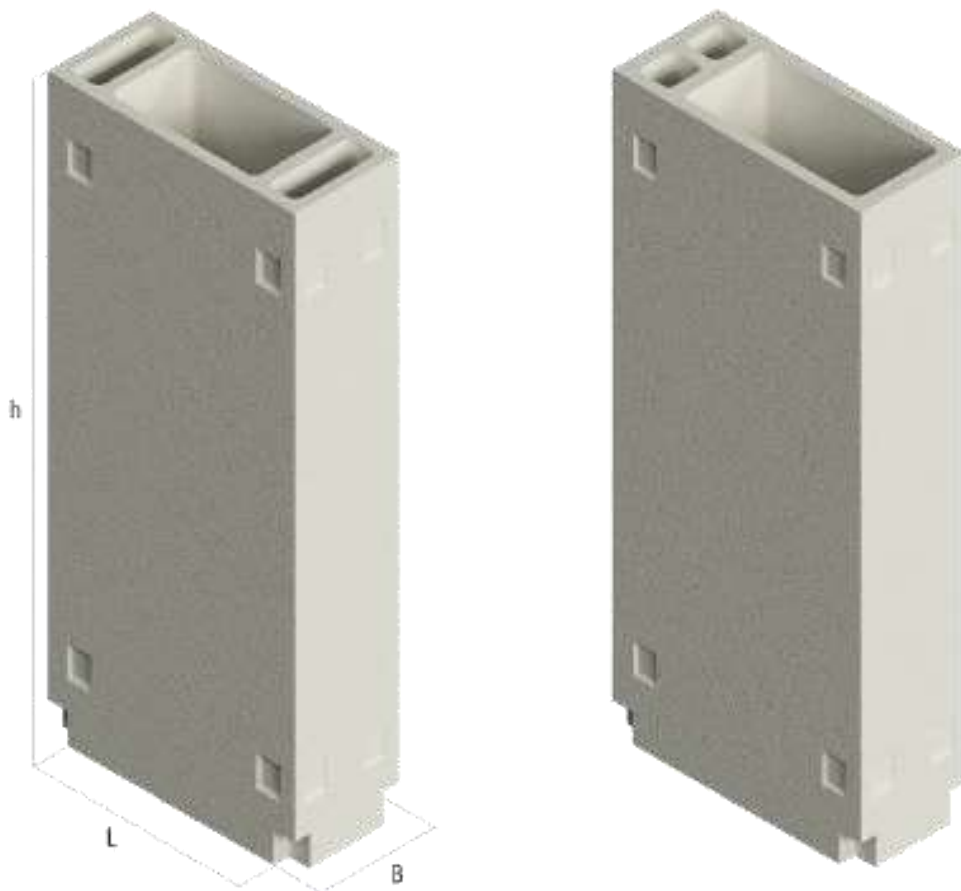


Fig. 5.4. Prefabricated reinforced concrete ventilation units with the location of connecting channels on both sides of the ventilation shaft and on one side of it

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The total thickness of the outer wall is 400 mm. Finishing – a layer of decorative plaster on the plates of insulation and painting with facade paints. Plinth – facing with ceramic tiles.

In order to reduce the height of the building located in the zone of height restrictions, the project does not provide a technical floor and in accordance with the requirements of DBN B.2.2-15: 2019 applied inversion roof.

Inversion roof is a flat roof with a minimal slope, which differs from traditional one-slope with a special placement of the inner layers. In contrast to the classic roof with an almost horizontal slope, the inversion has a "reverse" arrangement of the inner layers: the insulating layer is in it on top of the insulating (Fig. 5.5).

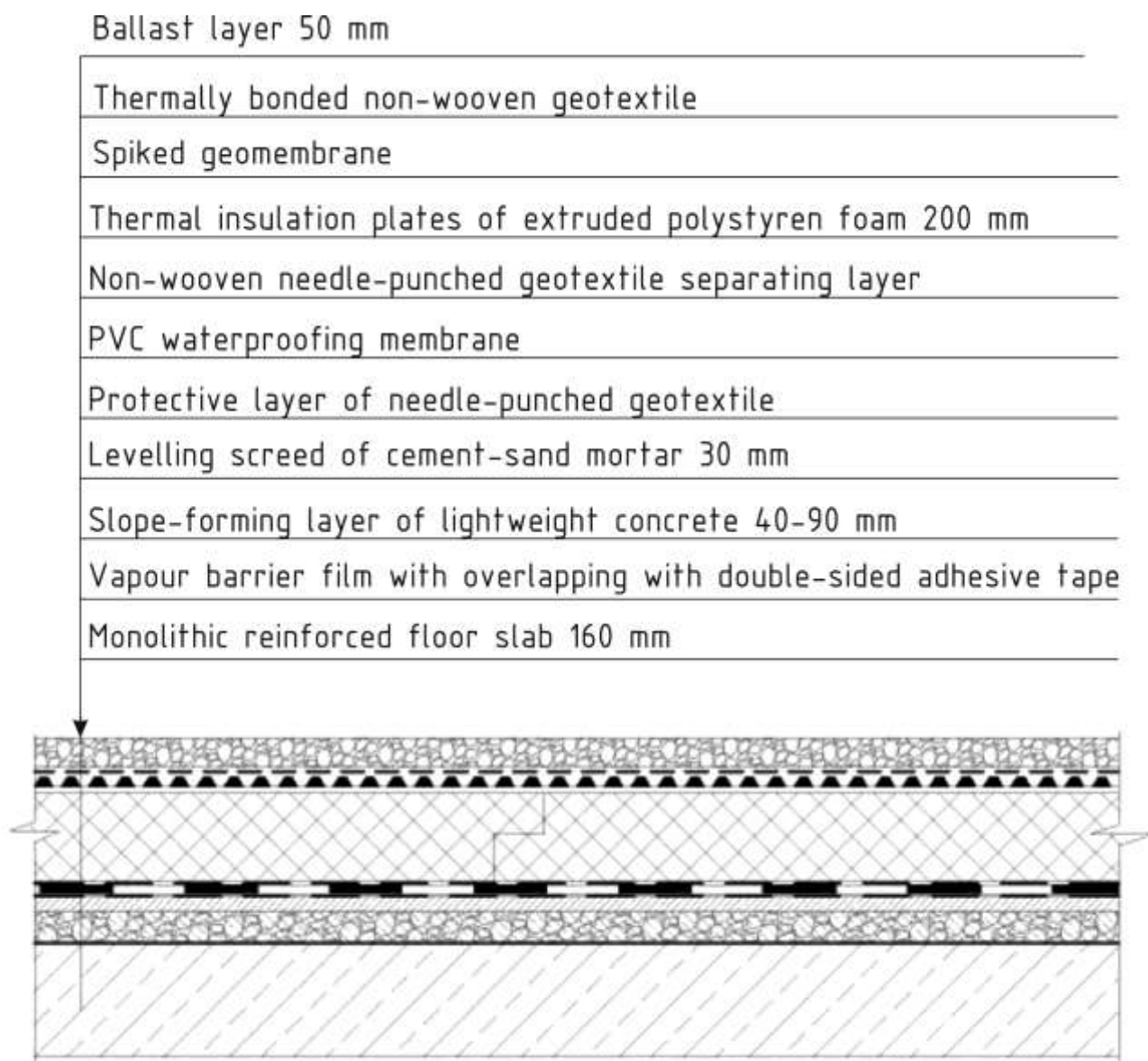


Fig. 5.5. The scheme of the inversion roof

This design significantly increases the service life compared to a soft roof, due to the arrangement of the outer layer of gravel – this top coating can be replaced by other modern materials. This design is possible due to the use of plates made of extruded polystyrene, which do not absorb moisture and retain their insulating properties even in a humid environment.

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The most common materials for window profiles are metal-plastic and aluminum. They have practically supplanted wooden profiles. Glass-composite components have recently appeared, they are rapidly gaining popularity. Plastic (polyvinyl chloride) profiles are the most popular, as they are durable and affordable. They can install multi-chamber windows with different glass thicknesses, depending on the desired level of noise and thermal insulation (Fig. 5.6).

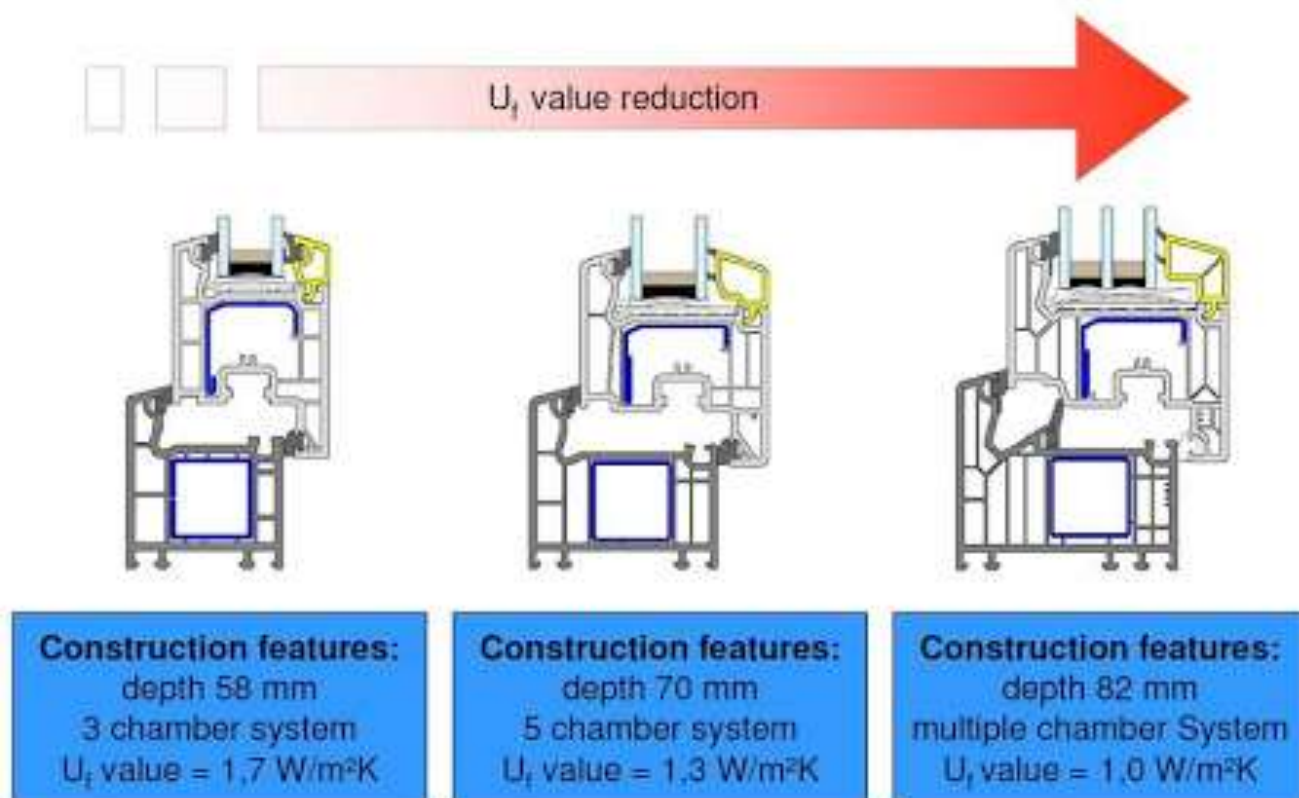


Fig. 5.6. Different types of window profiles and double-glazed windows

Profiles can be of different classes: economy, premium or standard. They are also cold and warm.

The project uses multi-chamber profiles with double-chamber energy-saving double-glazed windows for heated windows, and profiles with single-chamber double-glazed windows (taking into account the need for additional noise insulation from noise from Pushkin and Sinna streets) for glazing balconies and loggias (summer unheated premises).

Balcony doors are made of the same profiles as the windows, with the same degree of thermal insulation.

Doors.

Entrance doors in the section and entrance doors in the apartment – steel, resistant to breakage, resistant to fire (Fig. 5.7).

Interior doors are wooden.



Fig. 5.7. Entrance door to the apartment

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Floors

As a basis under floors the coupler from polystyrene concrete up to 70 mm thick is used. On top of it – leveling screed 20–30 mm. On this basis it is possible to lay a parquet, linoleum, a laminate, after a waterproofing layer – a ceramic tile, etc. This design solution allows you to reduce noise transmission (reduce the noise level by up to 46 dB), reduce the weight of the layers of preparation for the floor.

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6. OCCUPATIONAL SAFETY

6.1. General provisions. Analysis of harmful and dangerous factors that are taken into account when designing a public building

The designed object is a multi-storey sectional residential building in Poltava. The ground floor of the building is occupied by offices and public service facilities. The building is located near the central part of Poltava in the quarter bounded by Serhiia Sapiho Sreet, Pushkina Street and Sinna Street.

Main design standards and ways to avoid harmful and dangerous factors are described in the regulations of the Ministry of Health of Ukraine and other authorized central authorities.

The following harmful and dangerous factors are taken into account when designing a multi-storey residential building with offices and public services on the ground floor:

- non-compliance with regulatory requirements for storage of structures, insufficient artificial lighting of storage areas for materials and structures;
- movement of vehicles and their moving parts; movement of cargoes by load-lifting mechanisms over zones of performance of works;
- violation of the requirements for transportation and storage of explosive substances and materials;
- location of the workplace at a significant height relative to the earth's surface;
- unfavorable meteorological conditions of the production environment;
- location of workplaces in dangerous areas, closed volumes, at a significant height relative to the ground or well below ground level;
- probability of fires and explosions;
- increased voltage in the electrical circuit, the short circuit of which can occur through the human body;
- increased dustiness (gassiness) of the air at the working area;
- spontaneous collapse of brickwork elements;

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- moving machines, their working bodies, structures and materials moved by them;
- performance of works in the area near overhead power lines;
- insufficient artificial lighting of the work area during work in the dark;
- location of workplaces near the difference in height up to 1.3 m and more;
- moving machines and objects moving by them;
- collapse of elements of building structures and formwork;
- elevated temperature of the reinforcement bar (during the work on the preliminary thermal stress of the reinforcement bar);
- noise and vibration, insufficient illumination of the workplace; adverse weather conditions;
- collapse of structural elements of buildings and structures;
- falling materials, tools;
- lifting loads, the weight of which exceeds the load capacity of the mechanisms;
- overturning of machines, falling of their parts;
- insufficient rigidity of the structure, which can lead to its destruction during installation;
- flammable substances.
- increased contamination of the skin, overalls with chemicals, aerosol, dust;
- sharp edges, roughness on surfaces of finishing materials and structures;
- hazardous substances.

6.2. Technical means and organizational measures provided in the project for elimination of action of harmful and dangerous production factors

6.2.1. Transport and loading and unloading works

The movement of trucks on production territories, construction sites, loading and unloading areas and access roads to them must be regulated by effective road signs and indicators.

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Vehicles and equipment used for loading and unloading operations must correspond to the dimensions of the site and the nature of the cargo.

Transport and loading and unloading operations must be performed in a mechanized manner. Compliance with the procedure and method of transportation, loading and unloading of goods and the relevant safety requirements is the supervisor's responsibility.

Loading and unloading platforms must have a slope of not more than 5°, the dimensions and coverage must correspond to the design of works and be placed in the assembly areas of cranes.

During loading and unloading operations, it is necessary to comply with the requirements of regulations on the limits of lifting and moving cargo and admission of employees to perform such work. As an exception, men are allowed to carry loads up to 50 kg on stretchers horizontally and at a distance of not more than 50 m.

In the case of placing trucks on loading and unloading platforms, the distance between trucks standing one behind the other must be not less than 1.0 m, and between cars standing side by side, not less than 1.5 m.

6.2.2. Concrete works

Cement for concrete work must be stored in silos, hoppers, crates and other closed containers, preventing spraying during loading and unloading. The loading openings must be closed with protective grilles and the grilles must be locked.

When concreting floors, the formwork must be fenced along the entire perimeter. All openings in the working floor of the formwork must be covered with shields. If it is necessary for the openings to be permanently open, they must be closed by a lattice.

Locations of supports of floor formwork risers must be fenced and marked with prohibitory safety signs with explanatory inscriptions. Entrance (passage) during concrete works in (through) this zone is forbidden.

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Before installation of prefabricated formwork of walls, columns, pylons located on the edge of the floor, crossbars, vaults in cases where the installer during the work is not on the working floor of the formwork, must be arranged working decks at least 0.8 m wide with protective solid fences, the design of which must be designed for possible technological loads and be defined in the work execution program and schedule.

After removing part of the sliding formwork and suspended scaffolding, the end sides of the formwork must be fenced.

To protect workers performing work on suspended scaffolding from objects that may fall from above, the outer perimeter of the sliding formwork must be equipped with visors not less than the width of the scaffolding.

A protective fence at least 1.8 m high must be installed at the reinforcement bar tension sections in places where people can pass.

Reinforcement bar tensioners must be equipped with an alarm that is activated when the tensioner actuator is switched on.

It is forbidden for people to be closer than 1.0 m from electrically heated reinforcing bars.

Procurement and assembly of enlarged reinforcement frames must be performed in specially designated places.

Protective gloves and goggles must be worn when using concrete mixes with chemical additives.

The overpass for feeding the concrete mixture by dump trucks must be equipped with bumpers. Passages not less than 0.6 m wide should be provided between jack beams and fences. Transverse jack beams should be installed on dead-end overpasses.

When freeing the bodies of dump trucks from the remains of the concrete mixture, workers are prohibited from being in / on the body of the vehicle.

Before starting concrete work, the manager must:

- check the stability, strength, serviceability of scaffolding, formwork structures, fences of working horizons;

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– check the serviceability of containers, hoppers, concrete pumps, manipulators;

– provide employees with the necessary personal protective equipment.

During the operation of mixing machines, the cleaning of the pits for loading buckets should be carried out after secure fixing of the bucket in the raised position.

6.2.3. Masonry works

Erection of the walls (brickwork) of each upper floor of a multi-storey building must be carried out after the installation of floor structures, platforms and marches in the stairwells.

If it is necessary to erect brick walls without laying floors or coverings, it is necessary to use temporary fastenings of these walls.

When erecting walls higher than 7 m, it is necessary to use protective canopies or mesh fencing around the perimeter of buildings, which must meet the following requirements:

– the width of protective canopies or mesh fences must be at least 1.5 m with a slope to the wall so that the angle formed between the lower part of the building wall and the surface of the canopy was 110° , and the gap between the building wall and the plane of the canopy did not exceed 50 mm;

– protective canopies and mesh fences must withstand the snow load specified for this climatic region, and a concentrated load of at least 1600 N (160 kgf), applied in the middle of the run;

– the first row of protective canopies must be installed at a height of up to 6 m from the ground, have a solid deck and be stored until the end of the construction of the walls to full height.

The second row of protective canopies must be installed at a height of 6 – 7 m above the first row and in the process of further construction of the wall it must be rearranged every 6 – 7 m and have a solid or mesh floor with a hole size (cells) not more than 50 x 50) mm.

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Workers working on the installation, cleaning or removal of canopies must wear seat belts. Walking on canopies, using them as scaffolding, as well as stacking materials on them is prohibited.

Construction of walls up to 7 m high is allowed to be performed without the installation of protective canopies with the definition of a dangerous zone around the perimeter of the building.

6.2.3.1. Performing of masonry works

Erection of walls must be performed from the floor slabs or scaffolding. The design of scaffolding must meet the allowable load in accordance with the specified in the work execution program and schedule.

It is forbidden to make brick masonry from accidental scaffolding.

The height of each working tier of masonry is determined in such a way that the level of masonry after each bridging of the paving means was not less than two rows of masonry above the level of the new working flooring.

Erection of walls below and at the level of the floor, which is arranged from prefabricated reinforced concrete slabs, must be performed from the scaffolding installed on the lower floor.

It is forbidden to mount floor slabs without a pre-lined brick board two rows above the stacking slabs.

Stitching of external seams of bricklaying should be carried out from overlapping or scaffoldings after laying of each row of a laying. It is forbidden to perform this operation from a freshly laid wall.

When erecting the walls of buildings to a height of up to 0.7 m from the working deck, as well as during work at height, it is necessary to use the means of collective protection (fencing, catching devices) or safety belts specified in the work execution program and schedule.

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During thunderstorms, snowfall, fog, which significantly impair visibility within the work front, or at wind speeds of 15 mps and more, it is prohibited to perform brick masonry of the outer walls of multi-storey buildings and structures.

For transportation by cranes of artificial materials – bricks, ceramic stones, small blocks – it is necessary to use inventory pallets, containers, load-grabbing devices which prevent falling of these elements during lifting, unpacking, selection for work.

Above the place of loading of the lift the protective double flooring from boards not less than 40 mm thick has to be established at height of 2.5 m – 5 m.

Arrangement of fastenings of eaves, formwork of brick lintels, arched structures must be performed in accordance with the technological documentation. Remove temporary fasteners, formwork of brick lintels and arched structures is allowed if the solution has reached the strength determined by the process map.

Erection of brick structures by freezing is allowed if the work execution program and schedule has instructions on the possibility, procedure and conditions of application of this method. Thus on solutions without chemical additives it is allowed to erect constructions no more than 4 floors and no more than 15 m high.

Structures that are in the process of natural thawing and hardening must be constantly monitored.

Preparation and processing of natural stones within the construction site must be performed in specially designated areas, where the stay of persons who do not perform this work is prohibited. Workplaces at a distance of less than 3 m from each other must be separated by protective screens, and workers must be provided with personal protective equipment.

It is necessary to process bricks in gloves and glasses with unbreakable glass.

6.2.4. Site erection works

Other work and the presence of unauthorized persons are not allowed in the working area of site erection works.

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Installation of structures of buildings (structures) must begin with a spatially stable part: the connecting element, the core of rigidity, and so on.

Installation of structures of each upper floor (tier) of a multi-storey building must be performed after fixing all installed mounting elements in accordance with the project and achieving concrete (mortar) joints of load-bearing structures of the required strength.

Painting and anticorrosive protection of constructions and the equipment in cases when it is carried out on a building site, it is necessary to do before raising of designs on a design mark. After lifting these structures, painting or corrosion protection may be performed only at the joints and joints of structures.

Unpacking and canning of the equipment to be installed must be performed in the area designated in accordance with the work execution program and schedule and carried out on special racks or gaskets with a height of at least 100 mm.

Tools and materials with explosion-hazardous properties are not allowed during reactivation of the equipment.

During the installation of frame houses, the next tier of the frame may be installed only after the installation of enclosing structures or temporary fences on the previous tier.

Installation of stairways and platforms of buildings (structures), as well as freight and passenger lifts (elevators) must be carried out simultaneously with the installation of structures of the house. Fences must be installed immediately on mounted stairways.

When assembling structures of buildings or structures, installers must be on previously installed and securely fastened structures or means of paving.

It is forbidden for people to be on the elements of structures and equipment during their lifting and moving.

Hinged mounting platforms, ladders and other devices required to perform work at height must be installed on structures that are mounted before their lifting.

For transition of installers from one design to another it is necessary to apply ladders, transition bridges and ladders having protections.

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People are not allowed to be under the elements of mounted structures and equipment.

Hinged metal ladders longer than 5 m must be enclosed with metal arches with vertical connections and securely attached to structures or equipment.

Lifting of workers on hinged ladders to height more than 10 m is allowed only in case of their equipment with platforms for rest not less than in each 10 m on height.

Stretchers for temporary fixing of the mounted designs need to be attached to reliable support. The number of dislocations, their material and cross section, methods of tension and fastening points are determined in the work execution program and schedule.

Stretch marks must be located outside the dimensions of traffic and construction machinery; they must not touch the sharp corners of other structures. Bending of extensions in places of their contact with other structures is allowed only after checking the strength and stability of these elements under the influence of forces from disengagement.

It is necessary to prevent the rocking and rotation of the elements of structures or equipment to be mounted during movement.

Slings of structures and equipment must be performed by means that provide the possibility of remote slinging from the working horizon in the case when the height to the lock of the load-carrying means exceeds 2 m.

6.2.4.1. The order of performance of site erection works

Prior to the installation work, it is necessary to determine the order of exchange of conditional signals between the person who manages the installation and the driver (motorist) of the crane. All signals are given by only one person (foreman of the assembly team, section leader, rigger-slinger). Only a worker who has noticed the danger can give a "Stop" signal.

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If the structure to be mounted is out of sight of the crane operator, a reliable connection must be ensured between him and the installers. If this is not possible, intermediate signaling devices from among the slingers (riggers) are assigned.

In particularly important cases (in the case of lifting structures using complex rigging, the method of rotation, when pushing large and heavy structures; when lifting them by two mechanisms or more, etc.) signals should be given only by the supervisor.

Slings of the mounted elements must be performed in the places indicated in the working drawings, and ensure their lifting and feeding to the installation site in a position close to the design.

It is forbidden to lift the elements of building structures that do not have mounting hinges or holes, markings and markings that ensure their proper slinging and installation.

During installation from vehicles, structural elements must not be carried over the driver's cab.

Cleaning of structural elements to be installed from dirt and ice must be done before lifting.

Elements to be mounted must be lifted smoothly, without jerks, swings and rotations. Lifting loads (frozen, partially covered with soil, debris, connected to elements of other structures, etc.) that exceed the capacity of the assembly crane is prohibited.

It is necessary to lift constructions in two stages: at first on height of 20 – 30 cm, then, after check of reliability of slinging and assembly loops, to carry out the further lifting.

When moving structures or equipment, the distance from them to the parts of the mounted equipment, protruding structures must be horizontally not less than 1.0 m, and vertically – not less than 0.5 m.

It is forbidden to leave the raised elements of constructions and the equipment in the lifted condition during a break in work.

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Elements of structures or equipment installed in the design position must be fixed so as to ensure their stability and geometric invariance.

Slings of structural elements and equipment, which are installed in the design position, must be done after their permanent or temporary fixing in accordance with the project. It is not allowed to move the installed elements of structures or equipment after their unbundling without the use of installation equipment provided by the work execution program and schedule.

Until the end of verification and reliable fixing of the installed elements, it is not allowed to lean on them the structures located above, unless it is provided by work execution program and schedule.

It is forbidden to sling a load that is in a precarious position, as well as to move the device on a raised load.

When pushing (moving) structures and equipment with winches, the load capacity of brake winches and hoists should be equal to the load capacity of traction means, unless otherwise specified by the project.

It is forbidden to perform installation work at height in open places at wind speeds of 15 mps and more, during ice, thunderstorms, fog, which makes it impossible to see within the work front.

When assembling horizontal cylindrical tanks consisting of individual tsars, it is necessary to use wedge gaskets and other devices that prevent involuntary rolling of tsars. The aggregation assembly of those to be installed, structures and equipment must be performed in specially designated areas.

6.2.5. Electric welding and gas-flame works

Persons not younger than 18 years of age who have passed a medical examination, special training and testing of theoretical knowledge and practical skills in specific welding methods and certain types of welding work, passed the examination of the attestation commission and have the appropriate certificate are allowed to perform electric welding and gas-flame works.

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Electric welders must have an electrical safety group not lower than II.

Workers who have violated electrical or fire safety requirements must pass an extraordinary knowledge test.

Welders who have passed a special medical examination, have experience of climbing work of at least one year, the category of the welder is not lower than III are allowed to perform electric welding and gas-flame works at a height of 5 m and more.

Welding, cutting and heating with open flames of appliances, vessels and pipelines that contain any liquids or gases under pressure, as well as filled with flammable or harmful substances, or those belonging to electrical devices, is not allowed.

Before sealing, welding (cutting) containers from flammable and combustible liquids, they must be pre-cleaned (washed, steamed, ventilated five or six times by changing the air) to remove traces of these liquids, followed by monitoring the air. Such containers must be filled and refueled during soldering or welding with neutral gases and with open plugs (lids) before sealing and welding.

Simultaneous performance of electric welding and gas-flame works inside closed tanks is not allowed.

It is not allowed to use petrol cutters when performing gas-flame works in tanks, wells and other closed tanks.

It is not allowed to perform welding work outdoors during rain and snow.

6.2.5.1. Safety requirements at workplaces where electric and gas welding works are performed

Locations of welding work outside the permanent welding stations must be determined with the written permission of the supervisor or a specialist responsible for fire safety.

Welding places must be provided with fire extinguishers.

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Workplaces where electric and gas welding works are performed, passages to them at a height of 1.3 m and more and at a distance of less than 2 m from the difference in height, must be protected by temporary fences. When welding in a carbon dioxide atmosphere, the fences must not reach the floor by 300 mm.

It is forbidden to perform welding work on additional portable ladders.

Places of electric welding and gas-flame works on this, as well as on the lower tiers (if there is no protective refractory flooring or flooring protected by refractory material) must be free from combustible materials within a radius of at least 5 m, and from explosive materials and equipment (gas generators, gas cylinders, etc.) – not less than 10 m.

When cutting structural elements, measures must be taken to prevent accidental collapse of the cut elements.

Workplaces of welders in the room during open arc welding must be separated from adjacent workplaces and passages by non-combustible and light-proof screens (screens, shields) with a height of not less than 1.8 m.

When welding outdoors, fences must be placed in the case of simultaneous operation of several welders near each other and in areas of heavy traffic.

If welding work is performed using liquefied gases (propane, butane) and carbon dioxide, the welders' workplaces must be equipped with local suction from below.

Welding places must be equipped with exhaust ventilation. Welding is not permitted if the local exhaust ventilation does not work.

Work in closed or confined tanks must be performed by a welder under a permit under the supervision of a supervisor with electrical safety qualification group II and above, who must be outside. The welder must use a seat belt with a safety rope, the end of which is with the supervisor.

6.2.6. Electrical works

Laying cables and wires is allowed only in fully fixed pipes, trays, boxes, etc.

Welding work on the transformer housing is allowed only after filling it with oil to the level of 200 – 250 mm above the welding site.

Before drying electric machines and transformers with electric current, their housings must be grounded. When drying transformers in your own or special metal tank by induction method, it is necessary to avoid contact with the windings.

It is not allowed to perform work or be at a distance of less than 50 m from the test site of air switches. The safety valve on the air collector must be adjusted and tested for a pressure exceeding the working pressure by more than 10%.

Fuses in the electrical circuits of voltage transformers and power transformers on which the adjustment work is performed must be removed. At the place where the fuses are removed, you need to hang a poster: "Do not turn on. People are working."

2.6.1. The order of works performance

If it is necessary to supply operating current for the adjustment of mounted circuits and electrical installations, it is necessary to hang warning posters (signs) on them. Non-debugging work must be stopped and workers engaged in this work must be removed from the work area.

Prior to commissioning of switchgear, all supply lines and those to other substations must be disconnected from the equipment and grounded.

The connection of the mounted electrical networks and electrical equipment to the existing electrical networks must be carried out by the operation service of these networks.

It is not allowed to use and connect as temporary electrical networks and electrical installations that have not been put into operation in a certain order, as well as to perform electrical installation work on the assembled and commissioned electrical installations without the permission of the commissioning organization.

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During commissioning work on the installed electrical installation, the operating voltage on it can be applied by the operating personnel only after the introduction of the operating mode on the electrical installation and in the presence of a written request of the head of commissioning work.

Lifting, moving and installing disconnectors and other circuit breakers are performed in the "On" position, and devices equipped with return springs or free distribution mechanisms – in the "Off" position.

When adjusting the switches connected to the drives, care must be taken to prevent them from being switched on or off unintentionally or unintentionally.

Fuses of the control networks of the installed device must be removed for the entire time of installation.

Before the beginning of test works it is necessary on switching devices:

- bring the spring drives of switching devices to the inoperative position;
- switch off the operating circuits, alarm circuits, drive power circuits and heating circuits;
- close and lock the latches on the air supply pipes in the tank tanks and pneumatic actuators, as well as release the air available in them;
- hang posters on the keys and buttons of the remote control "Do not turn on. People are working".

Simultaneous operation on drives and switching devices is not allowed.

When working on power transformers, the terminals of the primary and secondary windings must be shorted and grounded for the entire duration of electrical work.

All terminals of voltage transformers and current transformers must be shorted and grounded during installation.

It is necessary to measure the voltage and density of the electrolyte in rubber gloves, respirators, standing on an insulating rubber carpet.

It is necessary to check up a condition of pole clamps of accumulators in dielectric gloves.

When tightening the bolts connecting the batteries to each other, it must be impossible to accidentally touch the key to the battery plates of different polarity.

Tightening wires through long boxes, boxes, pipes, blocks in which live wires are laid, as well as laying wires and cables in pipes, trays and boxes that are not fixed in accordance with the project, is not allowed.

Checking the insulation resistance of wires and cables with a megohmmeter must be performed by a link consisting of at least two people, one of whom has group IV, and the other group III on electrical safety. The ends of wires and cables that may be live during the test must be insulated and (or) fenced.

Testing of electric drives is allowed after communication between the personnel located in the room of the board or the control panel, and near electric drives.

During the adjustment of line and limit switches, sensors and other means of automation, the voltage of the power supply networks must be removed.

6.2.7. Installation of engineering equipment of buildings and structures

The elimination of deficiencies identified during the testing of the installed system and equipment must be performed on the basis of measures developed and approved by the customer and the general contractor together with subcontractors for the safety of these works.

Installation and removal of jumpers (connections) between installed and operating equipment, as well as connection of temporary installations to existing systems (electrical, steam, technical, etc.) without the written permission of the general contractor and the customer is not allowed.

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6.2.7.1. Organization of workplaces

Installation of pipelines and air ducts on overpasses must be performed from the inventory scaffolding, equipped with stairs for raising and lowering workers. Lifting and lowering of overpass structures is not allowed.

It is forbidden for people to be under the installed equipment, assembly units of equipment and pipelines until their final fixing.

It is necessary to lower pipes in the fixed trench so that not to break fastenings of a trench.

It is not allowed to roll the pipes into the trench with the help of crowbars and scales, as well as to use the struts securing the trenches as supports for the pipes.

Electrical installations in these premises must be fire and explosion-proof.

Premises in which degreasing is carried out must be equipped with supply and exhaust ventilation. When working outdoors, workers must be on the windward side.

Workers engaged in degreasing pipelines must be provided with appropriate gas masks, overalls, gloves and rubber gloves in accordance with the rules of free issuance of special clothing, special footwear and other personal protective equipment to workers.

6.2.7.2. The order of performance of work

Installation of equipment, pipelines and air ducts near electrical networks (within a distance equal to the maximum length of the unit or link of the pipeline to be mounted) is performed when the voltage is removed.

During purging of pipes with compressed air it is forbidden to be in chambers and wells where latches, valves, cranes, etc. are established.

When blowing pipes, shields must be installed at the ends of the pipes to protect the eyes from scale and sand.

Personnel are not allowed to stand against or near the ends of the blown pipes.

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When installing pipelines and equipment, joining and connecting holes and checking their coincidence in the parts to be mounted must be performed with a special tool (conical mandrels, assembly plugs, etc.). It is not allowed to check the coincidence of holes in the mounted parts with your fingers.

Measures must be taken during the installation of the equipment to prevent its unauthorized or accidental switching on.

When installing equipment using jacks, measures must be taken to prevent skewing or tipping of the jacks.

6.2.8. Testing of engineering equipment of buildings and structures

Testing of equipment and pipelines must be performed under the direct supervision of a specially appointed person from among the specialists of the installation organization.

Before testing the equipment it is necessary:

- to acquaint the head of works with the personnel participating in tests, with the order of carrying out of works and measures of their safe performance;
- to warn workers on adjacent sites about the time of testing;
- to provide visual, and if necessary, by means of devices, check of fastening of the equipment, a condition of isolation and grounding of an electric part, presence and serviceability of fittings, starting and braking devices, control and measuring devices and plugs;
- fence and mark the test area with appropriate signs;
- if necessary, arrange an alarm system;
- ensure the possibility of emergency shutdown of the equipment under test;
- check the absence of foreign objects inside and outside the equipment;
- mark with temporary signs temporary plugs, hatches and flange connections;
- equip posts at the rate of one post within the visibility of another, but at least every 200 m from each other to warn of the danger zone;

- determine the places and conditions of safe stay of persons engaged in testing;
- to ensure the readiness of fire extinguishers and maintenance personnel who may be involved in the fire;
- to provide illumination of workplaces not less than 50 lux;
- appoint persons responsible for carrying out the safety measures provided for in the test program.

Elimination of defects on the equipment detected during the tests must be performed after its shutdown and complete shutdown.

Simultaneous hydraulic tests of several pipelines mounted on the same supporting structures or trestle are allowed if the supporting structures or trestle are designed for the appropriate loads.

If the pipelines are located near residential or operating public or industrial buildings, their pneumatic tests can be carried out provided that the window and door openings of these buildings, which are located within the danger zone, must be closed by protective fences (shields, bars).

6.2.8.1. The order of works performance

Inspection of the equipment after the tests is allowed to do after reducing the test pressure to the worker.

Protective fences (screens) must be installed in front of open hatches and fittings when testing equipment and piping after testing.

Tests of equipment and pipelines under load must be performed after tests of its idleness.

Testing of equipment is allowed only after timely warning of persons in the test area and obtaining the permission of the test manager.

During equipment tests it is not allowed:

- remove protective fences;
- open hatches, fences, clean and lubricate equipment, touch its moving parts;

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– check and eliminate defects in electrical circuits of electrical equipment and automation devices.

Before pneumatically testing the piping, the safety valves must be adjusted to the appropriate pressure.

Plastering of welds directly during tests of pipelines and equipment is not allowed.

The connection and disconnection of the air supply lines from the compressor to the test line is only permitted after the air supply has been stopped and the atmospheric pressure has been reduced.

6.2.9. Finishing works, arrangement of heat-insulating facade systems

Mixtures and mastics during finishing works should be prepared, as a rule, centrally. Preparation of them, as well as the mortar mixture on the construction site must be carried out in rooms equipped with supply and exhaust ventilation to prevent exceeding the maximum permissible concentrations of harmful substances in the air of the working area.

Contractors must be provided with harmless detergents and warm water.

It is not allowed to use paints and solvents of unknown composition, as well as substances and materials that do not have indicators of fire and toxic hazards.

It is not allowed to use paints and solvents of unknown composition, as well as substances and materials that do not have indicators of fire and toxic hazards.

Operation of mobile painting stations for preparation of paint mixes which are not equipped with forced ventilation is not allowed.

Workplaces for finishing works, arrangement of facade systems at height must be equipped with means of paving and stairs-ladders for lifting on them.

The means of paving used during plastering, painting works, arrangement of facade systems in places under which other works are carried out or there is a passage, should be with floorings without backlashes.

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Internal plastering works, and also installation of prefabricated eaves and modeled elements of internal rooms need to be carried out only from the platforms or mobile little tables established on a floor, or on continuous floorings. External plaster work must be performed from inventory vertical or suspended scaffolding.

When performing work on the internal stairwells, it is necessary to use special platforms (tables) with different lengths of support struts, which are installed on the steps. The working flooring must be horizontal and have parapet fences.

When working with harmful and flammable explosive materials that form explosive vapors, the room must be constantly ventilated, as well as for 1 hour after work, using natural or mechanical ventilation.

Places over which glass or facing works are performed must be fenced.

Glazing or facing works on several tiers on one vertical at the same time is forbidden.

It is forbidden to heat and dry the premises with roasters and other devices that emit fuel combustion products into the premises.

When working with solutions containing chemical additives, it is necessary to use personal protective equipment (rubber gloves, protective ointments, goggles) in accordance with the manufacturer's instructions, taking into account the composition of the substances used.

Respirators with safety goggles should be worn during dry cleaning of surfaces and other work related to the release of dust and gases, as well as during mechanized spackling and painting.

Wear safety goggles, rubber gloves and an acid-resistant apron with a bib when cleaning surfaces with acid or caustic soda.

Goggles must be worn when applying the mortar to a ceiling or vertical surface.

6.2.6.1. The order of works performance

Before the start of each shift, the serviceability of mortar pumps, hoses, dispensers and other equipment used during plastering must be checked. Manometers must be tested and sealed (pass state inspection). If the pressure on the manometers of the mortar pumps exceeds the permissible values specified in the passport, it is not allowed to work on the mortar pump.

It is not allowed to bend hoses at an acute angle and in the form of a loop, and also to tighten epiploons during work of plaster cars.

Workplaces of plaster station operators (nozzles) must be provided with two-way alarm (sound, light, radio, etc.) with workplaces of mortar pump drivers.

Operators who apply plaster to the surface with a nozzle and workers who spray the solution by hand must be provided with safety goggles.

When performing work on the preparation and application of paint mixtures, including imported, it is necessary to follow the requirements of the instructions of manufacturers on occupational safety.

All incoming components and ready-made paint mixtures must have hygienic certificates indicating fire and explosion hazards, terms and conditions of storage, the presence of harmful substances, recommendations on the method of application, the need for collective and individual protection.

It is not allowed to use solvents based on benzene, chlorinated hydrocarbons, methanol.

When performing painting works with the use of pneumatic units it is necessary:

– before the start of work to check up serviceability of the equipment by the pressure specified in the passport, the alarm system, existence of protective grounding;

– during performance of works not to allow bending of hoses and their contact to the moving steel ropes;

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– switch off the air supply and close the air valve during a break in operation or in case of malfunctions of the unit mechanism.

Frozen hoses must be heated in a warm room. Do not heat the hoses with open flame or steam.

Containers with explosive materials (varnishes, enamels, nitro paints, etc.) during the break should be closed with corks or lids, and open with a tool that does not cause sparks. Paints and varnishes must be stored at workplaces in tightly closed containers, in quantities not exceeding the variable demand, or in quantities not exceeding the capacity of the paint tank or standard flask (40 l). Each container with paint, solvent must have a sticker or label with the exact name of the material and an indication of flammable properties.

Empty containers made of paints and varnishes must be tightly closed and stored in specially designated places.

When painting in rooms with the use of pneumatic devices, as well as quick-drying paints and varnishes containing harmful volatile solvents, workers must be provided by the employer with respirators of the appropriate type and goggles. Such work must be performed with open windows or artificial ventilation. However, the amount of gases, vapors and dust in the work area should not exceed the maximum permissible concentration of harmful substances.

For fans it is necessary to use electric motors in explosion-proof execution, and to take out switches in a safe place.

Fire works (welding, etc.) must be carried out at a distance of not less than 15 m from the open openings of the premises in which the work is performed using paints and varnishes containing volatile organic solvents.

Paint sprays and hoses at the end of the work shift must be cleaned and rinsed of paint residues.

At the workplace where the spray paint which is under a high pressure of a paint and varnish material is used, there should be warning inscriptions "Flammable", "High pressure!". The strainers of airless spraying systems must be removed and washed at least once a week.

When painting by airless spraying, it is forbidden to use electric heating systems until the hydraulic system is completely filled.

During dry cleaning indoors, workplaces must be equipped with local dust extractors.

When mechanizing sawing of finishing blocks and plates it is necessary to use means of dust suppression – for example, water.

The spraying machine must be equipped with a wooden deck with a stream for water drainage. The flooring must be cleaned daily.

Lifting and transferring the glass to the place of its installation must be performed in a mechanized manner in a special container.

The lifting area must be fenced.

Cutting of glass must be carried out in separate heated rooms in a horizontal position on special tables.

Glazing works areas must be fenced and protected from falling glass with canopies or solid flooring.

6.3. Measures provided for in the project to ensure the safety of residents of residential building and visitors and staff of placed on the ground floor offices and public service facilities during the operation of the building

A significant problem of residential buildings with ground-floor service facilities is the noise protection of residential apartments and the isolation of adjacent space from visitors to service facilities, their vehicles and trucks delivering goods. The project solves this problem according to the requirements of Ukrainian national regulations: all entrances to the residential part of the building are organized from the courtyard, entrances to service facilities – from the street, loading of goods is carried out from the ends of houses, preventing trucks in the courtyard. Protection from street noise is also provided by the layout of apartments, where all bedrooms are oriented to the courtyard, and towards the street kitchens and living rooms are oriented.

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The sufficient problem in the operation of such buildings is to ensure the rapid evacuation of people (and if possible – and material values) from the building in case of emergencies. The most common emergency is a fire, and the current regulations provide for a set of measures that ensure rapid evacuation of people from the building, sufficient stability of load-bearing structures to prevent the destruction of the building during the evacuation, the use of construction and finishing materials that do not emit toxic substances, reducing the likelihood of fire through the use of fire-resistant materials and structures, appropriate solutions for engineering systems and equipment. A separate problem is to ensure the evacuation of persons belonging to low mobility groups. During the evacuation, such persons not only need more time to evacuate, but also significantly reduce the speed of evacuation of others.

Sectional dwellings usually have only one escape ladder in a section. Therefore, as the second evacuation exit in all apartments the exit to a balcony or a loggia not less than 1.2 m deep where there is a deaf partition not less than 1.2 m wide is used (thus the distance between adjacent window apertures should not be less than 1.6 m).

On the ground floor of the designed object it is created conditions for visiting it by persons belonging to low mobility groups: entrances from ground level, width of entrance vestibules not less than 2.2 m, depth of entrance vestibules not less than 1.8 m, door width not less than 0.9 m. The width of the stairways is 1.35 m, which provides an opportunity to evacuate some members of the less mobile population.

The entrance to the residential part of the building is organized from the ground level and with the help of an elevator with internal cab dimensions of 1.1x1.4 m, accessible to wheelchair users, all floors are accessible.

The width of passages, corridors and other horizontal escape routes is taken into account:

- one-moment flow density of evacuees, not more than 5 people per 1 m;
- minimum width of passages – 1 m;
- the minimum width of the corridor or passage leading to another building is 1.4 m.

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The width of the aisles between the equipment in the trading halls provides accessibility for low-mobility groups and meets the requirements for evacuation. The width of the main passages in halls with an area of up to 100 m² is not less than 2 m, in trade halls with an area of more than 100 m² – not less than 3 m.

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