

Kosovo Challenge Fund - Support Programme to vocational education and training (VET) in Kosovo

Project

KCF 200010 - KOS Skenderaj
Vocational High School "Anton Çeta", Skenderaj,
Kosovo

Document title

Technical Specifications Construction– Short
version for Contractor

Document date

April 2025



In cooperation with:

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CONTENT:

1	Construction Technical Specifiactions	3
1.1	Locantion and project description.....	4
1.2	Plans	5
1.3	Tecchnical description of Works.....	9
1.4	Details of Materials.....	10-14
2	Mechanical Technical Specifiactions	15
2.1	Mechanical Installations.....	16
2.2	Technical Details	17
2.3	Maps and design.....	18



Location

The plot is located in Skenderaj. Based on the given design task, the Project Designer has made the necessary technical interventions so that the designed building fulfills its function as required, both as a functional unit and simultaneously having the necessary characteristics as an architectural object and part of the urban profile.

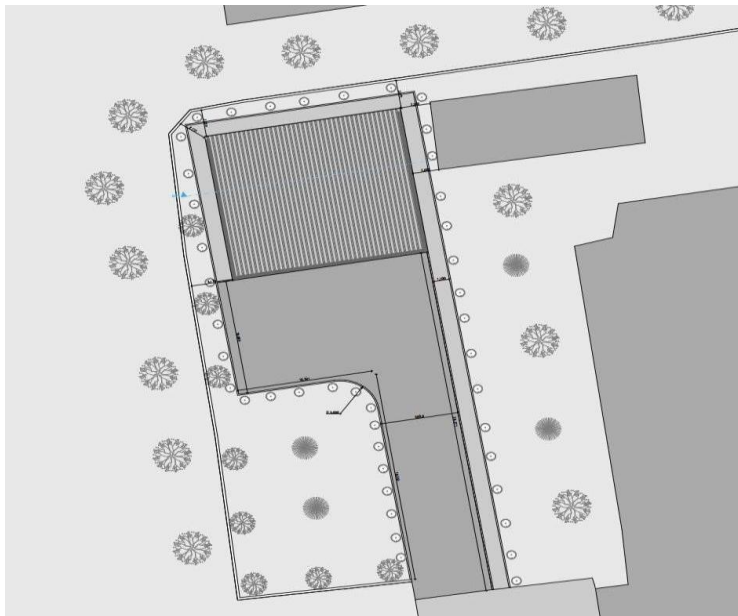


Fig. 1. Situation of the Annex

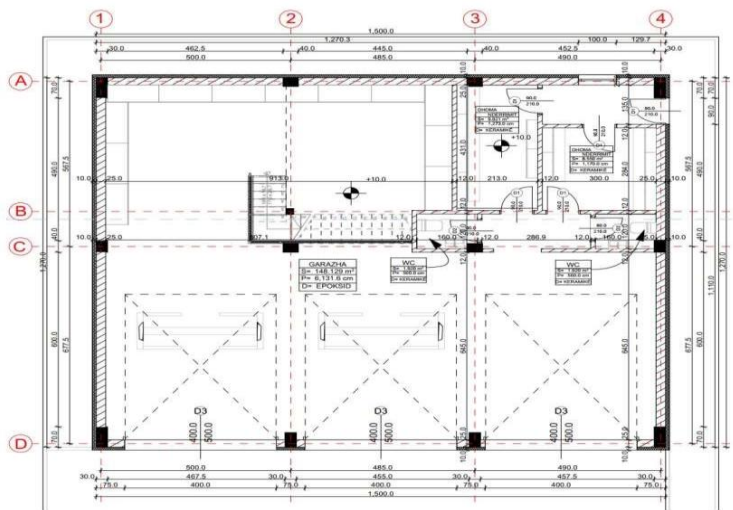


Fig. 2. Ground Floor Base

In Figure 2, the functional organization of the ground floor base is shown, where the garages, changing rooms, technical areas, and sanitary nodes are indicated. While in Figure 3, the functional organization showing the discussion room is presented.

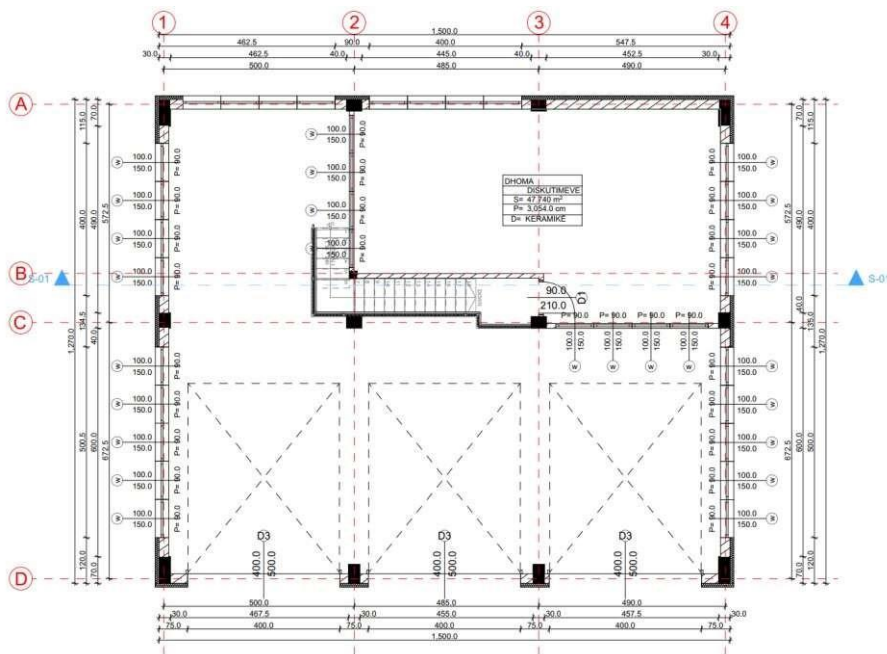


Fig. 3. First Floor Base



Fig. 4. 3D View

In Figures 4 and 5, the 3D views of the annex to the technical school are shown, along with the arrangement of the ground floor.



Fig. 5. 3D View

TECHNICAL SPECIFICATION AND DESCRIPTION OF WORKS

Design and construction must comply with the laws, administrative instructions, and technical regulations of Kosovo related to spatial planning, construction, environmental protection, energy efficiency, fire protection, accessibility, workplace safety, and where applicable, with international standards (ISO, EN, DIN). The designer is responsible for preparing the main building project based on the conceptual-ideational project and all laws, administrative instructions, and technical regulations of Kosovo related to spatial planning, construction, environmental protection, energy efficiency, fire protection, accessibility, and workplace safety.

The designer is tasked with preparing the construction documentation in order to obtain the building permit for the school building based on the provisions of the Construction Law no. 04/L-110, as well as the secondary legislation that follows it for Category II buildings and Administrative Instruction No. 06/2017 for determining the procedures for preparing and reviewing requests for building conditions, building permits, and demolition permits for Category I and II buildings.

Before starting construction work, the location must be fenced, and all necessary signs and boards must be placed in the appropriate places according to the provisions of the laws, administrative instructions, and technical regulations of Kosovo related to construction and safety.

The workshop must be organized in accordance with best practices for providing safety and public health for all personnel engaged in construction and workplace safety. During the construction phase, the Commission must implement all procedures related to supervision and

inspection of construction works, in accordance with the provisions of the Construction Law no. 04/L-110 and the secondary legislation that follows it, which relate to Category II buildings, and Administrative Instruction No. 05/2017 for supervisory inspection and the procedure for issuing a certificate of use. The concessionaire must obtain the Certificate of Use based on the provisions of the Construction Law no. 04/L-110 and the secondary legislation that follows it for Category II buildings and Administrative Instruction No. 05/2017 for supervisory inspection and the procedure for issuing a certificate of use. If there is any deviation approved by the Contracting Authority and the designer during construction, the designer must prepare the realized construction project before applying for the Certificate of Use.

- All materials and equipment installed must comply with ISO and EN standards. Wherever there is a discrepancy between two or more standards/documents, the higher standard applies unless specifically agreed upon with the Contracting Authority.

GENERAL CRITERIA

The main project and construction must comply with the laws, administrative instructions, and technical regulations of Kosovo related to spatial planning, construction, environmental protection, energy efficiency, fire protection, accessibility, workplace safety, and where applicable, with international standards (ISO, EN, DIN, CENELEC).

Project designers must ensure that the construction standards used in the design of educational buildings meet the building quality, value for money, energy efficiency, safety in design, construction, and use, proper cost consideration for the life cycle, and timely completion of the project. The project must also enable effective management and good operation of the building. The design and construction must comply, where necessary, and not be limited to the following list of laws and standards:

- Law no. 04/L-174 on Spatial Planning
- Law no. 04/L-110 on Construction (and its secondary legislation)
- Law no. 05/L-101 on the Energy Performance of Buildings (and its secondary legislation)
- Law no. 03/L-025 on Environmental Protection (and its secondary legislation)
- Law no. 04/L-012 on Fire Protection (and its secondary legislation)
- Technical Regulation no. 33/2007 on Building Objects, Technical Conditions for Accessibility for Persons with Disabilities
- Law no. 02/L-14 on Construction Products (and its secondary legislation)
- Law no. 02/L-30 (2005) on Waste
- Law No. 03/L-160, (2010) Law on Air Pollution Protection
- Law no. 03/L-025 (2009) on Environmental Protection
- Law no. 02/L-102 (2007) on Noise Protection
- Law No. 03/L-043, (2009) Law on the Prevention and Control of Integrated Pollution
- Law no. 03/L-214 (2010) on Environmental Impact Assessment

- Administrative Instruction No. 06/2017 for determining procedures for preparing and reviewing requests for building conditions, building permits, and demolition permits for Category I and II buildings
- Administrative Instruction No. 05/2017 for supervisory inspection and the procedure for issuing the certificate of use
- EN - Eurocode Standards
- CENELEC Standards
- ISO Standards
- DIN Standards

The main project for the Building Permit must be prepared in accordance with the contract, these criteria, technical specifications, the Conceptual-Ideational Project approved by the competent authority, as well as the standards and norms of design, construction, maintenance, and utilization. If there is any deviation approved by the Contracting Authority and designer during construction, the designer must prepare the realized construction project before applying for the Certificate of Use.

The designer must prepare the Execution Project according to these requirements: The main project must be prepared in accordance with the Standards and Regulations Guide, as well as all laws, administrative instructions, and other technical regulations related to spatial planning, construction, environmental protection, energy efficiency, fire protection, accessibility, workplace safety, and where applicable, international standards such as ISO, EN, DIN, and CENELEC. The construction documentation for obtaining the building permit must be prepared in accordance with the Construction Law and the secondary legislation derived from it for Category II buildings.

The main project and construction must comply with fire protection measures for buildings as provided in the Fire Protection Law (and its secondary legislation), the Conceptual-Ideational Project, Standards, and Best International Practices. Before the construction phase, the workshop must be fenced, and all necessary signs and boards must be placed in the appropriate locations according to the provisions of the laws, administrative instructions, and technical regulations of Kosovo related to construction and health and safety. The workshop must be organized according to the provisions of Kosovo's laws and best practices for safety and public health for all persons engaged in construction. The safety of all persons in the workshop, works, and facilities must comply with applicable laws and industrial good practices to avoid risks to those persons.

During construction, supervision of the construction and inspection of phases will be in compliance with the provisions of the Construction Law and its secondary legislation for Category II buildings, the Law on Spatial Planning, and other acts related to environmental protection, energy efficiency, fire safety, accessibility, and health and safety. The application for a certificate of use must comply with the provisions of the Construction Law and its secondary legislation for Category II buildings. Samples of materials, accompanied by quality certificates, certificates of origin, and warranty certificates, must be submitted to the Contracting Authority

for approval before installation. The Contracting Authority may request additional tests for physical, mechanical, and other properties before approving the supervisor on proposed installation elements or construction systems.

GENERAL MEASURES

Construction works must comply with the Building Permit and the Construction Documentation approved by the municipality. The Construction Documentation, Construction Book, and Construction Log must be kept on site to monitor construction works, which is necessary to obtain approvals for construction and to develop the executed project. The Construction Book and the Construction Log must comply with the Construction Law and its secondary legislation. Deviations from the Main Project that may occur during construction phases are not allowed without the approval of the Contracting Authority and Designer. If any deviation is approved by the Contracting Authority and Designer during construction, the Designer must prepare the realized construction project before applying for the Certificate of Use. Otherwise, if there are no deviations from the Main Project during construction, the Main Project is also the realized construction project. Construction works are carried out according to the detailed dynamic plan. The dynamic work plan includes the time, procedures, and methods for performing construction and completing the works. This includes the project representing the general arrangement of the workshop, temporary offices, and other temporary buildings, along with the details of the workshop and temporary works, as well as all other points needed for construction and completion of the works.

Following detailed technical specifications for some of materials:

1	Excavation of the layer of humus and soil with a thickness of 120 cm on the entire surface foreseen for the positioning of the object. The price should also include the transportation of the excavated soil to the landfill determined by the municipal authorities at a distance of up to 10 km. Remarks: The marked quantity represents the compacted volume where the friability coefficient is not taken into account. Note: A quantity of soil must remain in the workshop for eventual filling and modeling of the yard.
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2	Material supply and buffer work from gravel with a thickness of $t=50-70$ cm with a fraction of 0-400 mm in the entire width of the open channels around the perimeter walls of the foundations and under the elevator core, including leveling and compaction by mechanism until reaching of compactness $M_s=60$ MPa.
3	Material supply and buffer work from gravel with a thickness of $t=25-30$ cm with a fraction of 0-63 mm in the entire width of the open channels around the perimeter walls of the foundations and under the elevator core, including leveling and mechanical compaction until reaching of compactness $M_s=70$ MPa.
4	Material supply and buffer work from gravel with a thickness of $t=10-15$ cm with a fraction of 0-31.5mm in the entire width of the open channels around the perimeter walls of the foundations and under the elevator core, including leveling and mechanical compaction until reaching of compactness $M_s=80$ MPa.
5	NOTE 1: The contractor is obliged to take the concrete samples for each 'batch' of concrete, take care of their maintenance, sending them to specialized laboratories for the necessary examinations and providing relevant reports for all samples.NOTE 2:For the positions to be concreted with the additions specified below, the foreman is obliged to act according to the manufacturer's instructions, adhering to the mixing recipe, respecting the water-cementaggregate mix ratios, while the required additives must be added to the mixer after arrival in the workshop in the presence of the supervisory body.
6	Supply of material and foundation work for the support of the connected elements of the reinforcement of the perimeter foundations. Concreting should be done with poor concrete brand c-16/20MPa with a thickness of min 10cm on the gravel pad, including horizontal leveling. The width of concreting should be at least 10 cm wider on both sides of the foot of the foundations.
7	Supply of material, molding, and concreting of thermal plate. Concreting should be done with c-25/30MPa brand concrete with crystalline additive to achieve indescribability from water, at the rate of 1 kg for every 100 kg of cement. The price includes all the connecting tools, spacers and molds necessary for the realization of the position.
8	Supply of material, molding and concreting of pillars. Concreting should be done with c30/37MPa brand concrete. The price includes all the connecting tools, spacers and molds necessary for the realization of the position.
9	Material supply, molding and concreting of intermediate slabs with a thickness of 20 cm (level + 3.00 and +6.00), . Concreting should be done with c-25/30 brand concrete. The price includes all the connecting tools, spacers and molds necessary for the realization of the position.
10	Material supply, molding and concreting of the rest of the slabs with dimensions. Concreting should be done with c-25/30 brand concrete. The price includes all the connecting tools, spacers and molds necessary for the realization of the position.
11	Supply of material and masonry of 25-thick walls with baked clay blocks, Giter G5 bonded with mortar obtained by mixing sand with ready-made binders in a ratio of 3:1. The horizontal joint between the walls and the beams and the slab is filled with polyurethane mounting foam for damping.

12	Supply of material and masonry of 12 cm thick walls with baked clay blocks, Giter G5 bonded with varnish obtained by mixing sand with ready-made binders in a ratio of 3:1. The horizontal joint between the walls and the beams and the slab is filled with polyurethane mounting foam for damping.
13	The supply of material and the plastering of the internal surfaces of the walls in all alcoves on the ground and first floor, as well as the plastering of the ceilings in the alcoves without suspended ceiling, with pre-mixed material/mortar (lime+cement+aggregate) or with material of similar to 15 mm thick. The price includes preliminary treatment of the base with spray mortar or similar material, metal strips for determining the thickness of the plaster, metal corners, expansion strips (anputzlesite) made of plastic with reinforcing mesh and adhesive tape for doors and windows and the protection of all carpentry positions with PVC foil as well as PVC mesh with fiberglass to reinforce the mortar in any part where it passes from one material to another such as concrete blocks.
14	Material supply and finishing of the walls and ceiling of the technical alcoves with thin finishing varnish premixed with structure (lime + cement + fine aggregate).
15	Supply of material and patination of walls with two layers of plaster in all alcoves on the ground and first floor levels defined by the project.
16	Material supply and painting of patinated walls with two layers of polyurethane-based paint with great cleaning ability. Before painting, the surface should be adequately treated with base paint/primer for interior to reduce the absorption rate of the base, to improve the adhesion rate, etc.
17	Supply of material and leveling work in all internal alcoves with ceramic tile floors including the separation layer of adequate aluminum foil with heat reflection properties for underfloor heating, thermal and sound insulation layers as well as the perimeter strip of thick polyethylene 5 mm in contact with the walls as detailed for preventing structural sound transmission. The price includes the realization with the following layers: • Screed t=5 cm • Aluminum foil/substrate for pipe heating on the floor • Thermal insulation EPS® A100 t=3 cm • Thermal insulation EPS® T650 t= 2 cm
18	The supply of material and the covering of the floor of the technical alcoves with unglazed porcelain tiles with dimensions, color and texture/design to be selected in coordination with the supervisory body determined by the investor. The tiles must be slip-resistant of min. R12 class, resistant to temperature changes, frost-resistant, with a small degree of moisture absorption, abrasion-resistant and suitable for high attendance with shoes in public spaces, resistant to chemicals and against the creation of stains. The gluing of the tiles should be done with flexible and waterproof adhesive with 4 mm wide joints. The mass for filling the joints must be qualitative, flexible and resistant to water. The price includes the aluminum corner strips as well as the insulation of the working joints with mold-resistant sanitary silicone.
19	Supply of material and gluing of quartz tiles for parapet of all windows. The tiles must be attached with an appropriate quartz adhesive and have channels carved into the underside to prevent water from flowing towards the wall. The parapet, where possible, can be made with 1 single slab (without extensions). The price also includes closing the joints with waterproofing expansion strips and sanitary silicone. Thickness 2 cm Width 25 cm (3 cm must protrude from the wall) Color white

20	Supply (Work) and assembly of doors, made of PVC profiles (t=7cm), with thermopane glazing (4+12+4 mm), equipped with a qualitative mechanism that offers zonal Opening-Closing, according to the details (locksmith schemes)). All external doors and windows must be equipped with roller shutters with a manual mechanism, made of the same PVC material, of the same system. It is the duty of the foreman to measure the dimensions of the windows before production, in order to avoid possible errors... calculation according to square meters. Before starting work on windows and doors, consult the supervisory body for sample approval. DIm 90*210
21	Supply (Work) and installation of windows, made of PVC profiles (t=7cm), with thermopane glazing (4+12+4 mm), equipped with a qualitative mechanism that offers zonal Opening-Closing, according to the details (locksmith schemes) . All external doors and windows must be equipped with roller shutters with a manual mechanism, made of the same PVC material, of the same system. It is the duty of the foreman to measure the dimensions of the windows before production, in order to avoid possible errors... calculation according to square meters. Before starting work on windows and doors, consult the supervisory body for sample approval.
22	Thermal insulation of the perimeter walls for the sports gym and the school with styrofoam t=10 cm. Supply, transport and work of "DEMIT" Facade with these layers: Adhesive, Styrofoam N4T = 10 cm TIPLLA, Adhesive, Adequate plastic mesh, Adhesive, Fasadex 1.5 mm fully plasticized in white color. During the placement of the styrofoam tiles, use the dowels and expanding foam in order to provide the greatest possible stiffness of the styrofoam tiles for the wall. In this position, the opening of the horizontal joints according to the project with dimensions of 3*2 cm is provided, so there must be considering that in some positions it is necessary to work with Thermal insulation N4 - 8+2 cm. Also, the work of the drips of the facade around the object at the level of 0.0 m
23	The supply of the necessary material and the work of the roof construction, made of wood (conifer, floor II), with cross section 12/12cm and rafters 10/12cm with an axial distance of ~70cm, according to the details of the project. The position includes all consumables such as nails, clamps, bolts and the like. Wooden poles with dim. 12*12 placed at a distance of no greater than 4 m, reinforced with cleats and plaster. Beams with dim. 10*12 cm. The account is made for (m2), at the Base of the Peak.
24	Thermal insulation of the floor slab from above.-Supply and installation of "Styropor" thermoinsulating toxic slabs, 10 cm thick, from extruded polystyrene foam. The styrofoam plates were placed as thermal insulators according to the manufacturer's instructions and project details. The joints between the styrofoam plates were filled with expanding foam. Account according to the completed thermal insulation. The final account is made according to the actual sizes performed. Thermal insulation (stirpor) horizontal d=10cm
25	Supply of material and work of the leveling layer, Estrihut. The screed is made of cement mortar 1:3 with leveling of the upper surface. It is reinforced with rabc knitting (or fibers), placed in the middle of the layer. Before placing the screed, the floor must be swept well. Care should be taken to level it until it hardens. The placement of the verb PVC-on Styrofoam

	should also be calculated in the price. The account according to the cement leveling performed. The final account is made according to the quantities actually made.
26	Supply and installation on the floor rafters with wooden lamps t=18mm
27	The supply and assembly of the diffusive foil (Lamintek 14, Unofelt or similar) with a 10cm gap, on the lamp floor, the fixing of which is done with "Kontralistela" 1x4cm, on each rafter in their direction.
28	Supply and installation of horizontal wooden strips, with a cut of 3x5cm, their continuation is done only "On the rafters"
29	Supply and assembly of the cover made of corrugated sheet with trapezoid cross profile, 0.4 mm thick, gray color and anti-condensation layer. The calculation is made for (m2) of the base of the roof. This position also includes covering the attic with sheet metal according to the architectural detail. (Height of the attic = 120 cm)
30	The supply and assembly of the attic cover - the "cap" made of plasticized black sheet metal placed on the walls by means of metal supports which must be anchored in the concrete circle in advance. The width of the lid should be 41 cm. (based on the thermal insulation layers of the object and the thickness of the wall) see the detail of the attic in the architecture phase.
31	Supply and installation of vertical gutters, made of plasticized and colored sheet metal, $\delta=0.7\text{mm}$ with $\varnothing 12.0$ cm, circular cross-section with white color. The position includes all the necessary actions for this type of work, such as gutter holders, vertical heads, bends, welding, etc. Plasticized holders must be placed at 200 cm distances.
32	Supply of material and installation of horizontal gutters as detailed with dimensions of 25x25 cm. The price includes 10 holes with throats for connection to the vertical gutters and "Würth" quality silicone/or equivalent.
33	EARTH WORKS
34	Digging by hand and by machines, the soil is layered. III and IV in proportion 90% and 10%. The edges of the channels should be dug in a regular way and the bottom of the channel should be processed. The fine soil must be moved away from the channel at a distance of min. 1.00 m. - Excavation with machines in the average depth of the channel up to 0.80 m, and with a width of 0.60 m,
35	Supply, laying and covering of pipes with a layer of sand and gravel, according to the detail in the project.
36	Filling and covering the channel with the excavated material by compacting it in layers of 2030 cm.
37	DISTRIBUTION PANEL AND MEASUREMENT AND PROTECTION DEVICES
38	Main Mates frame, metal, door with key, wall mounting, IP 55 with bus bars for three phases and zero (dimensions 40x6mm) for devices according to the unipolar scheme and the fuse box.
39	Indirect three-phase meter 5 A, 400 V

40	Thermal magneto switch 100 A, 25 kA, 4 pole
41	Automatic fuse, 1P, cat.B/6kA, 16A - schneider type
42	Surge arrester 36 kA 4 pole
43	Generator automation with all 100A transmission equipment
44	Fine material such as busbars, clamps, shoes according to the unipolar scheme
45	FID 40/0.03A differential protection switch
46	Automatic fuse, 1P, cat.B/6kA, 20A - schneider type or similar
47	Automatic fuse, 1P, cat.B/6kA, 16A - schneider type or similar
48	Automatic fuse, 1P, cat.C/6kA, 10A - schneider type or similar
49	Automatic fuse, 3P, cat.B/6kA, 32A - schneider type or similar
50	Fine material such as busbars, clamps, shoes according to the unipolar scheme
51	From KSHK i TU in TS to KM on the floor, supply and extension of energy cable PP Al 4x25mm ² .
52	Supply and installation of power cables NYM-5x16mm ² .
53	Supply and installation of NYM 5x2.5mm ² power cables.
54	Supply and installation of NYM 3x2.5mm ² power cables.
55	Supply and installation of lighting cables NYM 3x1.5mm ² .
56	Supply and assembly of ribbed pipe PVC Fi 50mm.
57	Supply and installation of ribbed pipe PVC Fi 32mm.
58	Supply and installation of ribbed pipe PVC Fi 25mm.
59	Supply and installation of ribbed pipe PVC Fi 20mm.
60	Powering and placement of siteco LED lighting bodies 36 W, 60x60 cm
61	Reflector 50W, 4000K
62	Reflector 100W, IP65, 4000K
63	Powering and placement of 24 W LED panel lighting bodies, with motion sensor.
64	Power supply and placement of the 10A bipolar circuit breaker for wall mounting
65	Powering and placement of the 16A single-pole circuit breaker for wall mounting
66	Power supply and installation of single-phase single plug with earthing contact for wall mounting (10-16)A
67	Power supply and installation of single-phase double plug with earthing contact for wall mounting (10-16)A
68	Power supply and installation of single three-phase plug with earthing contact for wall mounting (20-25)A
69	Powering and extending the FeZn strip 25x4mm ² from the foundation of the building to the inspection measuring box

70	Powering and assembly of measuring boxes at an average height of 1.5m above the surface of the pavement and the FeZn crossover
71	Fastening and stretching of the FeZn strip 20x3mm through the concrete pillars from the measuring box to the roof
72	Fastening and connection of the FeZn strip with tensioners in the horizontal gutter and with two bolts in the plastic ribbed sheet of the roof
73	Fermentation and crosslinking of the FeZn strip
74	Energizing and stretching the FeZn strip 25x4mm from the grounding device of the foundation for the connections of the metallic masses and KSH x,
75	Power supply and extension for potential equalization with P/F 1x16mm ² breaker, for galvanic connection of metal masses, water pipes, heating

➤ Mechanical Installation

Electric boiler VIESSMANN VITOTRON 100 Q=24 kW, with integrated circulation pump and safety valve. The boiler will be connected with Steel radiators of "ENRAD" Gjilan, ordered complete with holders, valves for degassing and horizontal and vertical covers.

1. MAIN HEATING INSTALLATION DESIGN

To design the main central heating installation project for the P+1 building (ground floor + one floor).

The project shall be prepared based on:

- Data from the main architectural project,
- Climatic conditions of the Republic of Kosovo,
- Technical standards for the design of central heating installations for similar residential buildings.

During the design phase, the **underfloor heating system** with a **spiral method and forced water circulation** (boiler system) shall be adopted for the residential building.

For heating pipes, **Pe-Rt, PE-Xc 16x2.0 mm German-made or similar** shall be selected.

The building will be heated with hot water at **75/65°C**, which will be prepared by an **electric boiler** (e.g., "Vitotron 100" or similar).

All applicable technical standards for this type of installation must be followed.

2. TECHNICAL DESCRIPTION

The main heating installation project is based on data and drawings received from the architectural project and investor requirements.

The building consists of:

- Ground floor,
- First floor,
- Attic.

Heating Units

Radiators are selected based on:

- Heat requirements for the corresponding space,
- Window parapets.

Radiators **Type 22/600** are used for other spaces.

Sanitary units are heated using **pipe radiators**, locally produced in Gjilan, Type: **LUX**, dimensioned per space and heating needs.

Radiators are installed:

- Under windows or on interior walls,
- Mounted on wall brackets at 40 mm from the wall and minimum 100 mm above the floor.

They are connected using a **single-pipe system** with thermostatic valves and **Al-PVC pipes for central heating** according to **DIN EN ISO 15875**, with all necessary connection elements.

The radiators are calculated for operation at **75/65°C**, based on the latest EU standards.

Radiators come **pre-painted**, so additional painting is not required.

3. THERMAL SUBSTATION

The **electric boiler** will be installed in the ground floor area.

It has been selected based on the required heating capacity determined through thermal calculations.

Since the building is heated via radiators, a **24 kW electric boiler** (preferred type: **Vitotron 100 by Viessmann**, with integrated circulation pump) has been selected.

4. TECHNICAL CONDITIONS

4.1 Piping

- Must follow the technical description and graphic documentation.
- Pipe extensions **must not** go through walls or floor structures, only through accessible areas.
- When passing through walls, use **cylindrical rings** to prevent thermal expansion damage.

All supports, hangers, and brackets must be fixed on walls using cement plaster only – **gypsum use is prohibited**.

Concrete structural drilling is only allowed with prior approval from the construction authority.

Pipe insulation must be done with **Armaflex**.

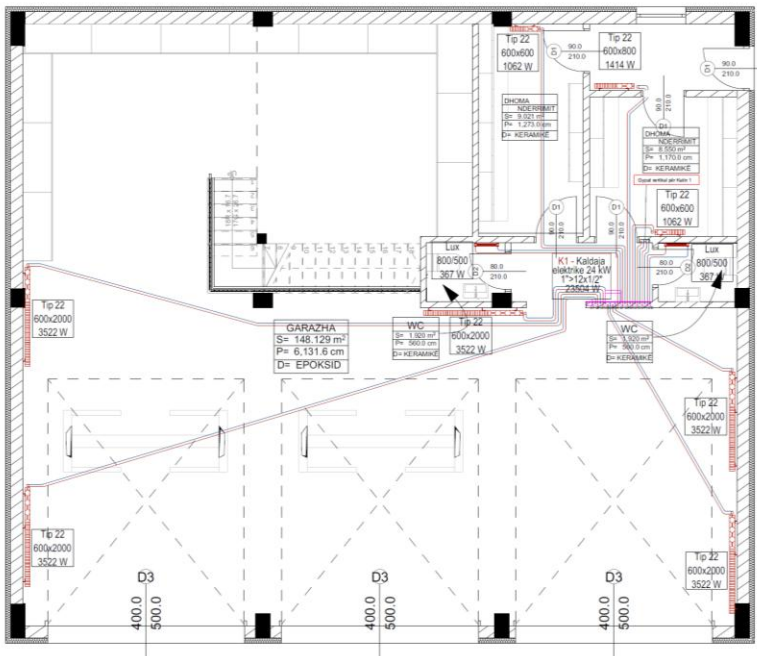
4.2 Inspection and Regulation

- Once piping and radiators are installed, the system must be **tested with cold water at 6 bar pressure**, in the presence of the responsible authority.
- All tests must be documented in the construction log.

5. HANDOVER OF COMPLETED WORKS

According to final procedures, the first step is the **acceptance of test protocols**, which confirms:

- Pipes, equipment, and devices function normally,
- All brackets and supports at critical points are secure and capable of withstanding thermal stress.



Mechanical Schema

