

FORM 1

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INVESTOR¹ Western Balkan Six Chamber Investment Forum
Plazza della Borsa nr. 14 34121 Trieste Italy

OBJECT² HIGH SCHOOL OF ELECTRICAL ENGINEERING "VASO ALIGRUDIĆ",
Podgorica, Montenegro

LOCATION³ c.p. 1193 cadastral district Podgorica I
Municipality Podgorica

TYPE OF TECHNICAL DOCUMENTATION⁴ ADAPTATION PROJECT OF PARTS OF THE FACILITY

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Licence no. UPI 107/7-705/8 od 26.07.2023

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¹ Investor's name

² The name of the object

³ Construction site, planning document, urban plot, cadastral plot

⁴ Conceptual solution, conceptual project, main project, i.e. the project of the finished object project (if it is the cover page of the entire technical documentation)

⁵ The name of the company, legal entity, or entrepreneur who created the technical documentation

⁶ The name of the responsible person in the company, legal entity, that is, the name and surname of the entrepreneur

⁷ Name and surname of the main engineer.

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INVESTOR ¹ :	Western Balkan Six Chamber Investment Forum Piazza della Borsa No. 14 34121 Trieste Italy
OBJECT ² :	"VASO ALIGRUDIĆ" HIGH SCHOOL OF ELECTRICAL ENGINEERING Podgorica, Montenegro
LOCATION ³ :	kp 1193 KO Podgorica I Municipality of Podgorica
PART OF THE TECHNICAL DOCUMENTS ⁴ :	ADAPTATION PROJECT OF PARTS OF THE FACILITY INSTALLATION OF EXTRA LOW VOLTAGE
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¹ Name of the investor

² Name of the projected object

³ Construction site, planning document, urban plot, cadastral plot

⁴ Architectural project, construction project, electrotechnical project, i.e. mechanical project (if it is the cover page of the part of the technical documentation)

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I TEXTUAL DOCUMENTATION

1 TECHNICAL DESCRIPTION OF THE FACILITY

1.1 INTRODUCTION

The subject of this investment-technical documentation is the electrical installation of low voltage for the High School of Electrical Engineering "Vaso Aligrudić" Podgorica Montenegro", which is located on cadastral plot no. 1193 KO Podgorica and Municipality of Podgorica, Investors Western Balkan Six Chamber Investment Forum Piazza della Borsa No. 14 34121 Trieste Italy.

The documentation provides technical solutions at the level of Adaptation project of parts of the facility installation of extra low voltage in accordance with the project task.

According to the architectural and construction solution, the building in question is part of the Machine Block (on the first floor) of the Vaso Aligrudić Electrical Engineering School, which is located at Vasa Raičkovića Street 26 in Podgorica. The building is built in a skeletal system of brick products, P+1 floors, and the clear height of the rooms is 3.25 m. The building is designed for education.

The project envisages:

- Installation of structural cable system - SKS
- Installation of an automatic fire alarm system
- Installation of the IP video surveillance system

During the creation of this project, the appropriate legal provisions, special regulations, technical norms, quality norms, standards and professional recommendations were observed.

1. 2 ELECTRICAL INSTALLATIONS OF EXTRA LOW VOLTAGE - TECHNICAL DESCRIPTION

1.2.1 Installation of structural cable system - SKS

One RACK cabinet is planned in the building, in the "Kitchen" room, and when performing the work, consider whether it is better to move the RACK cabinet to the other side of the wall, i.e. in the "MPS - multifunctional hall" room.

The project envisages that the operator will directly bring the optical SM cable to the RACK cabinet.

The telecommunications jacks are shielded FTP RJ-45 cat.6, modular and installed in installation boxes, in accordance with the dimensions and estimate of the electrical installations of high and low current. Connections are placed at a certain height from the level of the finished floor defined in the drawings of the electrical installations of high and low current.

S/FTP cat.6 LSZH cables are laid from the Rack cabinet to each connector in the facility. The cables are routed partly along the wall under the plaster, and partly through the concrete floor liner, in installation pipes with an internal diameter of Ø16mm. The computer S/FTP network is a universal installation according to the EIA/TIA T-568B standard. This type of installation can support all types of telephone and computer networks.

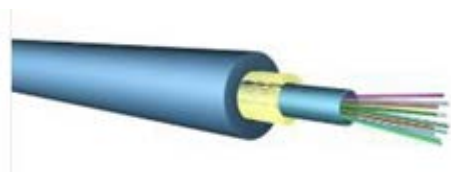
System elements:

Rack cabinet



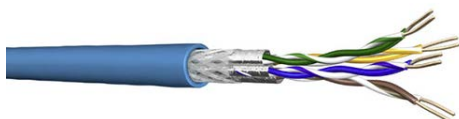
- 27U / 19"
- Wheels and feet with leveling
- glass door with lock
- glass front door
- ventilation unit
- cable entry on top and bottom
- load capacity 300 kg
- 600x600x1400mmmm (WxDxH)

Singlemode optical cable



- System cable or equivalent (for a 25-year warranty) loose tube, indoor/outdoor, CPR rating Dca-s2-d2-a1
- protection against rodents
- attenuation (dB/km) 1310nm-1625nm: ≤0.39; 1550nm: ≤0.25

S/FTP (Wall) cable cat. 6 LSZH



- System cable (for a 25-year warranty) - Construction S/FTP Cat.6 250 MHz AWG 23
- CPR rating Dca-s2-d2-a1
- dense twisting of pairs, whole bundle protected by foil, plastic cross

It is used to connect RJ-45 sockets located in wall installation boxes by room (defined by the High and Low Current Electrical Installation Project) with the associated ports. The provided cable enables data transfer at a speed of 1 Gb/s, which is more than enough considering that the terminals that will be connected to the LAN network do not have ports that require speeds higher than the specified.

Connectors RJ-45 cat. 6

RJ-45 cat connectors are provided for horizontal cable installation. 6, according to the international standard ISO/IEC 8877, which enable the transmission of data in class D according to the ISO/IEC 11801 standard. In each room, the required number of RJ 45 sockets is provided. The rear side of the RJ-45 connector has a so-called IDC connectors (Insulation Displacement Contact) for permanent fixing of rigid S/FTP (FTP Wall) cables using a special tool. This kind of contact is of the highest quality at high speeds. S/FTP patch cords are placed on the side of the sockets, where there is an RJ-45 connector on one side, and on the other RJ-45 if the socket is a computer socket, or RJ 11 6/4 if the socket is a telephone socket, where use two central pins in the RJ-11 connector.

In case the User wants to create a computer network for the business premises, a switch with the appropriate number of ports and patch cables cat. 6 are connected to the modules in the communication hub. In this way, the connectors from the room are connected to a common switch in the local computer network, with possible performance of 10/100/1000Mbps, depending on the switch device.

After building the described system, it is necessary to perform the necessary measurements and create a protocol with the results.

The passage of telecommunication cables is realized through suitable halogen-free installation pipes. The principle scheme of divorce is given in the drawing.

The project solution for the realization of horizontal cabling defines copper cables with 4 twisted pairs, minimum performance level of category 6. Conductors (solid wire) should have a diameter of *0.57 mm* (23 AWG). The design solution determines the use of cables with shielded (screened) twisted pairs — *S/FTP (Foiled Twisted Pair)* category 6. Standard *ISO/IEC 11801* defines the maximum length of horizontal cabling of 90 meters. The selected routes for the cables in the facility ensure that this condition is met.

When laying the installation cable with twisted pairs, care should be taken not to violate the minimum bending radius of *20 mm* (four times the diameter of the cable), as well as to ensure that the distance from the electrical installation of high current is at least 30 mm. Each RJ45 jack should have a female 8-pin *IEC 603.7* category 6 modular connector for 100Ω.

Appropriate category 6 installation S/FTP cables will be connected to the socket connectors. During installation, care should be taken that the spread of the twisted pairs of the installation cable when connecting to the back side of the socket connector does not exceed *13 mm*. Connectors represent the place where the fixed installation of the cable system begins. From the front side of the computer jack connector, connecting the flexible cable connects the User's equipment (computer or telephone) to the telephone/computer system.

The connection of active communication equipment for the implementation of a local computer network should be done by placing an active device on the communication node, while using as many modules as desired, while the rest of the modules would remain intended for telephone installation. Connecting active equipment to hub modules and redirecting tel. the line to certain connectors is made with *patch cords*. These flexible cables consist of 4 pairs of twisted *copper* conductors that meet the requirements for category 6 cables from the *ISO/IEC 11801 / Annex C standard*. These S/FTP cables can be up to 5 meters long (in this project, with their average length of 50cm-1m) and at their ends should be mounted appropriate 8-pin *RJ-45* (male) connectors (*RJ-45-Plug*) category 6 in accordance with *the IEC 603.7* standard. These connectors should be connected to the cable using the same wiring system used for the connectors (*T-568B*).

A switch with the appropriate number of ports is placed on the communication hub and connected to the modules in the communication hub with category 6 patch cables. In this way, the connectors are connected to a common switch in the local computer network, with possible performance of 10/100/1000Mbps, depending on the switch device. The principle scheme of connection and distribution of cables is given in the graphic attachments.

Note: Delivery and installation of the telephone switchboard and active equipment is the responsibility of the Investor.

1. 2.2 Installation of automatic fire alarm

The building will be covered by a stable fire alarm installation. The system envisages one conventional switchboard. The switchboard is located in the "Kitchen" room, next to the RACK wardrobe (in the event that during the execution of the works it is considered that the switchboard is better placed in the "MPS - multifunctional hall" room, this can be done on the same wall only on the other side).

The signaling system consists of:

1. Alarm centers;
2. Devices for detecting smoke, elevated temperature and fire in protected rooms;
3. Devices for activating / deactivating the fire protection system;
4. Executive elements of the system;
5. Transmission paths of signals and commands.

The fire alarm system is intended for the early detection and detection of smoke and/or elevated temperature - flames in protected rooms, as well as a sudden increase in temperature, which is made possible by the installed sensors (optical, thermal and optical-thermal detectors, as well as manual fire detectors). around the protected premises, then processing the signals coming from the sensor to the control panel and forwarding the signal via the output of the fire control panel to the executive elements of the system.

The central unit of the system

The central unit provides the following functions:

- control of the system's working capacity and error signaling in case of deviation from the expected parameters;
- receiving and registering information about the occurrence of a fire;
- alarming and reporting in case of fire;
- signals for controlling fire doors, elevators, air conditioning and power supply in the building in accordance with *the Elaborate on fire protection* ;

The fire alarm system is intended for the early detection and detection of smoke and/or elevated temperature - flames in protected rooms, as well as a sudden increase in temperature, which is made possible by installed sensors (optical, thermal detectors, as well as manual fire detectors) in protected rooms, then processing of signals coming from the sensor to the control unit and forwarding the signal via the output of the PPZ control unit to the executive elements of the system.

The control panel provides a clear presentation of pre-alarm and alarm conditions, as well as other phenomena, by means of LED-indicators, and by printing the location and time of the registered event on the display. Also, the control center processes and stores information collected in communication with all peripheral elements (primarily with detectors) and provides executive control functions according to the given program.

The central unit is primarily powered from a separate circuit of the facility's general consumption installation. The reserve power source is represented by accumulator batteries, which are constantly replenished and kept in a state of readiness. In the event of an interruption of the supply from the primary source of electricity, the batteries automatically and without interruption take over the power supply of the system. The control unit periodically tests the capacity of the batteries and, in case it detects their deterioration, gives the appropriate signal.

Fire control panel



- conventional switchboard with the possibility of accepting 2 zones (non-expandable)
- 32 detectors per zone
- one programmable output/input for each of the zones
- monitored output for siren activation
- programmable relay output
- dedicated output for the answering machine
- illuminated alpha-numeric display
- memory of the last 100 events
- protection against deep discharge of batteries
- possibility of programming via computer
- certified in accordance with EN54-2 / EN54-4 and EN12094-1 standards

Detectors

An adequate type of automatic detector for each of the rooms is determined on the basis of the expected early manifestations of fire, the purpose of the room, the fire load, as well as possible disturbing influences. The required number of detectors in the monitored area and their placement is defined in accordance with the manufacturer's recommendations.

The conventional automatic smoke (optical) fire detector has an opto-electronic chamber for the detection of dark and light smoke particles with increased immunity to false alarms. It represents the basic type of detector in the system and is used in all administrative areas. It is designed as a basic type of fire detector and is mounted on the ceiling of the room. In the case of a suspended ceiling, the optical detector is also used to cover the space between the suspended ceiling and the ceiling. The rule applied is that one detector monitors an area of 60 m² for ceiling heights <6 m, except in extinguishing zones where, as a rule, for two-zone dependence, the monitored area is reduced by 50%, i.e. the area covered by the smoke detector is 30 m². Accordingly, the maximum distance between two optical smoke detectors is 1.2x√60 = 9m, and the maximum distance of the detector from the wall is 4.5m, i.e. in extinguishing zones 1.2x√30 = 6.5m, and the maximum distance of the detector from the wall is 3.2m. In passages and corridors that are narrower than 3 m, the distances between detectors do not exceed 15 m.

The thermal fire detector is equipped with one thermal sensor, while the optical-thermal sensor has an opto-electronic chamber with two optical sensors for detecting dark and light smoke particles, as well as one additional thermal sensor that increases immunity to false alarms. They cover 20m² and the height of the space up to 7.5 meters.

All detectors are resistant to standard disturbances that may occur (dust, fibers, insects, humidity, condensation, EM influences, corrosive vapors, vibrations, shocks, etc.), have an alarm indicator visible in a 360° circle, as well as a built-in line isolator from short connections and disconnections. The detectors are mounted on a base made of synthetic material resistant to shocks, vibrations and scratches with terminal contacts without screws. In places where detectors are installed in spaces without a suspended ceiling or on the roof structure, additional supports for surface mounting are provided into which the cable is inserted from the side. When mounting the detector, it is necessary that the location of the detector is coordinated with the position of other elements that are installed in the ceiling (lights, elements of mechanical installations) and building elements (beams, walls, etc.), whereby: - the distance of the detector from the wall should be minimal 50 cm, - the distance of the detector from the beam (rib) should be at least 50 cm, - the distance of the detector from the place of air injection should be min. 50 cm, - the distance of the detector from the lamp should be at least twice the height of the lamp. When laying the cables, in the places where the installation of the detector is planned, the cables should be left in a slightly longer length in order to be able to carry out the aforementioned alignment.

Optical smoke detector

- ISP technology (Intelligent Signal Processing)
- reliable operation and high resistance to interference
- mesh with openings with a diameter of 500 µm, for protection from dust and insects

Thermal heat detector

- ISP technology (Intelligent Signal Processing)
- reliable operation and high resistance to interference
- the possibility of programming the operating mode: thermo-maximum 58°C/72°C; thermo-differential

Detector base

- - built-in jumper that ensures continuity in case of disassembly of the associated detector
- -material: polycarbonate
- -dimensions: Ø110mm x 24mm

Manual fire detectors

They are provided in visible and accessible places, along the evacuation routes. With lye for manual activation of the alarm in case of fire, without checking time and thus plays a role in fire protection for direct alarming. Any alarm caused by their activation is considered a sure sign that a fire has occurred and operates without a time delay. The detector consists of detector electronics with direct activation by breaking the protective glass and a red housing. A short -circuit line isolator is built into the detector . The detectors are mounted at a height of 1.5 ± 0.2 m from the floor level.

Hand-held call point

- LED status indicator: green-standby; yellow-error; red-alarm
- two integrated isolators
- automatic and manual adjustment

System executive functions

The functions that the subject system should perform in the event of a fire are defined *in the Fire Protection Elaborate*.

For the purposes of managing the work of other systems that are in the function of fire protection of the building, as well as receiving signals from them, are determined corresponding interface modules. The modules are installed in special housings intended for wall mounting or in the suspended ceiling where they exist or on the wall.

In the event of a fire in the building, different technical systems are commanded in order to perform certain functions: sound alarm, activation of sirens and playback of recorded messages in the sound system, lowering the elevators to the evacuation level and shutting them down by acting on the elevator control cabinet, unlocking doors in the system access control and are on the evacuation route, smoke extraction of the atrium and lobby bar on the ground floor, and added module for opening the door in case of fire, turning off the air conditioning and lowering the PP flaps, by acting on the energy cabinets, turning on the smoke extraction and ventilation system of the building's garage, turning on the elevator overpressure, turning on the ventilation, turning on the overpressure in the staircases, in the evacuation elevators and/or windows in the stairs on the last floor of the building, flow indicators, fire executive function, while the signals (bolt and relay) indicate a system error, which are connected to the central via the I/O module.

Alarming

Alarming in case of fire is provided as follows:

- by activating electronic sirens with the required sound levels;

The sirens are mounted on the wall, according to the graphic documentation at a height of 2.2m, corrections are possible on the spot (mechanic plan of MEP or interior design). One of 24 different warning tones can be programmed on the siren.

Internal siren



- automatic addressing by the central office
- sound pressure 101dB(A)@1m
- 14 types of melody available

Notification

The project envisages the installation of a machine with a recorded voice message, intended for telephone reporting of alarms and errors.

Alarm plan

With this alarm concept, in the event of a fire, staff can make decisions within the automatic sequence of operations. In this way, false alarms are not transmitted to the fire department. The impact of any human error is reduced by the technology of applied solutions.

The fire alarm system supports two modes of operation "day" and "night" in accordance with the Ordinance on technical norms for stable fire alarm installations ("Official Gazette of the FRY", no. 87/93).

Upon alarming of the automatic fire detector in the "day" operating mode, an internal light and sound alarm is given on the operating console of the fire alarm control panel. This is the first warning sign for the person on duty. In the event that the person on duty is not present, after the expiration of the pre-programmed time (from 20 - 60 seconds), which is also called "presence time", a general alarm occurs in the facility.

In a normal situation, the person on duty-operator who is always present, by pressing a button, confirms that he has received the information from the system. This confirms the presence and at the same time starts another programmable time, "reconnaissance time".

The reconnaissance time depends on the size and geometry of the monitored object and is defined separately for each object during the functional testing of the system. This time usually lasts 3 to 5 minutes.

Upon confirmation of presence, the person on duty on the operating console reads the exact location of the detector in the alarm, goes to the scene and in the event of a fire presses the nearest manual detector (as a confirmation of the alarm in the system) and proceeds to extinguish the fire in accordance with the predetermined operational plan in case of fire.

In the event that the automatic detector reacted to some disturbing influences (strong dust, water vapor, etc.), and the person on duty determines by inspection that it is a "false alarm", returns to the operating console, cancels the "internal" alarm and the system continues to function in regular operation mode.

Alarms from manual detectors do not have a delay and immediately indicate a general alarm condition in the building, considering that they are considered a reliable sign that a fire has actually occurred.

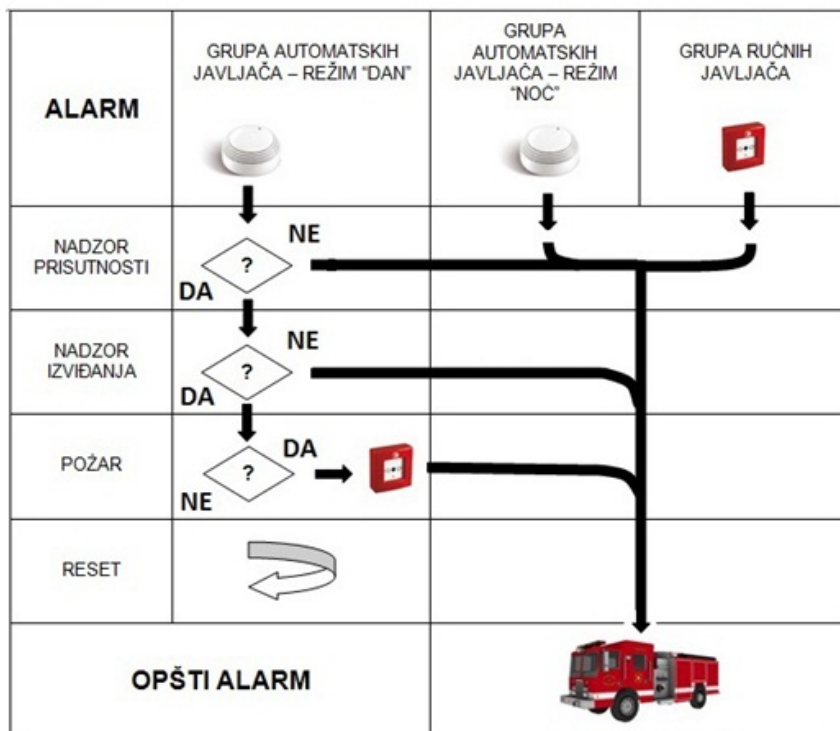
The control unit has the ability to switch the operating mode from "daily" to "night" mode. This switching must be done semi-automatically, i.e. automatically (via the switching clock) from day to night work, and manually from night to day work.

In the "night" operating mode, all alarms in the system are considered relevant and are automatically forwarded to the person on duty and/or the fire department without the previously described reconnaissance and confirmation time.

The warning plan is defined by the fire protection project and provides the following:

- warning persons in danger for timely evacuation
- inclusion of the person on duty and the fireman on duty, that is, the local fire department
- alerting the nearest fire department
- alerting personnel who have special duties in case of fire
- taking all measures in case of failure or disconnection of individual zones.

The block diagram of the alarm plan for day-night organization is shown below.



Installation

The cable distribution of the system will be realized with a paired, shielded, halogen-free cable, which will be pulled into halogen-free installation pipes of the appropriate section before laying.

For connecting system elements, a fire-resistant cable of type JE-H(St)H 2x2x0.8mm FE 180/ E90 is specified, the construction of which is shown in the following picture:

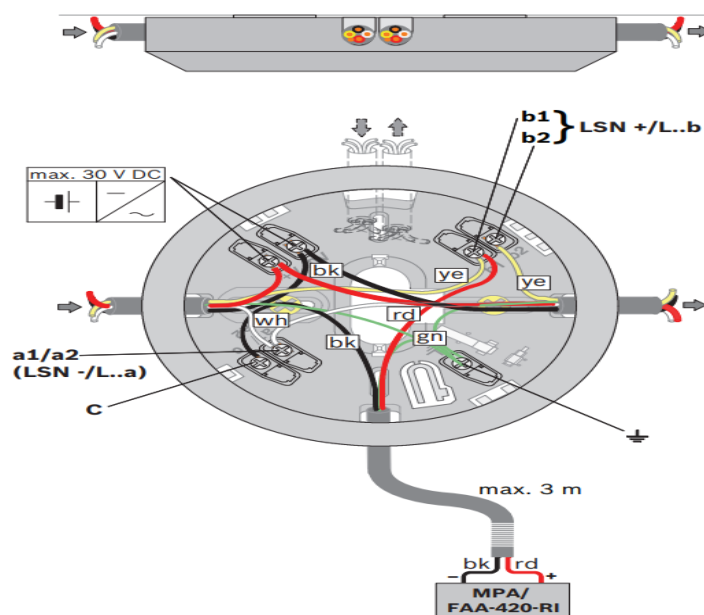


The component parts of the cable, marked in the picture above, are:

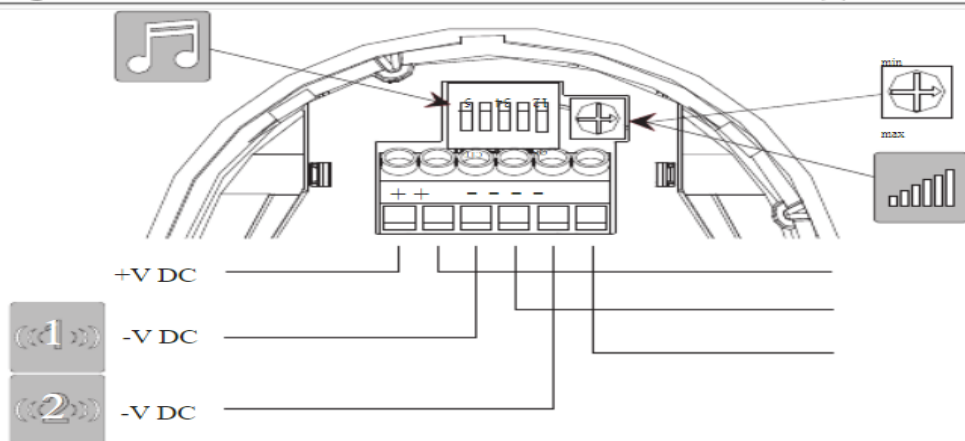
1. conductor (full-section copper wire, diameter 1 mm)
2. insulation of conductors (flame-retardant compound based on halogen-free polymers)
3. cable core (2 x 2 conductors twisted into pairs)
4. inner cover (polyester tape + glass fiber tape)
5. sheath made of polyester laminated with aluminum, with longitudinally placed draining copper wire, diameter 0.8 mm (protection against EM-interference)
6. cable insulation (flame-retardant compound based on halogen-free polymers)

The specified type of cable, in the event of a fire, ensures the integrity of the circuit for 90 minutes, according to the DIN 4102-12 standard.

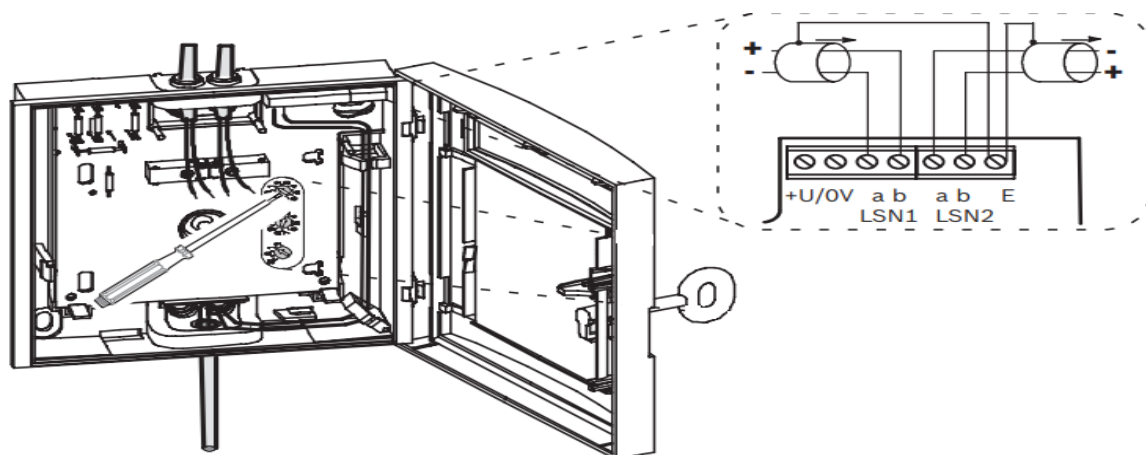
Below are the schematics __ connecting elements .



Detail of connecting the detector bases, as well as the parallel indicator with the detector



Siren connection detail



Detail of connection of manual call points

Conditions for functional testing and maintenance of a stable fire alarm installation

The following documentation must be obtained for functional testing of a stable installation:

1. The project of the derived state of the stable installation for reporting,
2. Alarm plan
3. Instructions for operation and maintenance of the call center
4. Program of operation of the control center and management of ventilation, air conditioning, dampers, doors and disconnections
5. Inspection and testing control book
6. All reports and certificates on the testing of installed equipment
7. Test lists and protocols for electrical installations

During the functional testing of a stable installation, the operation of each built-in element must be tested - each detector, each element for alarming and all elements for signal transmission, as well as the operation of the alarm center and all the functions and controls it performs. After eliminating all observed disturbances and malfunctions and retesting, a report is issued on the functionality of the stable fire alarm installation.

at least a free space around each automatic call point
750 mm.

The user of a stable installation is obliged to provide an inspection of the installation:

1. After the fire
2. After the appearance of signs of impaired operational readiness
3. In case of improper functioning
4. When changing technology

5. When changing the purpose of the site that affects the application of technical surveillance measures

Measures of regular maintenance of stable installations must be entered in the control book.

The operation of the stable installation is checked by the responsible person of the user at intervals of no longer than two months.

During the regular work check, the following must be examined:

1. At least one detector per primary line
 2. All alarming elements
 3. All signaling transmitters and receivers
 4. All automatic shut-off devices
off ventilation, drives, etc.
 6. Power supply devices (visual inspection of connections and electrolyte level)
- Periodic inspections of the stable installation are performed at least once a year.

The periodic inspection includes functional control of the stable installation and a detailed inspection of all components.

During the annual periodic inspection, the following must be carried out:

1. Checking the control book on the previous inspection, and the list of works that were subsequently performed on the installation
 2. Inspection and testing of the connector on the battery, the level and density of the electrolyte in each cell, as well as the measurement of battery capacity
 3. Checking the operation of indicators and control elements on the alarm center, as well as all disconnections and control of technological equipment
 4. Testing the operation of alarm elements, transmitters and receivers of remote fire and malfunction signaling
 5. Testing of interference indicators – simulating failures on primary lines and electrical power supply devices.
 6. Checking the operation of each individual fire detector according to the manufacturer's instructions
 7. Inspection of cables, lines, distribution cabinets, terminals and distribution boxes (that they are undamaged and adequately protected and marked)
- A detailed inspection of all components of a stable installation must be carried out every five years.

1.2.3 Installation of the video surveillance system

The video surveillance system in the facility is based on IP technology. The main purpose and goal of the surveillance security system is:

- Provide protection of critical infrastructure from unauthorized access and actions,
- Enable monitoring of corridors and multifunctional halls
- act preventively against break-ins and damage to property and provide assistance in identifying perpetrators,
- to enable subsequent analysis of the archived video material.

In accordance with the security aspect, the solution envisages the installation of high-quality color and day/night cameras.

Dome camera

- 5Mpx/20fps, turret
- fixed lens 2.8mm
- Onvif, 12VDC/PoE,

The central NVR device is located in the RACK cabinet and allows the connection of all cameras in the facility. The NVR device has the ability to power cameras at a distance of up to 100m.

NVR device

- 4 channels
- supports 8Mpx/5Mpx/4Mpx/3Mpx/1080p
- 1xHDD

Archiving of video material should be done using an efficient compression algorithm (recording only changes between video frames) and will enable archiving of recorded material for at least 15 days.

The installation of the system will be carried out in the same way as the installation of other telecommunication systems, partly in cable racks and partly in halogen-free, installation pipes of the appropriate diameter.

The laying of installation cables must be carried out under the constant supervision of the technical staff of the chosen company, who will perform assembly, connection, testing, commissioning and delivery of the installation with the issuance of a guarantee.

The system distribution scheme, equipment disposition and cable routing are shown in the drawings in the graphic part of the project.

RESPONSIBLE ENGINEER

Slobodan Marković, dipl.ing.el..

2 TECHNICAL REQUIREMENTS FOR WORK PERFORMANCE

2.1 GENERAL PART

When performing the works, it is mandatory to meet the following technical conditions:

Technical conditions, as an integral part of the project, oblige the Contractor as well as other participants in the implementation of the investment to adhere to the solutions given by the project during the execution of the works.

The investor is obliged to provide professional supervision over the execution of the works during the execution.

Before starting the works, the contractor is obliged to review the project, drawings with preliminary measurements and estimates, propose certain suggestions for improving the solution and, after coordination with the designer and the supervisory authority, create a dynamic plan and approach the realization of the investment.

The contractor is obliged to obtain the written consent of the supervisory authority for all deviations from the project during the execution of the works, and for major changes the supervisory authority will seek the consent of the investor and designer. All changes must be made in the project of the derived state.

On the basis of the project and valid regulations, the Contractor will record the routes of the entire installation and the locations of the switchboards, and only after obtaining approval from the supervisory authority will he begin work.

All materials and equipment, which will be used for making installations, must be of first-class quality and fully comply with the standards for the intended materials and equipment. Upon bringing the material to the construction site, the supervisory authority is obliged to inspect the material and record its condition in the construction diary.

For the complete equipment installed on the building, the Contractor must obtain certification documentation. The installation must be carried out according to the current Rulebook on technical standards for low-voltage electrical installations ("Official Gazette SF-RJ" no. 53/88, 54/88 and 29/95).

During the execution of the works, the Contractor is obliged to keep an up-to-date construction diary with all the information such a diary should contain. All requests, announcements and notifications from the supervisory authority, designer, contractor or investor must be properly recorded in the diary.

The Contractor is obliged to remove all defects found by the supervisory authority during the inspection of the works as soon as possible at his own expense.

When handing over the works, the contractor is obliged to hand over to the investor certificates and guarantee sheets for all installed equipment.

For the correctness of the performed works, the Contractor provides a guarantee that cannot be shorter than the agreed one, counting from the day of the commission inspection of the installation. During the warranty period, the contractor is obliged to repair as soon as possible at his own expense all damages that may occur due to poor material or unsound workmanship.

For the reliable and correct functioning of communication equipment, the quality of electrical installations in the building is very important, especially from the level of quality of grounding and phase balance.

For everything that is not expressly stated in these conditions, the Contractor is obliged to comply with applicable regulations and standards.

2.2 TELECOMMUNICATION INSTALLATIONS

Any continuation or branching of lines is allowed only in lead-in boxes and cabinets. Installation of pipes in the wall begins after rough plastering and when it dries well.

PVC pipes are laid in hollow channels in the wall, and steel, seam-black pipes are attached to the steel structure by welding or using metal brackets (as holders).

In the case of installing several pipes in one direction (either on the wall or on the rack), the pipes are laid next to each other, in the installation plane, and not one above the other.

The front side of the PVC pipe must lie in the level of the brick (that is, the wall mass), so that the pipe is covered with the entire layer of plaster.

It is not allowed to deepen the channels in reinforced concrete walls and columns, but they are left during the actual construction of the walls and columns.

PVC and steel seamed black pipes should always be laid in a straight line, both horizontally and vertically.

When laying horizontally, the pipes are allowed to have a slight slope towards the boxes, so that condensed water does not remain in the pipes. If, during the horizontal laying of pipes, it is necessary, due to some obstacle, to temporarily deviate from the direction, it is allowed to go around the obstacle in a slight arc and return to the adopted laying direction.

At room corners or wall outlets, changing the pipe laying direction is performed by bending the pipe in the shape of an arc. A well-executed arch, when placed in the wall, must be covered with at least an entire layer of plaster.

Changing the direction of pipes on free wall surfaces is done in boxes.

Laying risers in chimney walls is not allowed, and such laying of other pipes should be avoided.

The following regulations must be adhered to in the case of parallel guided pipes, i.e. telephone installation cables in pipes and other installations:

- at 0.10 m, pipes or cables for telephone installation are placed under the ceiling;
- at 0.10 m, under these pipes or cables, pipes or cables are placed for signal installation;
- at 0.10 m, under the pipes or cables for signal installation, pipes or cables for high current electrical installations are placed.

In any other case, when pipes or cables for telephone installation run parallel to pipes or cables for high current, the distance between them must be at least 0.20 m.

When crossing pipes for telephone installation with pipes for high current, if this is unavoidable, you should

crossings should be made at a right angle, and the distance between the pipes must be at least 10 mm, with special insulation measures of at least 3 mm.

At a long distance between distribution boxes or if there are more pipes at a distance between distribution boxes

curve, before the pipe is plastered, a steel wire should be inserted through it for later routing of the lines.

Before plastering the pipes, all junction boxes should be closed with paper so that they are not filled with plaster or paint during the plastering and painting of the walls.

In the case of parallel laid pipes for telephone lines, for bells and for strong current, in places where vertical pipes are separated from horizontal pipes and vice versa, junction boxes are placed on an oblique line that forms an angle of 45 degrees with the pipes.

It is allowed that two telephone lines come out of one pipe in one room.

Minimum mutual distances when laying cables in parallel:

- telecommunications next to signal is 0.05 m,
- telecommunications next to energy is 0.30 m.

No other plug box or any outlet from the pipe (e.g. electric lighting, thermal current, etc.) may be placed around the telephone socket, at a distance of less than 20 cm, except for the radio antenna and the signal bell, which must be on distance of at least 10 cm.

The insulated conductors are pulled into the pipe only when the glue is dry.

Telephone lines, if possible, must be continuous.

It is not allowed to continue the conductors in the pipes.

Continuation of conductors is done with connectors and reglets in cabinets. In the case of a smaller number of lines, the connection is made in the lead-in boxes, on the terminals of the same.

It is not allowed to run any other lines through the pipes for telephone lines.

The cable that only passes through the cabinet is attached to the wall of the cabinet with cable clamps or is cornered.

The telephone lines in the distribution cabinet or box should be arranged in such a way that replacing or adding new lines can be done easily. This also applies to other lines of signal installations.

In order to connect to the connectors, the textile or lead sheath of the insulated conductor is removed by 25 mm, and the rubber or PVC insulation by 20 mm. In the case of hidden screws or where there is an obstacle that does not allow the wire to fall out of the screw, the stripping of the insulation can be reduced to 10 mm, but only if the insulation of the connecting wire on the connector is 2-3 mm away from the screw. The wire is placed under the screw so that it is tightened when screwing.

In case of connection to soldering spikes, the rubber insulation must be about 5 mm away from the spike.

Lead cables must be connected immediately upon opening.

The cores of the cable must not be straight, tightened, but connected in an arc to the connectors in the soldering spikes. In this way, a small reserve remains, so that in the event of a break, the connector or soldering spike can be reattached by correcting the arc.

The wire connection on the connector or screw must be well processed, i.e. there must not be any fibers lying on the bare conductor or more firmly outside the insulation.

Instead of the usual telephone installations with installation pipes placed in the wall or on the wall, in larger business and industrial buildings, if it is technically and economically justified, telephone installations can be carried out with installation channels in the floor, side walls or ceiling.

For making telephone installations with installation channels, only those installation systems can be used that are approved by ZJ TK Technical regulations of ZJ TK for installation materials, technical regulations related to the construction of electric. installation in buildings, as well as JUS standards for electrical equipment. installations. When building telephone installations with installation channels, the following conditions must be taken into account:

in the installation channels in which the telephone installation lines intended for connection to the telephone network are laid on site, if the possibility of electricity is excluded. influence of these lines on telephone installation lines. This means that when making telephone installations with installation channels, special channels must be installed (for example, for low-current installations), and for multi-part channels, special fields for telephone installation lines must be used. During the specified laying, the lines must be clearly marked to which type of installation they belong. It is not allowed to place high current electrical installation lines in the channels for the telephone installation.

Telephone installations with installation channels can only be built in dry rooms, the dimensions of the channels should be determined in such a way that the required number of installation cables and conductors can be easily and safely inserted into them.

Telephone installations with installation wall channels must be made in such a way that they provide full mechanical protection to the installation cables and conductors. Installation of ducts, distribution boxes, connection boxes and other materials is done for each installation system according to the manufacturer's installation instructions.

After making the internal telephone installation, the insulation resistance should be measured. The obtained results must be within the following limits:

- between the conductors of the same telephone line as the conductors of distribution lines - at least 20 megohms;
- between each conductor and ground at least 10 megohms.

2.3 LAYING OF ROAD INSTALLATIONS

2.3.1 General conditions for laying S/FTP cables

1. These technical conditions are part of the main project for the LAN network, and the contractor must adhere to them when performing the work.

2. All works must be performed in accordance with the main and contractor's project, international standards and norms of the equipment manufacturer, that is, the entire installation must be performed in accordance with the international standard ISO/IEC 11801, and according to the technical description, drawings, specifications of equipment and materials .

3. Upon delivery of equipment and materials to the construction site, the supervisory authority is obliged to perform a visual inspection of the arrived equipment and to enter their condition in the construction diary.

4. During the execution of the works, minor changes in the project are approved by the supervisory authority, and major changes are approved by the authority that performed the technical review of the investment-technical documentation with the consent of the designer.

5. The supervisory body should record the work on assembly and testing of installations, as well as all changes in the project, in the construction diary.

6. These works are supervised by electrical engineers, specialized in this type of work.

7. Anything that proves to be of insufficient quality during the work or later, the contractor is obliged to remove at his own expense.

8. The contractor is obliged to carefully study the project in order to avoid possible disagreements and misunderstandings, and if there are certain deviations between the project and the existing condition of the building, to propose adjustments to the project.

9. After the installation of the device and the installation of the cable system, it is necessary for maintenance to carry out periodic (daily, weekly, monthly) inspections and tests of the installed equipment, and to write the findings and remarks in the control book. These periodic inspections and tests are essential to maintain a high level of availability of the structured cabling system.

2.3.2 Special conditions for laying S/FTP cables

1. Before starting the works, the contractor is obliged to precisely determine and mark the position of all elements of the designed system (sockets, distribution cabinets, active equipment, cable ducts, etc.).

2. The contractor should specify the places where the projected installations are connected to the existing installations, as well as determine and execute the connections for the electrical installation.

3. For the cabling of computer networks, use cables of category 6 or more according to the ISO/IEC standard, certified for operation at 450 MHz.

4. The global structure of the network is of the star type (multiple stars). Each connection is point-point type.

5. Any place where multiple S/FTP cables are connected is called a communication hub. The communication hub can be the master for the entire network, the master for a single location, the master for a single building, or local.

6. Active network equipment and patch panels are installed in the communication hub in an appropriately sized distribution cabinet.

7. Communication hubs are placed in rooms where office conditions prevail.

8. All RACK cabinets are closed (except the opening for the introduction of cables and the opening for ventilation), and on the front side they have a glass door that can be locked.

9. For RACK cabinets that are mounted on the wall, certain reinforcements and openings for fixing to the wall should be provided. Fasten to the wall with suitable dowels and screws.

10. S/FTP cables are terminated on a panel or socket.

11. The S/FTP cable must not be interrupted and continued.

12. The S/FTP cable is passed through the ducts, or fixed with OG clamps to the wall at a distance of 30-50 cm, or passed through a ribbed hose installed in the wall.

13. Routes of S/FTP cable laying and their marking are given in the Graphical Documentation.

14. After passing the cables, cover the channels with a suitable cover along the entire length.

15. The S/FTP cable must not be twisted longitudinally, tied in a knot, pinched, or damaged in any way when it is pulled through and attached.

16. The S/FTP cable must not stretch when pulled through.

17. The S/FTP cable is installed vertically or horizontally. Slanting installation of U/FTP cables is not allowed.

18. When laying cables, care must be taken to avoid possible cable damage. In places where the cable routes change direction, slight bends must be made, the radius of which must not be less than eight times the outer diameter of the cable.

19. The S/FTP cable must not be placed near a device, object or source that could damage the cable.

20. The S/FTP cable must not be placed and routed near heat sources (heat pipes, radiators, heater furnaces), and if this cannot be avoided, appropriate thermal insulation must be performed.

21. The S/FTP cable outside the building is placed inside a one-piece PE hose, whose ends inside the building are protected from atmospheric influences.

22. RJ sockets are placed at a height of 20-40 cm from the floor.

23. Leave a reserve of 10 cm in the cable on the side of the RJ socket, and 30-100 cm on the side of the patch panel, depending on where the patch panel is mounted (in a wall cabinet or RACK cabinet)

24. Immediately after pulling through, mark each cable with the same number on both ends (stickers).

25. The numbers of the cables should be taken according to the numbers of the sockets, so that the numbers increase clockwise, viewed from the entrance door to the room.

26. After passing the S/FTP cables, check the cables for breaks and short circuits. Terminate all correct cables with a socket or on a patch panel, according to the project documentation.

27. If there is a break or a short circuit, pull out the cable and replace it with a new one.

28. Installation of RJ sockets and patch panels must be performed with a professional tool.

29. After installing the sockets and patch panels, test the performance of each line.

30. Patch cables of appropriate lengths are used to connect wall sockets and terminal equipment, or patch panels and active equipment.

31. Parallel laying of cables with electrical power cables should be done at a minimum distance of 20 cm, or 10 cm, if the S/FTP cable is screened (shielded).

32. S/FTP cables should be crossed with electrical power cables at an angle of 90 degrees.

2.4 RACK CABINET

A distribution or rack cabinet represents the concentration of cables and communication equipment. The height of rack cabinets, as well as the elements placed in them, is expressed in units of *U* (some manufacturers also use the designation *E*), which is 44.45 mm. Larger rack cabinets should have fans and vents on the upper side for blowing air out of the rack upwards, while on the lower side there is an opening for drawing in fresh air. The back side of the rack cabinet should also be accessible, unless it is mounted on the wall. The cabinet on the front and back sides should have two perforated vertical rails for mounting equipment.

The RACK wardrobe is a free-standing 27U/19", glass door with lock, wheels and feet with leveling, front and rear rails 19", with unit numbers, dimensions 600x600x1400 mm, load capacity up to 300 kg.

The power supply panels should contain no less than seven power sockets with grounding, for power supply on the 220V/50Hz network and a central switch. Communication devices are connected to these sockets, while the power supply panel itself is connected to the direct outlet of the low-voltage network, provided for in the electric power installation project. All moving metal parts of the rack cabinet, as well as the metal housings of all active devices powered by 220 V voltage, must be connected to the potential equalization rail inside the rack cabinet, and the rack cabinet is connected with the N2XH-J 1x16mm² cable to the rail for potential equalization in the nearest power distribution cabinet.

The shelf is placed in the lower unfilled part of the rack cabinet and is used to store spare material, tools and documentation. In addition, the shelves can be used to place communication equipment that is not intended for mounting in a rack (*stand-alone*). Other unfilled rack cabinet spaces can be closed with gap filler masks.

The rack cabinet should be closed from the front with a glass door with a key, on the upper side there must be an opening with fans for blowing air from the rack upwards (or install fans as special panels), while on the lower side there must be an opening for drawing in fresh air and cable entry.

At this stage, no provision is made for specifying active equipment, and it should be emphasized that only passive elements are installed in the RACK cabinet.

2.5 QUALITY TESTING OF PERFORMED INSTALLATIONS

The segment length must comply with the IEEE 802.3u 100 Base-TX standard of 100 meters per segment, using 22 AWG UTP cable.

After laying the cable, it is necessary to measure the actual length that has been laid.

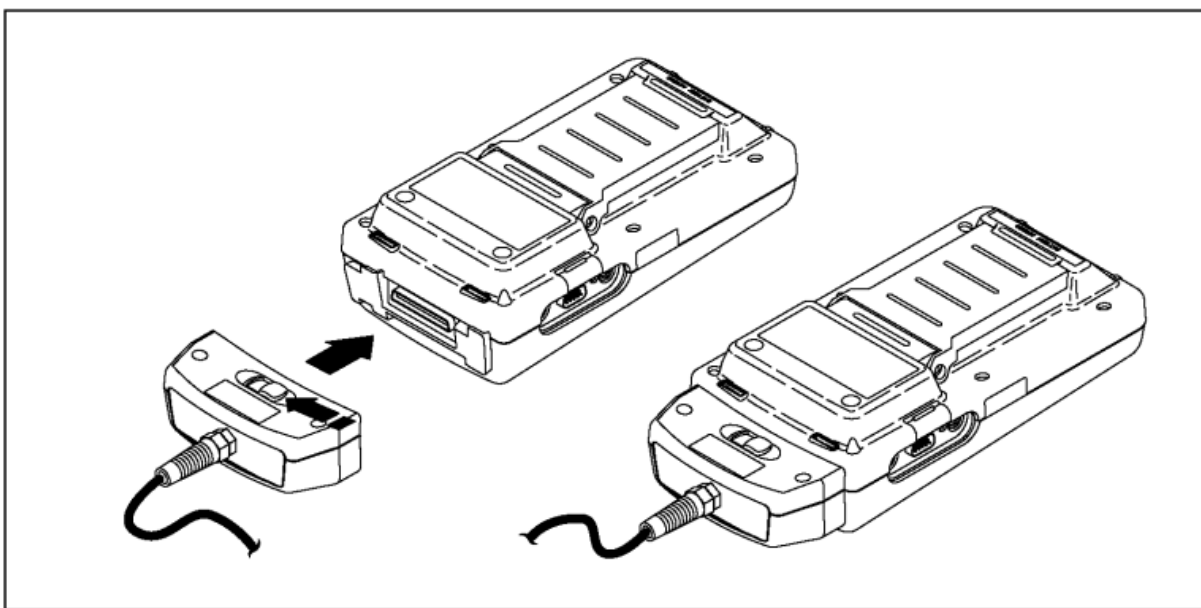
This length should not exceed 90 meters between the patch panel and the sockets in the premises (due to the attenuation introduced by the connectors).

It is also necessary to check whether the pairs on the connectors are correctly arranged. The standards that must be met are ISO/IEC 11801 class E.

The check is performed using a device for testing and measuring the performance of twisted pair cables in local networks.

It consists of two units that are placed on opposite sides of the cable and that communicate with each other.

The main unit initiates all tests, while the remote one closes the loops, collects and sends the results of each measurement.



Both units are synchronized and all tests are performed automatically.

Rulebook on technical and other conditions for the design, construction and use of electronic communication networks, electronic communication infrastructure and related equipment in facilities, adopted by the Agency for Electronic Communications and Postal Activities of Montenegro, 2015. defines testing and measurement of EKM building in articles 84-90, which are listed below.

Article 84

By testing the electronic communication networks of buildings, it is determined, on the basis of measurement procedures defined by standards, the results of which are relevant, repeatable and credible, whether the requirements stipulated by the relevant regulations and standards have been met.

Examination of electronic communication networks of buildings includes examination of all constructed network segments:

1. accesses the external access network (NA);
2. generic building cabling system (GC);
3. cabling of terminal equipment.

Depending on the designed solution and supported applications, the examination of electronic communication networks of buildings includes examination of:

1. ICT-cabling, which includes:

- generic ICT cabling of business premises and appropriate cabling of access to the external network for access;
- generic ICT-cabling of apartments, associated floor ICT-distributions and associated ICT-backbones, i.e. associated cabling of access to the external network for access.

2. BCT-cabling, which includes:

- generic BCT-cabling of apartments, associated floor BCT-distributions and associated BCT-backbones, i.e. associated cabling of access to the external network for access;
- optional generic BCT-cabling of business premises, associated floor BCT-distributions and associated BCT-backbones, i.e. associated cabling of access to the external network for access.

3. BCT-network - of common antenna systems (ZAS, MATV/SMATV) and cable television system (CATV);

4. optional generic CCCB-cabling of apartments;

5. additional application-specific cabling for the needs of applications that are not supported by generic cabling;

6. installation of electrical supply and grounding and potential equalization for the needs of the building's electronic communication network.

The following applies to the testing of generic building cabling:

1. permanent connections (PL) and consolidation connections (CPL) must be tested, if no consolidation cable (CPC) is installed and the associated PL is formed (if the PL also contains an adapter cable (e.g. consolidation cable - CPC), all test results are valid only for PL in that configuration and with that CPC);

2. Channel scan (CH) is optional; if a channel is tested, all connecting/switching cables that will be used in the composition of that channel must be connected, and all test results are valid only for the CH in that configuration and with those connecting/switching cables;

3. testing, measurement accuracy and connection are defined in appropriate reference planes; connection of test devices, which can be central transceivers or transmitters (T1) and remote transceivers or receivers (T2), depends on the configuration and test subject - connection with test connecting cables (TCR) and/or connecting cables of EC equipment; concrete levels of PL/CH are defined by the reference example, according to which the cabling that is the subject of the test was performed; end points on PP1 and PP2 switch panels or additional connection point/user connection - xO);

4. test sample:

- in principle, 100% of installed connections/channels are tested;
- exceptionally, for balanced ICT cabling, when testing the parameters of external influences (AXT; foreign crosstalk), a representative sample of at least 3% (but not less than 15) of disturbed connections/channels is tested, using the selection procedure of disturbed connections/channels according to standard EN/IEC 61935-1 with the option of reducing the required number of tests, if the measurement results show an appropriate margin according to the limit value of the tested parameter;
- the associated overall test result of the parameters in question are reported for each connection/channel/HNI/BO as "satisfies/does not satisfy".

5. if some connections/channels/HNI/BO are not satisfactory, the causes should be diagnosed and eliminated and the tests repeated; if the causes cannot be diagnosed and/or removed, the relevant connections/channels/HNI/BO should be clearly marked as faulty.

Application-specific cabling for the needs of applications that are not supported by generic cabling is tested for 100% of the connections/channels in accordance with the relevant applicable regulations and standards of the relevant applications, i.e. relevant European, international and Montenegrin cabling standards for information technology.

The BCT networks of the building (ZAS/MATV/SMATV, CATV) are tested at the interface of the BCT network of each apartment (HNI) and at all associated diffuse connections (BO).

Installations of electric power supply, grounding and potential equalization for the needs of EKM of buildings are tested in accordance with the relevant regulations.

Article 85

Before testing the cabling, a visual inspection of the installation must be carried out, which identifies and removes visible defects (e.g. damage to the cable and/or connecting accessories, disturbances in the

necessary geometrical relationships between cable pairs (crushing of the cable, unraveling, etc.), inappropriate bending radii, cables that are too long, inadequate distance from sources of electromagnetic interference.

When testing the cabling of the building, the following procedures should be carried out:

1. verification ;
2. certification ;
3. qualification .

Verification refers exclusively to verifying connectivity (connectivity test). It is mandatory for all types of cabling, and it includes testing the basic prerequisites for the functionality of cabling (eg short circuits of metal lines/shields). It is recommended that the verification be carried out before the final construction works (e.g. installation of insulation, plasterboard, etc.), as well as after them.

Certification includes confirmation of compliance of the performed cabling installation with a specific standard. It is tested whether the transmission performance of the cabling meets the requirements of a certain quality class of the corresponding standard. Certification is mandatory for generic cabling, as well as for application-specific cabling, if there are special standards for the same with defined requirements regarding its transmission parameters.

The qualification includes cabling testing in order to directly demonstrate the ability to support a specific network application (eg 100BASE-T, IEEE802.3 1000BASE-T). The qualification is optional for generic cabling and for application-specific cabling, for which there is a special standard according to which certification is carried out, and mandatory for application-specific cabling, for which there is no special standard that would be used for certification.

Article 86

The building's electronic communication networks can only be examined by natural/legal persons who are authorized to do so based on the relevant regulations.

Before testing, the examiner must:

1. to give the investor's representative the calibration sheets of the test devices for inspection, as proof of their calibration within the terms prescribed by the manufacturer of the device, but not longer than one year;
2. to carry out the normalization of the measuring system in accordance with the appropriate standard, that is, the instructions of the manufacturer of the measuring device.

For each test (Article 85 paragraph 2), the examiner must submit a report on the conducted test, which must have the following content:

1. information about the project (designation of the project, etc.);
2. information about the facility (campus, building, floor, etc.);
3. information about the examiner (name and surname, legal entity);
4. date and time of examination;
5. relevant environmental conditions (temperature, etc.);
6. data on test devices:
 - type, manufacturer and serial number;
 - operating system software version ;
 - database version with limit values of transmission parameters;
 - measurement class ;
 - calibration status .
7. data on measuring adapters, reference connectors, measuring connecting cables, final elements and other relevant test accessories:
 - type, manufacturer and reference number;
 - relevant performances.
8. data on tested cabling:
 - channel/connection identification mark (CH/PL) when testing the cabling, that is, the interface BCT-network of the apartment (HNI) and the diffuse socket (BO) when testing the common antenna system (ZAS), in accordance with the marks in the technical documentation of the performed state;

- type , construction and category of cable (e.g. BL-F/UTP-Cat 6; OF-50/125-OM3 ; CX -BCT-C) and any associated parameters whose values are entered into the measuring instrument for calculation purposes (eg when calculating the length – for copper cabling: nominal velocity of propagation - (NVP), for optical cabling: effective group index of refraction (IOR));
- type , construction and category of connecting accessories during cabling testing (eg BL-GG45/Cat 7; OF-MM-LC, CX-BCT-CF) and additional elements and equipment during ZAS testing;
- manufacturers of cables, connecting accessories and other equipment as part of the tested system.

9. details of the measuring system:

- configuration of the measurement procedure, as well as configuration and adjustment of the measuring device;
- configuration/measurement interfaces of the test object (channel, permanent connection, consolidation connection, backbone, horizontal distribution, HNI, BO, etc.);
- channel/connection class , frequency range, wavelengths;
- use of termination elements as well as their location (final impedances, etc.);
- name , issue and date of issue of the standard that defines the measurement procedure by which the test is performed;
- name , issue and date of issue of the standard in which limit values are prescribed, which are used for comparison with measurement results;
- specification of the programmed *auto-test* procedure (if used).

10. measurement accuracy ;

11. details of the measurement parameter;

12. limit values of tested parameters, i.e. required results;

13. test results for each individual parameter; if the instrument has the possibility of printing the results directly to the printer or to a file that can be printed, the results are attached in the original print format;

14. overall result for the individual tested connection/channel expressed as "satisfies/does not satisfy";

15. comments regarding the testing, functionality and safety of the installation.

Each report on the conducted examination should be certified by the examiner's signature, seal and signature of the responsible person/legal entity responsible for the accuracy of the examination.

In addition to written reports, test results are also submitted on electronic media in the native format of the measuring device manufacturer, including software for their review, or in one of the standardized document formats (e.g. *.pdf), but in such a way that it is not possible to change the content of the document.

Examination of generic ICT-cabling

Article 87

Balanced cabling for the needs of ICT applications is tested according to EN 50346 using measurement procedures, devices and accessories in accordance with EN/IEC 61935-1. Exceptionally, for testing classes A, B and C, measurement procedures, devices and accessories that do not comply with EN/IEC 61935-1 can also be used .

The required tests for individual classes of cabling are shown in table 15. The test results for the specified ICT-cabling transmission parameters must meet the requirements of EN 50173-1 for the class in question.

The length of the connection/channel is informative, i.e. it does not represent a test criterion for the rating "satisfies/does not satisfy", and it can be determined as physical (e.g. based on the markings on the cable) or electrical (by calculation, based on the measured propagation delay and the entered data on the nominal signal propagation speed for the cable in question).

The certification of the satisfaction of the parameters of external foreign influences is applied, if it does not arise automatically as a consequence of the quality of the construction of the associated components, based on the appropriate criteria from the EN 50173-1 standard (the amount of the coupling *attenuation parameter*).

Table: Verification and certification of balanced cabling

Vrsta Ispitivanja	Parametar koji se ispituje	Ispituju se za klasu									
		A	B	C	D	E	E _A	F	F _A	BCT-B	CCCB
Verifikacija: <i>Osnovni parametri</i>	Neprekinutost *	•	•	•	•	•	•	•	•	•	•
	Ispravnost spajanja *	•	•	•	•	•	•	•	•	•	•
	Dužina	x	x	x	x	x	x	x	x	x	x
Sertifikacija: <i>Parametri unutrašnjeg prenosa</i>	Jednosmjerni otpor petlje	•	•	•	•	•	•	•	•		•
	Kašnjenje prostiranja	•	•	•	•	•	•	•	•	•	•
	Klizanje kašnjenja			•	•	•	•	•	•		
	IL	•	•	•	•	•	•	•	•	•	•
	RL			•	•	•	•	•	•	•	
	NEXT	•	•	•	•	•	•	•	•		
	PS NEXT				•	•	•	•	•		
	ACR – N				•	•	•	•	•		
	PS ACR – N				•	•	•	•	•		
	ACR - F				•	•	•	•	•		
	PS ACR - F				•	•	•	•	•		
Sertifikacija: <i>Parametri spoljnjih stranih uticaja</i>	PS ANEXT					(○)	○	○	○		
	PS ANEXT _{avg}					(○)	○	○	○		
	PS AACR - F					(○)	○	○			
	PS AACR - F _{avg}					(○)	○	○			

• = 100% veza/kanala;
 ○ = uzorak od minimalno 3 % (ali ne manje od 15) veza/kanala; izbor uzorka prema EN/IEC 61935-1
 () = samo u slučaju da je potrebna podrška aplikacijama sa brzinama prenosa do 10 Gb/s;
 x = dužina je informativni, a ne ispitni kriterijum na osnovu koga se odlučuje;
 * obuhvata ispitivanje prekida i kratkih spojeva pripadajućih vodova/oklopa i ispravnosti spajanja provodnika na odgovarajuće kontaktespoinog pribora (razdvojene, obrnute i ukrštene parice)

Article 88

Optical cabling for the needs of ICT applications is tested according to the EN 50346 standard, using test procedures, devices and accessories in accordance with the ISO/IEC 14763-3 standard.

The necessary tests to be performed are shown in table 16. The test results for the specified transmission parameters must meet the requirements of the EN 50173-1 standard, that is, the requirements of the optical power reserve (OPB) of the connection/channel in question based on the appropriate calculation from the project documentation.

The length can be determined as physical (e.g. based on the markings on the cable) or optical (by calculation based on the measured propagation delay and the manufacturer's data on the effective group index of refraction (IOR) of the optical cable in question).

Table: Verification and certification of optical cabling

Vrsta Ispitivanja	Parametar koji se ispituje	Ispituje se
Verifikacija: <i>Osnovni parametri</i>	Neprekinutost	100% veza/kanala
	Polaritet	
Sertifikacija: <i>Parametri prenosa</i>	Slabljenje	
	Dužina (kašnjenje prostiranja)	

Testing generic BCT-cabling Article 89

The required tests for balanced BCT-cabling (BCT-B class) are shown in table 15. The test results for the specified transmission parameters must meet the requirements of the EN 50173-1 standard for the class in question.

Coaxial BCT-cabling is verified for continuity, short-circuits and the correctness of the conductor/shield connection.

Examination of the BCT network Article 90

The BCT-networks of the building (ZAS/MATV/SMATV, CATV) are certified using test procedures, devices and accessories in accordance with the EN 60728-1 standard. In doing so, a set of signal quality parameters prescribed by the relevant standards of the EN 60728-1 standard series is tested. The test results for the network interface of each apartment (HNI) and the associated diffuse connections (BO) must be within the limits prescribed by the relevant standards of the EN 60728-1 series, as shown in the figure.

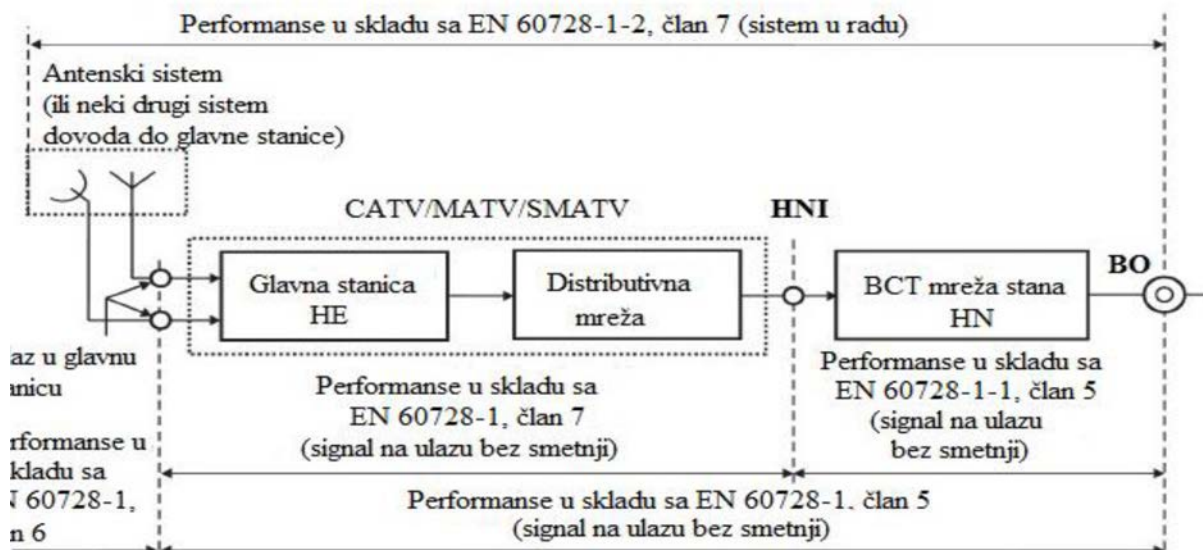


Figure: Requirements for BCT networks

2.6 TECHNICAL REQUIREMENTS FOR PERFORMING WORK ON CONNECTION TO TK INFRASTRUCTURE

2.6.1. Sewer routing

The choice of the route of the TK sewerage and the routing of the trench before the start of construction significantly affects the quality of the works, that is, later on the functionality and service life of the TK sewerage. For these reasons, attention should be paid to routing when starting the works. When determining the sewerage route, the designer chose the most favorable route, adhering to the UTU conditions for route selection and field conditions. Of course, deviations may occur during routing, but this must not endanger the safety of the route, as well as the safety of other underground installations if they are located near the route. When locating the planned manholes, take into account that their position allows the construction of sewerage under the sidewalk or along the very outer edge of the sidewalk if it is

not possible to place the sewerage completely under the sidewalk due to the large curvature of the streets. Sewers and shafts are located under or next to the sidewalk for two reasons:

- a. the least risk of physical damage;
- b. the easiest work during their exploitation, that is, pulling and mounting cables.

Since PVC pipes are flexible and have a low coefficient of friction, this enables the sewerage between two TK manholes not to always be straight, and that the way of stacking the pipes can be changed between the manholes and the distance between the manholes can be increased. The projected route is shown in the graphic attachment.

2.6.2. Digging a trench

After __ is done __ tracing , approaches are digging trench .

Per as a rule , trench should that be deep that at least distance from surfaces __ countries to scalp pipes in the uppermost ok amounts to :

- a. for pipes installed in the pavement: 50 cm;
- b. for pipes laid in asphalt: 80 cm;

The depth of the trench is determined by taking into account the thickness of the sand substrate , the number of pipe rows and the distance between the rows. The width of the trench is determined based on the number of pipes per row, the distance between the pipes, the width of the space required for manipulating the pipes and the depth of the trench.

Taking into account these parameters, the trench should be:

- a. 45 x 71cm (width x depth) for TK sewerage capacity 1x2xPVC Ø110mm in the sidewalk ;
- b. 45 x 101cm (width x depth) for TK sewerage capacity 1x2xPVC Ø110mm in asphalt ;
- c. 60 x 71cm (width x depth) for TK sewerage capacity 1x3xPVC Ø110mm in the sidewalk
- d. 60 x 101cm (width x depth) for TK sewage capacity 1x3xPVC Ø110mm in asphalt;

When excavating the trench, it is necessary to widen the trench on the parts of the route where there are breaks (deviations from the straight line), in order to alleviate the bending of the PVC pipe (appendix 9). When excavating a trench, remove larger stones and place them on one side of the trench, and the excavated soil on the other side, so that it does not mix with the excavated soil that is returned to the trench after covering the PVC pipe with fine sand. Excavated material should be deposited at least 50 cm from the edge of the trench. If there is a danger of the trench collapsing, the trench is demolished. The opening of the trench is done in this way, where the formwork is placed from boards on the side walls of the trench, which is opened with billets. When the prescribed depth of the trench is dug, start leveling the bottom of the trench. The leveling is done in such a way that at the two end points of each connecting shaft, vertical wooden levelers are placed, which make up the determined depths of the trench excavation at that location. Tighten the rope between the placed levelers above the trench at a height of 2 cm, and then use a third wooden leveler to find the prescribed depth of the trench every 5-10 cm. At the end of the leveling, start leveling the trench with an ax or shovel. If, during digging, you come across underground installations that are not marked in the cadastre of installations and cannot be bypassed in the prescribed manner, it is necessary to move the mentioned installations in agreement with the Supervisory Authority, the owners of underground installations and the Designer.

2.6.3 Continuation of PVC pipes

Continuation PVC pipes are perform __ help __ PVC connector or by use pipes with expansion . __ In order for the joint to be watertight, the joint must be glued. When continuing the pipe with expansion, the end of the pipe with expansion on the inside and the unexpanded end of the other pipe on the outside

are well cleaned, wiped and smeared with a thin layer of adhesive axially from the inside to the outside. Then the unexpanded end of one tube is inserted into the expanded end of the other tube. The joint must not be touched for several minutes, and after 1-2 hours it can be exposed to stress: laying in a trench, bending, etc. The above-mentioned procedure is also applied when connecting pipes using connectors, where the inner surface of the connector is coated with glue.

When making a joint using glue, the instructions for using the glue must be followed. Examination of PVC

the pipes waterproof with compressed air at a pressure of 1.5 bar. Pipes are considered correctly installed if the tested pressure does not drop within 1 minute. The designer proposes PVC pipes with expansion, where the joints are sealed using rubber rings.

2.6.4 Bending of PVC pipes

If the circumstances on the ground (construction site) do not allow a straight sewer trench, it is necessary to bend PVC pipes or use flexible PVC pipes. For larger changes of direction, PVC arches must be used. At the point of the bend, you should use as long pipes as possible and the number of extensions should be as small as possible. In the case of a curve with a small radius, it is necessary to use pipes 12 m long, and the connection point should not be located in the middle of the curve. A wooden stake should be placed behind each joint in the curve so that the joints are not loaded during further work.

PVC pipes must be bent slowly and evenly so that there are no impermissible stresses in the material. Fasten the bent pipes with stakes, and place combs between the pipes. The permissible bend radius of the bent pipe depends on the dimensions of the pipe, the external temperature and the bending procedure. PVC arches are used for larger curves. They are installed in the same way as PVC pipes.

2.6.5 Introducing the PVC pipe into the shaft

The introduction of PVC pipes into the shafts is done using PVC inlets, which have an extension for connecting to the PVC pipe on one side, and an extension with rounding on the other side. They are installed in the same way as PVC pipes. It is mandatory to pay attention when introducing PVC pipes in shafts that the direction of the pipe is in the direction of the cover, due to easier access to sewer pipes during exploitation, when passing cables.

2.6.6 Base for PVC pipes

A base for PVC pipes is placed at the bottom of the trench. The substrate consists of a layer of fine sand about 10 cm thick (attachments no. 6, 7). The sand should have a grain size of 0 - 4 mm. The layer of fine sand is lightly compacted using a suitable device or a wooden rammer if the Contractor does not have the necessary machinery. The upper surface of the layer is leveled using a rake. If there is no material in the excavated soil (sand, pebbles) with a grain size greater than 4 mm, excavated soil can be used as a base.

In the event that there is a danger that the sand will be washed away by underground water, the base is made of a mixture of cement and sand in a ratio of 1:20. PVC pipes are then coated with the same mixture.

2. 6.7 Laying PVC pipes and backfilling the trench

Pipes are placed on a compacted and leveled substrate made of fine sand. The distance between the pipes of 3 cm is maintained using PVC spacers (combs). Combs are placed at a distance of no more than 1.5 m. If there is a risk of sand being washed into the substrate, then it is necessary to put a concrete

substrate of cement and sand in a ratio of 1:20, and place the combs at a distance of 3.0 m. The inside of the dirty pipes must be cleaned before laying. During this cleaning, be careful not to damage the inner surface of the pipe. Before laying the pipes, it is also necessary to check whether all edges are damaged or improperly processed. Only pipes with properly processed and undamaged edges may be installed. Before laying pipes, inspect the installed pipe base. The surface must be flat and must not contain stones, foreign objects and sharp objects that can damage the pipes.

After laying and continuing the PVC pipes, the pipes are backfilled with fine sand of 0-4 mm. The sand is carefully tamped between the pipes with a wooden flat rammer. The thickness of the layer above the pipe is about 10 cm (attachments number 6, 7). The sand is also the same as for the 0-4 mm granulation base. In case there is a danger that the sand will be washed away, then cover the pipes with a mixture of cement and sand in a ratio of 1:20. If there is no material (sand, pebbles) larger than 4 mm in the excavated soil, excavated soil can be used instead of fine sand to backfill the PVC pipe.

After the compacted layer of sand above the pipe, the trench is backfilled with excavated soil. Backfilling is done in layers of 20-30 cm, which are compacted well. At a height of 25-30 cm above ground level, place a warning tape along the entire length of the trench. Lay the tape in the middle of the trench so that the inscription on the tape "ATTENTION PTT KABAL" faces the outside of the trench. If the prescribed depth cannot be reached during excavation, that is, if the distance from the ground surface to the topmost row of pipes is less than 50 cm for the sidewalk, or 80 cm for the road, protective measures must be applied as applied to the existing sewer. If the specified distance is between 30 and 50 cm, concrete the pipe, and if it is less than 30 cm above the top row of pipes, place a reinforced concrete layer (MB 20) and use mandatory PVC pipes with a wall thickness of 5.3 cm. Should protective measures be applied and which type, the Supervisory Body decides in cooperation with the Designer.

2.6.8 Distances from other underground installations

On the route of the sewage system, it often happens that during excavation, installations are encountered for which the owners did not have information. In order to protect the sewerage and future cables in it from various disturbances and damage, the distance between the PVC pipe sewerage and other underground installations must be taken care of. Necessary protective measures between individual installations should be carried out in agreement with the owners of the installations.

The minimum distance between the PVC pipe sewer and underground electrical installations is

- 0.3 m without applying protective measures;
- 0.1 m with the application of protective measures.

Protective measures must be taken at points of intersection and approach, as well as on a length of 0.5 m on both sides of the threatened section. Figure 1 of attachment 8 shows the method of performing protection at the intersection of the sewage system and the electric cable when the distance between them is less than 0.3 m.

The minimum distance between underground heating pipes and PVC pipe sewerage should be:

- 1.0 m without the application of protective measures;
- 0.1 m with the application of protective measures.

Protection is performed by placing a protective layer of a mixture of cement and sand in a ratio of 1:20 between the heating pipe and the PVC pipe.

2.7 APPENDIX ON PROTECTION AT WORK

When carrying out works on the construction of the building, it is mandatory to observe the dangers that may occur when using electrical equipment and to adhere to the following measures to prevent them:

2.7.1 Dangers and harm that may occur when using electrical installations and electrical equipment

- Danger of short-circuit current
- Danger of overloading
- Danger of excessive touch and step voltage
- Danger of accidentally touching live parts
- Unauthorized voltage drop
- Danger from moisture, water, dust, explosive and flammable materials and chemical influences
- The impact and danger of static electricity
- The influence of electromagnetic and electric fields
- Danger of sudden power failure
- Risk of fire

2.7.2 Anticipated measures to eliminate hazards and harm

Danger of short-circuit current

This kind of danger does not exist with designed telecommunication and signaling installations, except for the installation for automatic fire alarm.

Danger of overloading

neither cables nor devices can be overloaded .

Danger of excessive touch and step voltage

Protection against excessively high contact voltage is solved by a whole system of protective measures: a system of zeroing with a protective line system, a system of reduced voltage 24V and the like. The central grounding of the facility is provided through a strip grounding device, to which all protective lines and metal parts of the facility that do not belong to circuits and all central devices of telecommunication and signal installations are connected.

Risk of accidental contact with live parts

This protection is provided by the correct selection of equipment, devices and cables, as well as by placing them in appropriate cabinets, by pulling them into pipes, separating them with protective nets, separating them with protective fences and the like, as well as by locating them conveniently so that the equipment is not exposed to mechanical damage. The design of the device prevents accidental contact with live parts.

Protection against unauthorized voltage drop

Protection against unauthorized voltage drop is provided by proper dimensioning of power cables, both main power supply and cable outlets for individual consumers.

Protection against moisture, water, dust, explosive and flammable materials and chemical influences

The protection was carried out by the correct selection of equipment, distribution cabinets and rooms for the accommodation of central devices.

Danger of static electricity

The danger of static electricity is eliminated by proper grounding.

Danger from the influence of electromagnetic and electric fields

By correctly choosing the distance between power, signal and telecommunication lines as well as the choice of electrostatic and electromagnetic protection inside and outside the lines is eliminated the specified danger.

Danger of sudden power failure

The danger is eliminated by the application of emergency power supply, which is reflected in the correct selection of autonomous or external batteries, necessary for the operation of telecommunication and signaling devices in the facility, which enables independent operation in terms of legal provisions.

2.7.3 General notes and obligations of the contractor from the aspect of occupational safety

All electrical equipment and material provided for in this project must comply with all valid technical regulations and standards.

The contractor is obliged to prepare a special report on the arrangement of the construction site and work on the construction site. The manufacturer of tools for mechanized work is obliged to submit instructions for safe work and to confirm that the prescribed measures and occupational safety standards have been applied to the tool, i.e., to submit with the work tool, a certificate about the applied occupational safety regulations.

The work organization is obliged to notify the competent labor inspection authority about the start of work 8 days before the start of work.

The labor organization is obliged to draft normative acts in the field of occupational safety.

The labor organization is obliged to train workers in matters of occupational safety and to familiarize workers with working conditions, dangers and harms related to work and to check the worker's ability to work independently and safely.

The work organization is obliged to determine workplaces with special working conditions, if such positions exist.

The work organization in which explosive mixtures appear must have the Rulebook on the handling of electrical installations, which are explosively protected, as well as records on the performance of works, repairs and maintenance of these installations. This rulebook should provide for mandatory periodic inspections of these facilities, as well as the deadlines for these inspections, with the proviso that they cannot exceed one year.

When procuring work tools and devices from the documentation, which is attached to the work tools and devices, data on their acoustic properties must be obtained, from which it will be seen that the noise at the workplace and in the work rooms will not exceed the permitted values. If it is necessary to take special measures (noise suppressors, elastic supports, etc.) in order to fulfill the conditions on permissible values, these measures must also be indicated in the mentioned documentation.

During handling and manipulation in the plant, the application of protective equipment and means is mandatory.

2.7.4 Instructions for the management of construction waste, i.e. hazardous waste generated during the construction, use or removal of an object, in accordance with a special regulation

The waste generated during the construction of low-current electrotechnical installations belongs to non-hazardous solid waste and does not have the characteristics of hazardous waste. The phases of managing this waste are the transport and disposal of solid waste, which means the collected waste in the vehicle and the transport to the designated disposal location where the vehicle is emptied. Waste collection is the activity of systematic collection, sorting and/or mixing of waste for transport. The works provided for in this project are exclusively of the prescribed nature of the classic execution of construction works. Take the excavated material to the landfill. Parts of the installation material will be brought to the construction site and installed. The resulting waste, material during preparatory work, the remains of the packaging of individual elements that are installed, etc., must be carefully picked up and taken to the designated landfill. After the completion of the works, arrange the entire used belt of the construction site and restore it to its original condition, return the excess material to the warehouse.

Environmental protection measures

Environmental protection measures consist, above all, in the selection of quality materials, their proper installation and regular monitoring and maintenance of the planned buildings. In addition, the rehabilitation of the construction site will refer to the improvement of the environment after construction is completed.

Fire protection measures

When applying fire protection measures, comply with the Law on Protection and Rescue (Official Gazette of the Republic of Croatia 13/07, 32/11 and 54/16).

During the execution of the designed works, it is necessary to accurately determine the position of the existing electrical installations. Pay special attention to easily flammable materials that can cause a fire on the construction site (oil, boards, beams, slats, etc.). Such materials must be kept away from heat sources and stored in suitable areas protected from fire.

Rehabilitation of the environment

Upon completion of the works, the entire used area of the construction site should be arranged and restored to its original condition, the surplus material should be returned to the warehouse, and the waste material from the construction site should be taken to the appropriate landfill. Road and pedestrian surfaces should be repaired, grass areas should be planned and sown with grass, and road canals should be cleaned. When performing the works, all planned excavations in the vicinity of existing installations should be carried out manually, taking care not to damage the already existing installations and to damage the roots as little as possible.

RESPONSIBLE ENGINEER

Slobodan Marković, dipl.ing.el..

3 QUALITY CONTROL AND ASSURANCE PROGRAM

All installation material and equipment used to perform this type of installation must comply with the standards. Materials that do not meet the standards must not be used. When bringing materials to the construction site, and before assembly, it is necessary to inspect the materials by expert supervision and make a record. All works should be performed with quality and professional workforce.

A cable break can occur for a number of reasons, including:

- cable break during installation or installation of a faulty cable
- mechanical break of the cable (cutting, damage to the network cable and connector, etc.)
- cable break caused by the disconnection of the UTP connector.

In order to reduce the possibility of such interruptions, and therefore to significantly increase the reliability of the entire network, the following procedures are recommended:

- when laying the cable and mounting the connection box, follow the rules as much as possible, be sure to check the correctness of each installed connector
- install network equipment with appropriate patch panels in special cabinets, which would prevent access to this equipment by unauthorized persons,
- to warn all network users about the consequences of a cable break. Any intervention on the cable of the central segment and on the network equipment on it is performed exclusively by the system administrator.

In order to reduce the possibility of such interruptions, and therefore to significantly increase the reliability and availability of the network, the following procedures are recommended:

- when laying the cable and mounting the connection boxes, follow the above rules as much as possible, it is mandatory to check the correctness of each installed component before and after installation
- warn all network users about the consequences of cable breakage.

The problem of computer network reliability is viewed from the following aspects:

- breaks the cable of the central segment of the network
- breaks the cable of the local network segment and
- failure of network equipment.

A break on the local network segment, as already pointed out, makes it impossible to use the network from the workstation connected to that segment.

The most common reasons for the termination of the local segment are:

- interruption of the cable from the concentrator to the junction box during installation or installation of a defective cable
- mechanical interruption of the cable from the concentrator to the connection box (cutting, tearing, damage to the network cable and connector, etc.)
- using a faulty connection cable from the connection box to the network adapter in the computer
- interruption caused by disconnection of the RJ-45 connector from the connection box or network adapter in the computer.

Possible failures of network equipment, primarily those connected to the central segment of the network, affect the reduction of network reliability.

These failures occur most often as a result of damage to the network adapter and other computer components, as a result of exceeding the signal threshold on the cable.

The appearance of exceeding the signal threshold on the cable can be caused in different ways: induction due to atmospheric discharge, sudden increase (shock) of voltage in the electrical network, potential difference between the grounding on different components in the network, etc.

In order to prevent the aforementioned phenomena, it is recommended:

- follow the given instructions when installing the cables,
- use quality power supply for network equipment and
- power the server via an uninterruptible power supply (UPS).

Regardless of the choice of network operating system, it is common for the network server to have a special shutdown procedure, which must be started before turning off the computer.

If the server's power supply is interrupted, when it is turned on again, the operating system will try to correct the errors caused by the forced shutdown of the computer.

In most cases, the aforementioned correction will be successfully completed, although it is not excluded that there may be data loss or permanent damage to the operating system that would require its reinstallation, and thus the loss of all user data from the server.

In order to prevent such situations, it is necessary to connect the network server to the power supply through a special device for uninterrupted power supply - UPS.

In addition, it is recommended to install appropriate hardware and software that enable:

- informing all workstations that there has been an interruption in the power supply of the network server and that, after a certain period of time (e.g. 5 min), the shutdown procedure is started. In that case, users have enough time to save their data on the network drive,
- automatically starts and performs the regular shutdown procedure
- automatically starts the network server when the power is restored.

In addition to the above, the UPS also stabilizes the power supply voltage of the network server, which is of great importance both for reliable functioning and for the durability of the components and the computer as a whole.

The aforementioned software for using the UPS is built into most modern operating systems, or comes as a separate driver for the UPS, and the serial (COM) port is used for the hardware connection to the UPS.

Failure of the concentrator disables work in the network of those workstations that are connected to the network through it.

The way to prevent such occurrences is listed above.

3.1 LIST OF APPLIED REGULATIONS, RECOMMENDATIONS AND VALID STANDARDS ACCORDING TO WHICH THE FACILITY WAS DESIGNED AND ACCORDING TO WHICH WORK WILL BE PERFORMED:

- Rulebook on technical norms for low-voltage electrical installations ("SL.list SFRJ" no. 53/88)
- Yugoslav standards - Electrical installations in buildings - Safety requirements JUSN.B2.741/1989
- Law on Spatial Planning and Building Construction ("Official Gazette of Montenegro" No. 64/17)
- Law on Occupational Safety (Official Gazette of the Republic of Montenegro, No. 79/04, Official Gazette of the Republic of Montenegro, No. 26/10 and 40/11)
- Law on Health and Safety at Work ("Official Gazette of Montenegro" No. 34/14)
- Law on Protection and Rescue ("Official Gazette of Montenegro" No. 13/07, 05/08, 86/09, 32/11 and 54/16)
- Law on Protection of Persons and Property ("Official Gazette of Montenegro" No. 1/14 and 6/2014)
- Law on Electronic Communications ("Official Gazette of Montenegro" No. 40/13, 56/13 and 02/17)
- Law on Digital Broadcasting ("Official Gazette of Montenegro" no. 34/11 and 31/12)
- Personal Data Protection Act ("Official Gazette of Montenegro" no. 79/08, 70/09 and 44/12 and 22/2017)
- Law on Electronic Documents ("Official Gazette of Montenegro" No. 05/08, and 40/11)
- Law on Electronic Identification and Electronic Signature ("Official Gazette of Montenegro" No. 31/17)
- Rulebook on the method of preparation, scale and detailed content of technical documentation ("Official Gazette of Montenegro" number 044/18)
- Rulebook on the method of auditing the conceptual and main project ("Official Gazette of Montenegro" No. 30/14)
- Rulebook on the manner and procedure of professional supervision ("Official Gazette of Montenegro" number 06/09)

- Rulebook on the method of technical inspection ("Official Gazette of Montenegro" number 33/09 and 57/13)
- Rulebook on the method of keeping and content of the construction diary, construction book and inspection book ("Official Gazette of Montenegro" No. 81/08)
- Rulebook on technical and other conditions for the design, construction and use of electronic communication networks, electronic communication infrastructure and related equipment in facilities, adopted by the Agency for Electronic Communications and Postal Activities of Montenegro, 2015.
- Rulebook on the joint use of electronic communication infrastructure and related equipment, adopted by the Agency for Electronic Communications and Postal Activities of Montenegro, 2014.
- Rulebook on radio equipment and telecommunication terminal equipment, ("Official Gazette of Montenegro" number 46/14)
- Rulebook on the width of protective zones and the type of radio corridors in which the planning and construction of other facilities is not allowed, 2014.
- Rulebook on determining the list of standards in the field of radio equipment and telecommunications terminal equipment, 2014.
- Rulebook on technical norms for stable installations for the detection of explosive gases and vapors ("Official Gazette of the FRY" No. 24/93)
- Rulebook on technical norms for stable fire alarm installations ("Official Gazette of the FRY" No. 87/93)
- Rulebook on technical requirements for the protection of garages for passenger cars against fire and explosions ("Official Gazette of Montenegro" No. 9/12)
- Rulebook on technical norms for the creation of technical documentation with which systems, equipment and devices for fire detection and alarming must be supplied ("Official Gazette of the FRY" No. 30/95)
- Rulebook on closer conditions and methods of adapting facilities for access and movement of persons with reduced mobility and persons with disabilities
- EN 50173-1 Information technology - Generic cabling systems - Part 1: General requirements
- EN 50173-2 Information technology - Generic cabling systems - Part 2: Office premises
- EN 50173-3 Information technology - Generic cabling systems - Part 3: Industrial premises
- EN 50173-4 Information technology - Generic cabling systems - Part 4: Homes
- EN 50173-5 Information technology - Generic cabling systems - Part 5: Data centers
- EN 50174-1 Information technology - Cabling installation - Part 1: Installation specification and quality assurance
- EN 50174-2 Information technology - Cabling installation - Part 2: Installation planning and practices inside buildings
- EN 50174-3 Information technology - Cabling installation Part 3: Installation planning and practices outside buildings
- EN 60728-1 Cable networks for television signals, sound signals and interactive services - Part 1: System performance of forward paths
- EN 50117-2-4 Coaxial cables - Part 2: Sectional specification for cables used in cabled distribution networks - indoor drop cables for systems operating at 5 MHz - 3 000 MHz.
- EN 50117-2-3 Coaxial cables used in cabled distribution networks. - Part 4: Sectional specification for distribution and trunk cables
- EN 50117-2-5 Coaxial cables used in cabled distribution networks - Part 2-5: Sectional specification for outdoor drop cables for systems operating at 5 MHz - 3000 MHz
- EN 50290-2-1 Communication cables -- Part 2-1: Common design rules and construction
- EN 50310 Application of equipotential bonding and earthing in buildings with information technology equipment
- EN 50346 Information technology - Cabling installation - Testing of installed cabling
- EN 50441-1 Unscreened cables for indoor residential telecommunication installations - Part 1: class 1
- EN 50441-2 Screened cables for indoor residential telecommunication installations – Part 2: class 2

- EN 50441-3 Screened cables for indoor residential telecommunication installations – Part 3: class 3
- EN 60603-7-3 Connectors for electronic equipment - Part 7-3: Detail specification for 8-way, shielded, free and fixed connectors, for data transmissions with frequencies up to 100MHz (currently under preparation)
- EN 60603-7-5 Connectors for electronic equipment: - Part 7-5: Detail specification for 8-way, shielded, free and fixed connectors, for data transmissions with frequencies up to 250 MHz (currently under preparation)
- EN 60603-7-7 Connectors for electronic equipment: - Part 7-7: Detail specification for 8-- way, shielded, free and fixed connectors, for data transmissions with frequencies up to 600 MHz (category 7, shielded)
- EN 60966-2-4 Radio frequency and coaxial cable assemblies - Part 2-4: Detail specification for cable assemblies for radio and TV receivers (Frequency range Oto 3 000 MHz, IEC 61169-2 connectors).
- EN 60966-2-5 Radio frequency and coaxial cable assemblies - Part 2-5: Detail specification for cable assemblies for radio and TV receivers (Frequency range Oto 1 000 MHz, IEC 61169-2 connectors).
- EN 60966-2-6 Radio frequency and coaxial cable assemblies - Part 2-6: Detail specification for cable assemblies for radio and TV receivers (Frequency range Oto 3 000 MHz, IEC 60169-24 connectors).
- EN 61169-2 Radiofrequency connectors - Part 2: Sectiona1 specification - Radiofrequency coaxial connectors of type 9.52 EN 61169-24 Radiofrequency connectors - Part 24: Sectional specification - Radiofrequency coaxial connectors with screw coupling, typically for use in 75 ohm cable distribution systems (type F).
- EN 50083 Cabled distribution systems for television, sound and interactive multimedia signals
- EN 50083-1 Safety requirements.
- EN 50083-2 EMC for equipment.
- EN 50083-3 Active broadband equipment;
- EN 50083-4 Passive broadband equipment;
- EN 50083-5 Headend equipment;
- EN 50083-6 Optical equipment;
- EN 50083-7 System performance.
- EN 50083-8 EMC for networks.
- EN 50083-9 Interface for DVBIMPEG2 transport stream.
- EN 50083-10 System performance for return path.

II NUMERICAL DOCUMENTATION

4.1 MATERIAL SPECIFICATION

MATERIAL SPECIFICATION
of electrical installations of low voltage

no.	Item description	unit measures	quantity
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1 Installation of structural cable system

RACK

1.1.	Procurement and delivery of a free-standing RACK cabinet with the following characteristics: - height 27U -smoke. 600x600x1400 mm -glass door with lock, wheels and feet with leveling, front and rear rails 19" -load capacity up to 300 kg. Total for material:	pcs	1
1.2.	Procurement and delivery of power supply panel 19", 7 x SCHUKO and switch, PVC, 1.25HU. The panel is installed in a RACK cabinet. Total for material:	pcs	1
1.3.	Procurement and delivery of heavy duty fixed shelves - for racks with a depth of 600 mm. Total for material:	pcs	2
1.4.	Procurement, delivery and installation of fan panel 19"/1U with 4 fans and thermostat (LCD), for cabinets with a depth of 600 mm. Total for material:	pcs	1
1.5.	Procurement and delivery of cable organizers. Total for material:	pcs	8
1.6.	Procurement and delivery of an empty modular patch panel with 24 slots for RJ-45 cat.6 modules that is placed in a RACK. In the patch panel, install RJ-45 modules for installation of SKS system and video surveillance and connect to SFTP cat. 6 and UTP cat.6 cables that are laid around the building. Total for material:	pcs	4
1.7.	Procurement and delivery of RJ45 cat.6 modules in patch panels. Total for material:	pcs	77
1.8.	Procurement and delivery of S/FTP cat. 6 patch cords with final RJ-45 connectors on both sides, length 1m-3m. Total for material:	pcs	77

1.9.	Procurement and delivery of switches with the following characteristics: -48 x 10/100/1000 RJ45 Ports -4 x 1GB SFP Ports -manageable	pcs	1
1.10.	Procurement and delivery of POE switches with the following characteristics: -8 x 10/100/1000 Mbps RJ45 Port -2 x Gigabit SFP Slots	pcs	1
<i>Equipment per space</i>			
1.11.	Procurement and delivery of FTP RJ-45 cat.6 sockets for installation in modular accessories (defined by preliminary measurements and high current calculations) and for access points. The connectors are terminated at the ends with SFTP cat.6 cables. Total for material:	pcs	75
1.12.	Procurement and delivery of indoor access point devices with the following characteristics: wireless 300Mb/s gigabit access point 2.4GHz 802.11b/g/n power 200mW (22dBm), PoE 802.3af, Multi-SSID, VLAN, QoS, EAP Controller Software. Total for material:	pcs	3
1.13.	Procurement and delivery of a halogen-free installation pipe with an internal diameter of Ø16mm, through which S/FTP cat.6 AWG23 LSHF are passed. The installation pipe is laid partly on the wall under the plaster, partly on the ceiling under the plaster, and partly through the concrete floor liner. Total for material:	pcs	1000
1.14.	Procurement and delivery of halogen-free S/FTP cat. 6 AWG23 LSHF cables. The cable is passed through the installation pipe with an outer diameter of Ø16mm, partly on the wall under the plaster, partly on the ceiling under the plaster, and partly through the concrete floor liner to the corresponding connectors in the rooms. The calculation should be done by the required meter. Total for material:	pcs	1700
1.15.	Procurement and delivery of 10m long HDMI cables with end HDMI connectors on both sides. The cable is passed through the installation pipe with an outer diameter of Ø16mm, partly on the wall under the plaster, and partly on the ceiling under the plaster. Calculate per piece. Total for material:	pcs	7
1.16.	Procurement and delivery of S/FTP cat. 6 patch cords with final RJ-45 connectors on both sides, length 1m-3m. Total for material:	pcs	3

2 Installation of the IP video surveillance system

2.1.	Procurement and delivery of NVR with the following characteristics: - 4-channel, resolution up to 5 Mpx -supports 5Mpx/4Mpx/3Mpx/1080p -1x6TB HDD -decoding capacity @25fps per channel -H.264/H.265 compression -bandwidth 32Mbps -1xHDMI, 1xVGA Total for material:	pcs	1
2.2.	Procurement and delivery of 4TB HDD. Type HDD 4TB. Total for material:	pcs	1
2.3.	Procurement and delivery of the following IP cameras characteristic: -Dome housing -resolution 5Mpx/20fps -lens motorized 3.3-12 mm (92°-32.9°) -optical sensor 1/2.7" Smartsens SC233AI -Onvif -IP 67 -compaction H.265 SD card slot -IR range 20-30m 0.0085Lux@F1.2, 0Lux IR ON -True WDR 120dB -VCA analytics -dimensions Ø111.5 x 99.6 mm Total for material:	pcs	4
2.4.	Procurement and delivery of dose.	pcs	4
2.5.	Procurement and delivery of halogen-free installation pipes with an internal diameter of Ø16mm, through which cables are passed for connecting elements of the video surveillance system. Total for material:	m	80
2.6.	Procurement and delivery of S/FTP cat. 6 AWG23 LSHF cables for connecting video surveillance system elements. Total for material:	m	120
2.7.	Supply and delivery of final RJ-45 connectors at the end of the cable. The cable is used to connect cameras with S/FTP cables. Total for material:	pcs	2

3 Installation of an automatic fire alarm system

3.1. Procurement and delivery of a fire control panel with the following characteristics:

- conventional switchboard with the possibility of accepting 2 zones (non-expandable)
 - 32 detectors per zone
 - one programmable output/input for each of the zones
 - monitored output for siren activation
 - programmable relay output
 - dedicated output for the answering machine
 - illuminated alpha-numeric display
 - memory of the last 100 events
 - space for two 12V/7Ah batteries
 - protection against deep battery discharge
 - the possibility of programming via a computer
 - certified in accordance with EN54-2 / EN54-4 and EN12094-1 standards
- Total for material:

pcs 1

3.2. Procurement and delivery of batteries with the following characteristics:

- rated voltage: 12V
 - nominal capacity: 7Ah
 - recommended working temperature: 25±3°C
 - connector type: F3
 - declared working life: 5 years
- Total for material:

pcs 2

3.3. Procurement and delivery of an answering machine with the following characteristics:

- 5 zone entrances
 - connection to landline and GSM network (the device provides a redundant line of communication in case of absence/interruption of the landline connection)
 - possibility to call 15 tel. numbers
 - 100 voice messages with a total duration of 15 min.
 - case with space for 12V/1.2Ah battery
 - power supply: 13.8Vdc/ 650mA
- Total for material:

pcs 1

3.4.	<p>Procurement and delivery of a conventional optical smoke detector with the following characteristics:</p> <ul style="list-style-type: none"> - reliable operation and high resistance to interference - mesh with openings with a diameter of 500 µm, for protection from dust and insects -3-color LED signaling - automatic soiling compensation - possibility to adjust the sensitivity - complete diagnostics of the state of the detector -memory of the smoke level in a 5-minute interval. before the last detected alarm - operating voltage: 19-30 Vdc -consumption: 90µA (standby)/ 40mA (alarm) <p>Total for material:</p>	pcs	10
3.5.	<p>Procurement and delivery of a conventional heat detector with the following characteristics:</p> <ul style="list-style-type: none"> - reliable operation and high resistance to interference - the possibility of programming the operating mode: thermo-maximum 58°C/ 72°C; thermo-differential -3-color LED signaling - complete diagnostics of the state of the detector -memory of the temperature measured in an interval of 5 min. before the last detected alarm - operating voltage: 19-30 Vdc -consumption: 70µA (standby)/ 40mA (alarm) <p>Type ID200, manufactured by Inim or similar.</p> <p>Total for material:</p>	pcs	1
3.6.	<p>Procurement and delivery of a base for an automatic detector with the following characteristics:</p> <ul style="list-style-type: none"> - built-in jumper that ensures continuity in case of disassembly of the associated detector -material: polycarbonate -dimensions: Ø110mm x 24mm <p>Total for material:</p>	pcs	11
3.7.	<p>Procurement and delivery of a conventional manual call point with the following characteristics:</p> <ul style="list-style-type: none"> - operating voltage: 9~30V -resistance in alarm: 260 or 660Ω - complete with glass and plastic resettable element -material: ABS plastic <p>Total for material:</p>	pcs	2

- | | |
|---|-------------------------------------|
| <p>3.8. Procurement and delivery of a conventional siren-flasher with the following characteristics:</p> <ul style="list-style-type: none"> - automatic addressing by the central office - sound pressure 101dB(A)@1m - 14 types of melody available - built-in short-circuit isolator - consumption: 200µA (standby)/ 20mA (alarm) @27.6Vdc - possibility of external mounting (IP65 degree of protection) - case in red color <p>Total for material:</p> | <p>pcs 2</p> |
| <p>3.9. Procurement and delivery of halogen-free installation pipes with an outer diameter of Ø16mm, through which JH(St)H FE180/E90 2x2x0.8mm cables are passed for connecting elements of automatic fire alarm. The installation pipe is laid partly on the wall under the plaster, and partly on the ceiling. Total for material:</p> | <p>m 150</p> |
| <p>3.10. Procurement and delivery of halogen-free JH(St)H FE180/E90 2x2x0.8mm cable. The cable is passed through halogen-free installation pipes with an outer diameter of Ø16mm, partly on the wall under the plaster, and partly on the ceiling, and serves to connect the elements of the fire protection system. Total for material:</p> | <p>m 200</p> |
| <p>3.11. Procurement and delivery of S/FTP cat. 6 cables, and is used to connect the fire control panel with the alarm system, which is located in the Rack cabinet. Total for material:</p> | <p>m 5</p> |

Responsible Engineer:
 Slobodan Marković, dipl.ing.el.

4.2 BILL OF QUANTITIES OF MATERIALS AND WORKS

BILL OF QUANTITIES
of works and materials of electrical installations of extra low voltage

This bill of measure foresees the delivery and installation of all material specified by position and all small unspecified material required for complete construction and installation as specified by position, testing and putting into proper operation as well as bringing to the correct original state the places damaged in the already performed works and constructions. All materials used must be of first-class quality and meet standards. The work must be performed by professional workers, and fully in accordance with the valid technical regulations for the same type of work. The price includes the price of materials, labor costs and all taxes and contributions on the material. The price includes the preparation of all possibly necessary workshop documentation, testing and commissioning of all installation elements listed by position. The listed equipment manufacturers are not exclusive. The contractor can also install other equipment or material, but under the condition that this equipment or material has the same electrotechnical and constructive characteristics as the above, which is confirmed by an expert - the supervisory authority.

row no.	Description of the item	unit of measures	quantity	unit price	sum
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1 Installation of structural cable system

RACK

- | | | | |
|------|---|-----|---|
| 1.1. | Procurement, delivery and installation of a free-standing RACK cabinet with the following characteristics:
-height 27U -dim. 600x600x1400mm
- glass door with lock, wheels and feet with leveling, front and rear rails 19"
- load capacity up to 300kg.
Total for material and work: | pcs | 1 |
| 1.2. | Procurement, delivery and installation of a power panel 19", 7 x SCHUKO and switch, PVC, 1.25HU. The panel is installed in a RACK cabinet. Total for material and work: | pcs | 1 |
| 1.3. | Procurement, delivery and installation of fixed shelves heavy duty - for rack depth 600mm. Total for material and labor: | pcs | 2 |
| 1.4. | Procurement, delivery and installation of a fan panel 19"/1U with 4 fans and a thermostat (LCD), for cabinets with a depth of 600 mm. Total for material and work: | pcs | 1 |
| 1.5. | Procurement, delivery and installation of cable organizers. Total for material and labor: | pcs | 8 |

1.6.	Procurement, delivery and installation of an empty modular patch panel with 24 slots for RJ-45 cat.6 modules that is placed in a RACK. In the patch panel, install RJ-45 modules for installation of SKS system and video surveillance and connect to SFTP cat. 6 and UTP cat.6 cables that are laid around the building. Total for material and labor:	pcs	4
1.7.	Procurement, delivery and installation of RJ45 cat.6 modules in patch panels. Total for material and labor:	pcs	77
1.8.	Procurement and delivery of S/FTP cat. 6 patch cords with final RJ-45 connectors on both sides, length 1m-3m. Total for material:	pcs	77
1.9.	Procurement, delivery and installation of switches with the following characteristics: -48 x 10/100/1000 RJ45 Ports -4 x 1GB SFP Ports -manageable	pcs	1
1.10.	Procurement, delivery and installation of a POE switch with the following characteristics: -8 x 10/100/1000 Mbps RJ45 Port -2 x Gigabit SFP Slot Type TP	pcs	1

Equipment per space

1.11.	Procurement, delivery and installation of FTP RJ-45 cat.6 sockets for installation in modular accessories (defined by preliminary measurements and calculation of high current) and for access points. The connectors are terminated at the ends with SFTP cat.6 cables. Total for material and labor:	pcs	75
1.12.	Procurement, delivery and installation of indoor access point devices with the following characteristics: wireless 300Mb/s gigabit access point 2.4GHz 802.11b/g/n power 200mW (22dBm), PoE 802.3af, Multi-SSID, VLAN, QoS, EAP Controller Software. Total for material and labor:	pcs	3

1.13.	Procurement, delivery and laying of a halogen-free installation pipe with an internal diameter of Ø16mm, through which S/FTP cat.6 AWG23 LSHF are passed. The installation pipe is laid in the wall with the creation of slits and the repair of damaged surfaces. The item includes all the small materials needed for their installation, electrical connection on both sides, halogen-free installation hoses, cleaning as well as restoring damaged surfaces to their original state. Total for material and labor:	m	1000
1.14.	Procurement, delivery and drawing of halogen-free S/FTP cat. 6 AWG23 LSHF cables. The cable is passed through the installation pipe with an external diameter of Ø16mm, partly on the wall under the plaster, partly on the ceiling under the plaster, and partly through the concrete floor liner to the corresponding connectors in the rooms. The calculation should be done by the required meter. Total for material and labor:	m	1700
1.15.	Procurement, delivery and routing of 10m long HDMI cables with end HDMI connectors on both sides. The cable is passed through the installation pipe with an outer diameter of Ø16mm, partly on the wall under the plaster, and partly on the ceiling under the plaster. Calculate per piece. Total for material and labor:	pcs	7
1.16.	Procurement and delivery of S/FTP cat. 6 patch cords with final RJ-45 connectors on both sides, length 1m-3m. Total for material:	pcs	3
1.17.	Small prefabricated and unspecified material.	flat rate	1
1.18.	Measurements and testing of the SKS system in accordance with Articles 84, 85, 86, 87 and 88 of the Rulebook (Regulation on technical and other conditions for the design, construction and use of electronic communication networks, electronic communication infrastructure and related equipment in buildings, adopted by the Agency for electronic communications and postal activity of Montenegro, 2015) and according to valid standards. Issuance of measurement protocols and a certified report on the measurement and correctness of all installations.	flat rate	1
1.19.	System setup and commissioning services:	flat rate	1

Total SKS installations

2 Installation of the IP video surveillance system

2.1. Procurement, delivery and installation of NVR with the following characteristics:

- 4-channel, resolution up to 5Mpk
- supports 5Mpk/4Mpk/3Mpk/1080p
- 1x6TB HDD
- decoding capacity @25fps per channel
- H.264/H.265 compression
- bandwidth 32Mbps
- 1xHDMI, 1xVGA

Total for material and labor:

pcs 1

2.2. Procurement, delivery and installation of 4TB HDD. Type HDD 4TB. Total for material and labor:

pcs 1

2.3. Procurement, delivery and installation of the following IP cameras
feature:

- Dome case
- resolution 5Mpx/20fps
- lens motorized 3.3-12 mm (92°-32.9°)
- optical sensor 1/2.7" Smartsens SC233AI
- Onvif
- IP 67
- compaction H.265
- SD card slot
- IR range 20-30m
- 0.0085Lux@F1.2, 0Lux IR ON
- True WDR 120dB
- VCA analytics
- dimensions Ø111.5 x 99.6 mm

Total for material and labor:

pcs 4

2.4. Procurement, delivery and installation of doser.

pcs 4

2.5. Procurement, delivery and laying of halogen-free installation pipes with an internal diameter of Ø16mm, through which the cables for connecting the elements of the video surveillance system are passed. The installation pipe is laid in the wall with the creation of slits and the repair of damaged surfaces. The item includes all the small materials needed for their installation, electrical connection on both sides, halogen-free installation hoses, cleaning as well as restoring damaged surfaces to their original state. Total for material and labor:

m 60

2.6.	Procurement, delivery and placement of S/FTP cat. 6 AWG23 LSHF cables for connecting elements of the video surveillance system. Total for material and labor:	m	120
2.7.	Supply and delivery of final RJ-45 connectors at the end of the cable. The cable is used to connect cameras with S/FTP cables. Total for material and labor:	pcs	2
2.8.	Small prefabricated and unspecified material.	flat rate	1
2.9.	Necessary measurements and tests on all cable routes:	flat rate	1
2.10.	System commissioning, user training. Calculation by position:	flat rate	1
Total installation of IP video surveillance system			

3 Installation of automatic fire alarm system

3.1.	Procurement, delivery and installation of a fire control panel with the following characteristics: -conventional switchboard with the possibility of accepting 2 zones (non-expandable) -32 detectors per zone - one programmable output/input for each of the zones -monitored output for siren activation -programmable relay output -dedicated output for the answering machine -illuminated alpha-numeric display - memory of the last 100 events -space for two 12V/7Ah batteries -protection against deep discharge of batteries - the possibility of programming through a computer -certified in accordance with EN54-2 / EN54-4 and EN12094-1 standards Total for material and labor:	pcs	1
3.2.	Procurement, delivery and installation of batteries with the following characteristics: - rated voltage: 12V - nominal capacity: 7Ah -recommended working temperature: 25±3°C - connector type: F3 - declared working life: 5 years Total for material and work:	pcs	2

- 3.3. Procurement, delivery and installation of an answering machine with the following characteristics:
- 5 zone entrances
 - connection to landline and GSM network (the device provides a redundant line of communication in case of absence/interruption of the landline connection)
 - possibility to call 15 tel. numbers
 - 100 voice messages with a total duration of 15 min.
 - case with space for 12V/1.2Ah battery
 - power supply: 13.8Vdc/ 650mA
- Total for material and work:
- com 1
- 3.4. Procurement, delivery and installation of a conventional optical smoke detector with the following characteristics:
- reliable operation and high resistance to interference
 - mesh with openings with a diameter of 500 µm, for protection from dust and insects
 - 3-color LED signaling
 - automatic soiling compensation
 - possibility to adjust the sensitivity
 - complete diagnostics of the state of the detector
 - memory of the smoke level in a 5-minute interval. before the last detected alarm
 - operating voltage: 19-30 Vdc
 - consumption: 90µA (standby)/ 40mA (alarm)
- Total for material and work:
- pcs 10
- 3.5. Procurement, delivery and installation of a conventional heat detector with the following characteristics:
- reliable operation and high resistance to interference
 - the possibility of programming the operating mode: thermo-maximum 58°C/ 72°C; thermo-differential
 - 3-color LED signaling
 - complete diagnostics of the state of the detector
 - memory of the temperature measured in an interval of 5 min. before the last detected alarm
 - operating voltage: 19-30 Vdc
 - consumption: 70µA (standby)/ 40mA (alarm)
- Total for material and work:
- pcs 1
- 3.6. Procurement, delivery and installation of a base for an automatic detector with the following characteristics:
- built-in jumper that ensures continuity in case of disassembly of the associated detector
 - material: polycarbonate
 - dimensions: Ø110mm x 24mm
- Total for material and work:
- pcs 11

3.7.	Procurement, delivery and installation of a conventional manual call point with the following characteristics: - operating voltage: 9~30V -resistance in alarm: 260 or 660Ω - complete with glass and plastic resettable element -material: ABS plastic Total for material and work:	pcs	2
3.8.	Procurement, delivery and installation of a conventional siren-flasher with the following characteristics: - automatic addressing by the central office -sound pressure 101dB(A)@1m - 14 types of melody available -built-in short-circuit isolator -consumption: 200μA (standby)/ 20mA (alarm) @27.6Vdc -possibility of external mounting (IP65 degree of protection) -case in red color Total for material and work:	pcs	2
3.9.	Procurement, delivery and laying of halogen-free installation pipes with an external diameter of Ø16mm, through which JH(St)H FE180/E90 2x2x0.8mm cables are passed for connecting elements of automatic fire alarm. The installation pipe is laid in the wall with the creation of slits and the repair of damaged surfaces. The item includes all the small materials needed for their installation, electrical connection on both sides, halogen-free installation hoses, cleaning as well as restoring damaged surfaces to their original state. Total for material and labor:	m	150
3.10.	Procurement, delivery and routing of halogen-free JH(St)H FE180/E90 2x2x0.8mm cable. The cable is passed through halogen-free installation pipes with an outer diameter of Ø16mm, partly on the wall under the plaster, and partly on the ceiling, and serves to connect the elements of the fire protection system. Total for material and labor:	m	200
3.11.	Procurement, delivery and routing of S/FTP cat. 6 cables, and is used to connect the fire control panel with the call station located in the Rack cabinet. Total for material and labor:	m	5

3.12.	Programming and adjustment of the fire alarm control panel in accordance with the Rulebook on technical standards for stable fire alarm installations (Official Gazette of the SRJ No. 87/93) with the issuance of a certified Record with a listing containing a list of alarm and executive elements and a list of programmed executive function.	flat rate	1
3.13.	Small prefabricated and unspecified material	flat rate	1
3.14.	Necessary measurements and tests on cable routes	flat rate	1
3.15.	System commissioning, user training. Calculation by position:	flat rate	1
Total installation of automatic fire alarm system			
4	Creation of the project of the derived condition (maintenance)	flat rate	
In total, the design of the finished state (maintenance):			

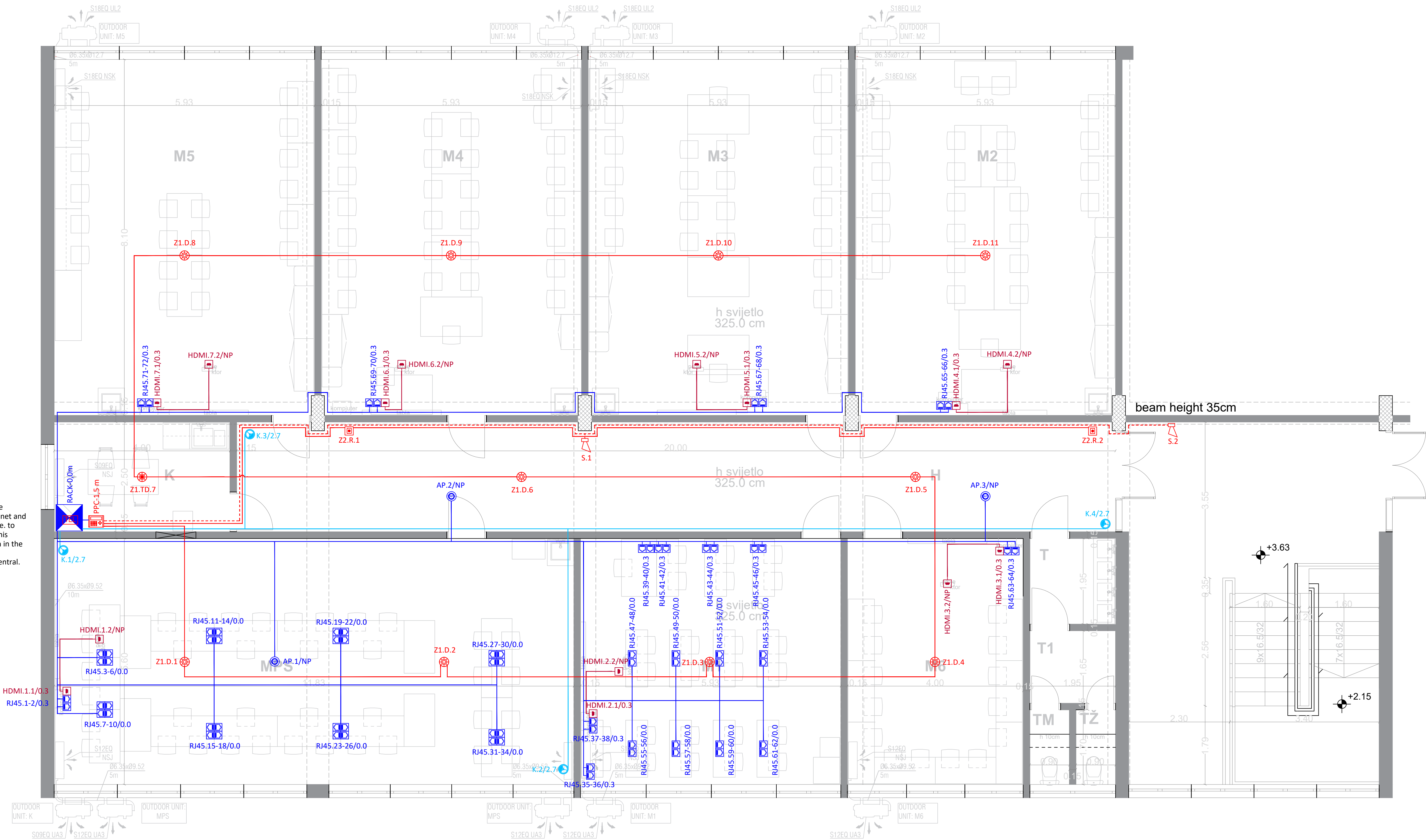
RECAPITULATION

1	Installation of structural cable system
2	Installation of the IP video surveillance system
3	Installation of automatic fire alarm system
4	Creation of the project of the derived condition (maintenance)
Total extra low voltage installations:	
VAT AMOUNT (21%)	
Total extra low voltage installations with VAT	

Responsible Engineer:

Slobodan Marković, Spec.Sci.El.Eng.

III GRAPHIC DOCUMENTATION



Note: When carrying out the work, determine whether it is better to transfer the RACK cabinet and the PP central to the other side of the wall, i.e. to another room, the "multifunctional hall". If this change is made, all other installations remain in the designed positions, the only change is the positioning of the RACK cabinet and the PP central.

No.	Room	Floor	Area	Extent
H	corridor	stone slabs	49.63 m ²	45.00 m ²
T	toilet hand washing	ceramic tiles	3.80 m ²	7.80 m ²
T1	toilet antechamber	ceramic tiles	3.22 m ²	7.20 m ²
TM	toilet for men	ceramic tiles	1.53 m ²	5.20 m ²
TZ	female toilet	ceramic tiles	1.53 m ²	5.20 m ²
M1	multifunc. cabinet	PVC antistatic	33.18 m ²	23.06 m ²
M2	multifunc. cabinet	PVC antistatic	47.93 m ²	28.06 m ²
M3	multifunc. cabinet	PVC antistatic	47.93 m ²	28.06 m ²
M4	multifunc. cabinet	PVC antistatic	47.93 m ²	28.06 m ²
M5	multifunc. cabinet	PVC antistatic	47.96 m ²	28.06 m ²
M6	multifunc. cabinet	PVC antistatic	22.40 m ²	19.20 m ²
MPS	multifunc. cabinet	finished parquet type Tarkett	66.22 m ²	34.86 m ²
K	kitchenette	ceramic tiles	10.00 m ²	13.00 m ²

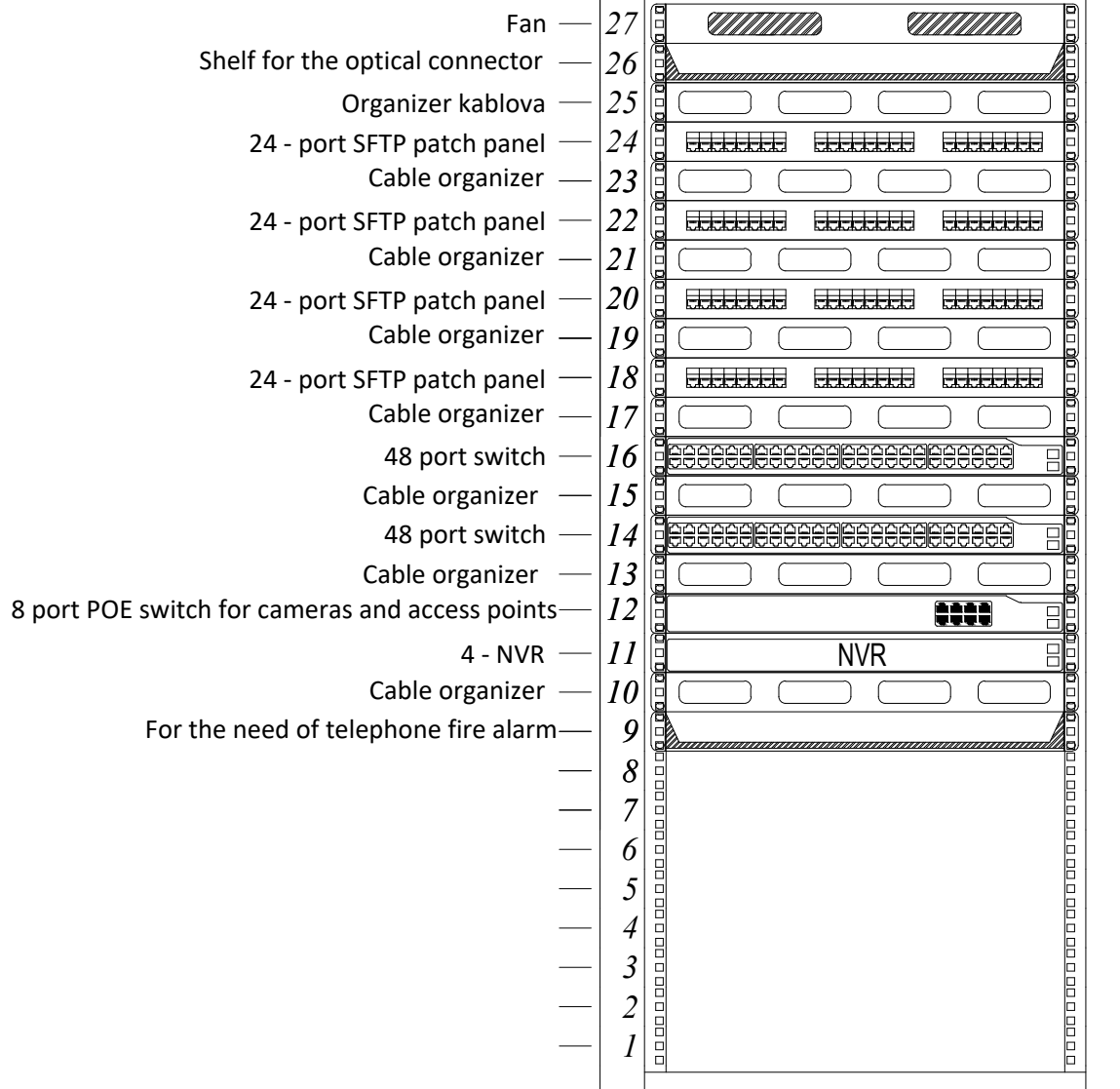
Total net area 383.25 m²

LEGEND OF THE SYMBOL	
Symbol	Description
	RACK cabinet
	RJ-45 Cat.6 modular socket 1M
	Access point
	HDMI socket 1M
	Indoor Dome Camera
	Fire control center
	Fire alarm by phone
	Optical fire detector
	Thermal fire detector
	Internal siren
	Internal siren

LEGEND OF THE CONDUCTOR	
Symbol	Description
	S/FTP cat.6 LSZH conductor
	HDMI provodnik
	S/FTP cat.6 LSZH conductor for cameras
	J-H(St)H FE180/E90 2x2x0.8mm conductor
	J-H(St)H FE180/E90 2x2x0.8mm conductor

DESIGNER: ENpro ing Enproing DOO bul. vojvode Stanka Radonjica br.47, Izmeđa 1, stan 43., Podgorica tel: +382(0)67 215 992		INVESTOR: Western Balkan Six Chamber Investment Forum Piazza della Borsa nr. 14 34121 Trieste, Italy	
Objekat: HIGH SCHOOL OF ELECTRICAL ENGINEERING "VASO ALIGRUDIĆ"		Location: k.p. 1193, KO Podgorica I, Municipality Podgorica	
Leading designer: Zagorka Božović Pejanović, dipl. ing. arh.		Type of technical documentation: Adaptation project of parts of the facility	
Authorized designer: Slobodan Marković, dipl.inž.el. br. lic. UPI 107/7-1164/2 Assistant designer: Marko Vujović, spec.sci.el.		Part of technical documentation: Electrical engineering project- extra low voltage	SCALE: 1:50
Drafting date and M.P.		Inclosure: Base floor - SKS, video surveillance, automatic fire alarm	No. of attachment: 1 Page no. 57
		Date of revision and M.P.	

RACK



DESIGNER:

ENpro
ing

Enproing DOO
buĹ. vojvode Stanka Radonjića br.47,
lamela 1, stan 43., Podgorica
tel: +382(0)67 215 992

INVESTOR:

Western Balkan Six Chamber Investment Forum
Piazza della Borsa nr. 14
34121 Trieste, Italy

Objekat: HIGH SCHOOL OF ELECTRICAL ENGINEERING
"VASO ALIGRUDIĆ"

Location:
k.p. 1193, KO Podgorica I, Municipality Podgorica

Leading designer:
Zagorka Božović Pejanović,
dipl. ing. arh.

Type of tehcnical documentation:
Adaptation project of parts of the facility

Authorized designer:
Slobodan Marković, dipl.inž.el.
br. lic. UPI 107/7-1164/2

Part of tehcnical documentation:
Electrical engineering project- extra low voltage

SCALE:

Assistant designer:
Marko Vujović, spec.sci.el.

Inclosure:
Block scheme- Rack cabinet

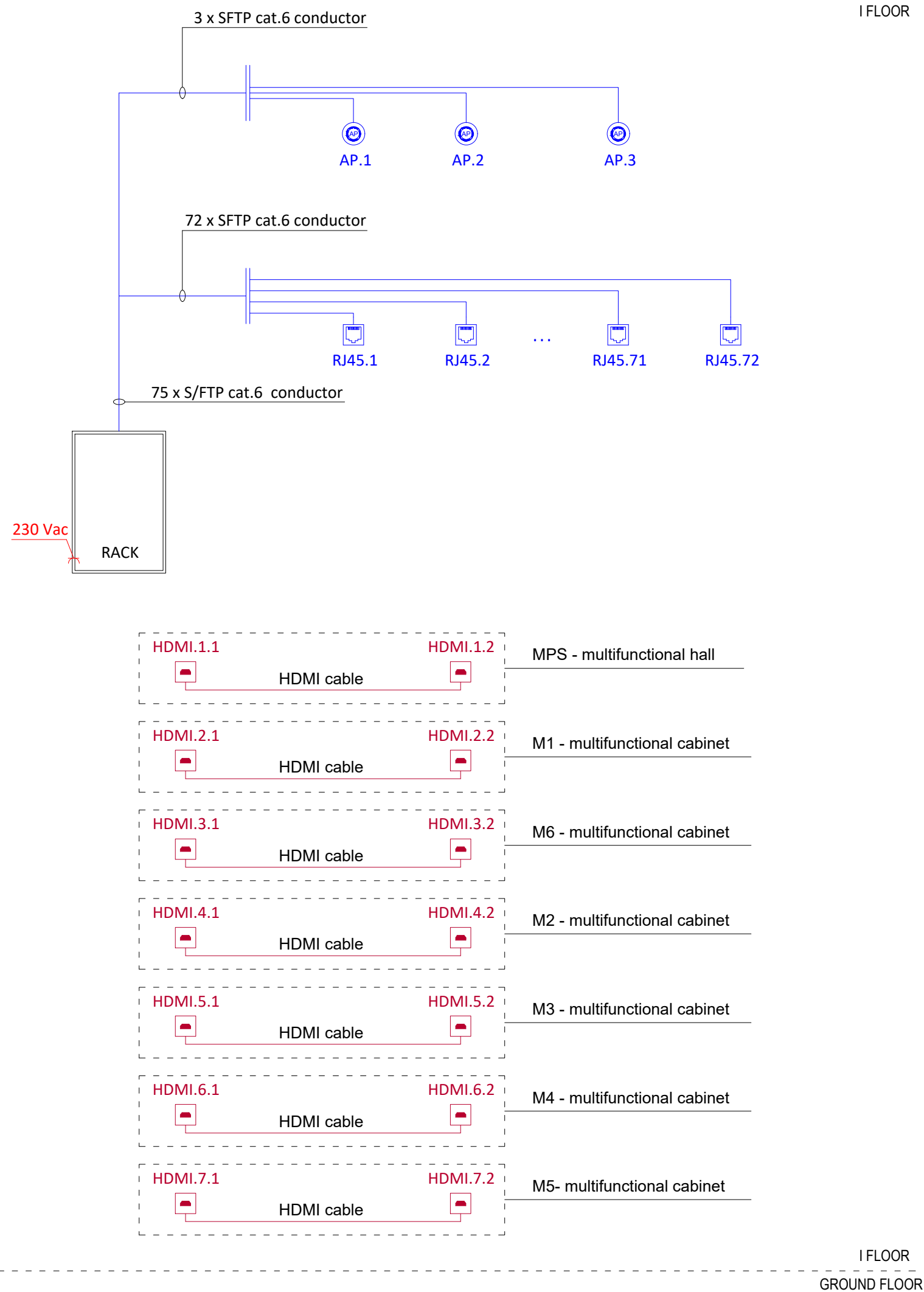
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Page no.
58



Drafting date and M.P

Date of revision and M.P

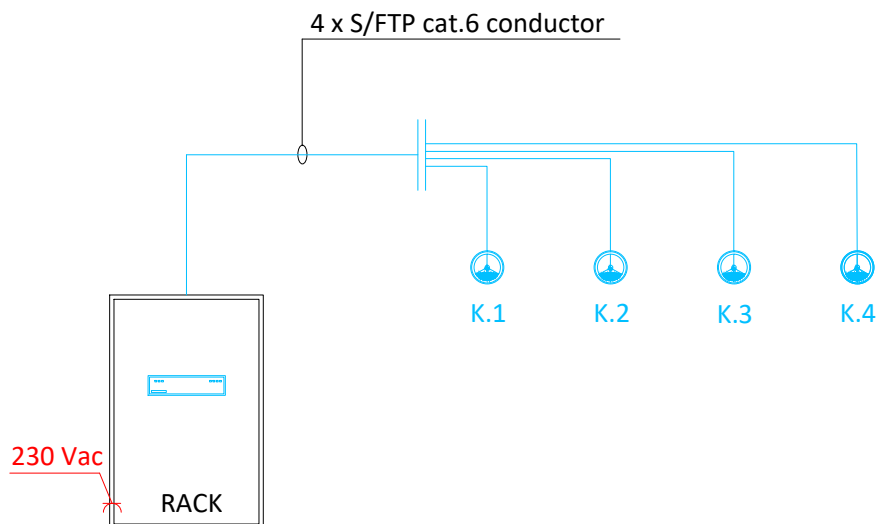
February, 2024. year





LEGEND OFF THE SYMBOL	
Symbol	Description
	RJ-45 Cat.6 modular socket 1M
	Access point
	HDMI socket 1M

LEGENDA PROVODNIKA	
Simbol	Opis
	S/FTP cat.6 LSZH conductor
	HDMI conductor


DESIGNER: ENpro ing Enproing DOO bul. vojvode Stanka Radonjića br.47, Iamela 1, stan 43., Podgorica tel: +382(0)67 215 992	INVESTOR: Western Balkan Six Chamber Investment Forum Piazza della Borsa nr. 14 34121 Trieste, Italy		
Objekat: HIGH SCHOOL OF ELECTRICAL ENGINEERING "VASO ALIGRUDIĆ"	Location: k.p. 1193, KO Podgorica I, Municipality Podgorica		
Leading designer: Zagorka Božović Pejano vić , dipl. ing. arh.		Type of tehcnical documentation: Adaptation project of parts of the facility	
Authorized designer: Slobodan Marković, dipl.in ž .el. br. lic. UPI 107/7-1164/2		Part of tehcnical documentation: Electrical engeneering project- extra low voltage	SCALE:
Assistant designer: Marko Vujović, spec.sci.el.		Inclosure: Block scheme - Installations SKS system to connectors	No. off attachment 3
Drafting date and M.P		Date of revison and M.P	
February, 2024. year		Page no. 59	



LEGEND OF THE SYMBOL

Symbol	Description
	4-channel NVR switch
	Indoor Dome Camera

LEGEND OF THE CONDUCTOR

Simbol	Description
	S/FTP cat.6 LSZH conductor for cameras

DESIGNER:

**ENpro
ing**Enproing DOO
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INVESTOR:

Western Balkan Six Chamber Investment Forum
Piazza della Borsa nr. 14
34121 Trieste, ItalyObjekat: HIGH SCHOOL OF ELECTRICAL ENGINEERING
"VASO ALIGRUDIĆ"Location:
k.p. 1193, KO Podgorica I, Municipality PodgoricaLeading designer:
Zagorka BoŹović Pejanović,
dipl. ing. arh.Type of tehcnical documentation:
Adaptation project of parts of the facilityAuthorized designer:
Slobodan Marković, dipl.inŹ.el.
br. lic. UPI 107/7-1164/2Part of tehcnical documentation:
Electrical engineering project- extra low voltage

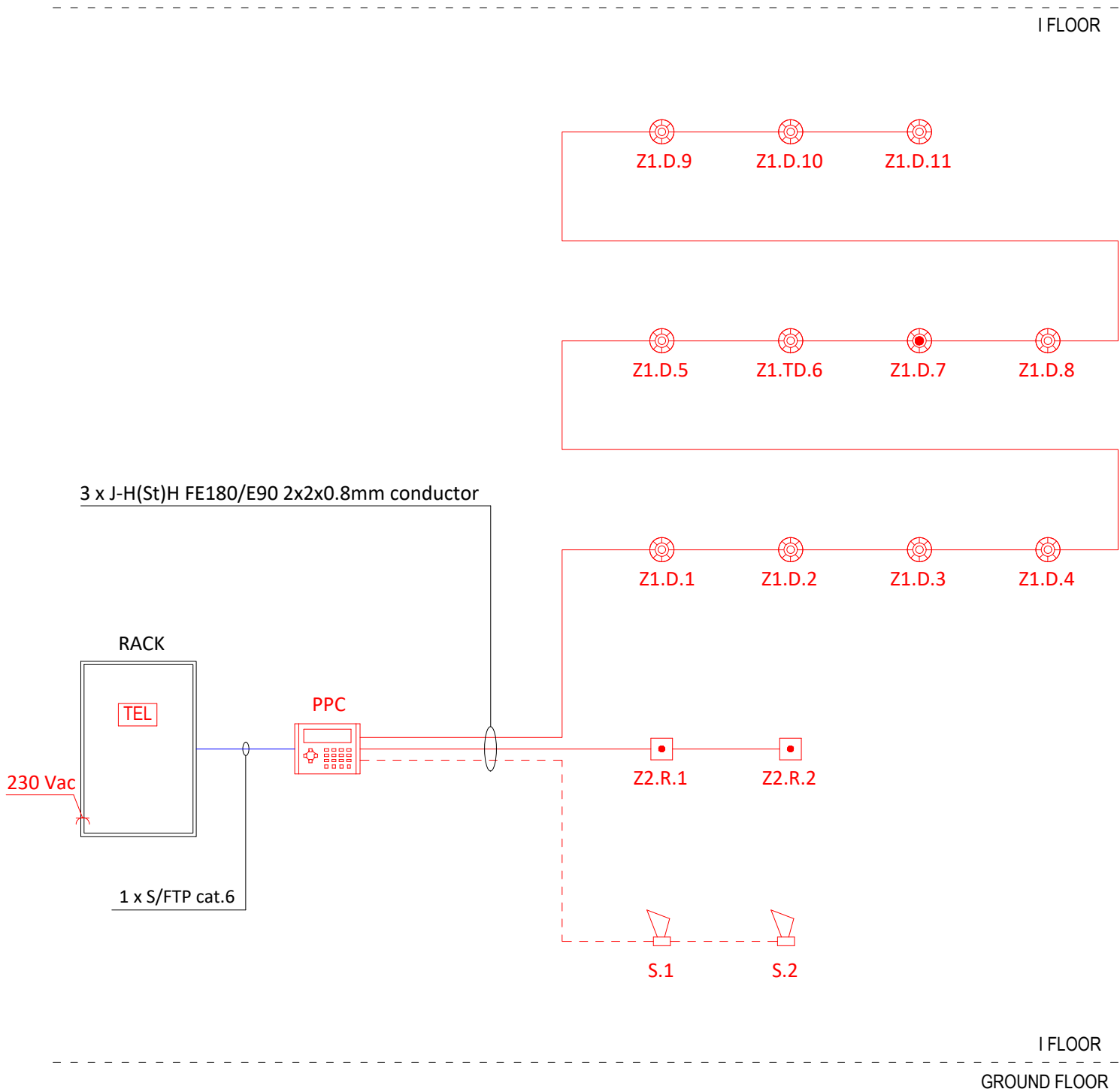
SCALE:







Assistant designer:
Marko Vujović, spec.sci.el.Inclosure:Block scheme-
video surveillance installationsNo. off attachment
4Page no.
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Drafting date and M.P

Date of revision and M.P

February, 2024. year



LEGENDA SIMBOLA	
Simbol	Opis
	Fire control center
	Fire alarm by phone
	Optical fire detector
	Thermal fire detector
	Internal siren
	Manual fire alarm

LEGEND OF THE CONDUCTOR	
Simbol	Description
	J-H(St)H FE180/E90 2x2x0.8mm conductor
	J-H(St)H FE180/E90 2x2x0.8mm conductor

DESIGNER: <div>ENproing</div> Enproing DOO bul. vojvode Stanka Radonjića br.47, Iamela 1, stan 43., Podgorica tel: +382(0)67 215 992		INVESTOR: Western Balkan Six Chamber Investment Forum Plazza della Borsa nr. 14 34121 Trieste, Italy	
Objecat: HIGH SCHOOL OF ELECTRICAL ENGINEERING "VASO ALIGRUDIĆ"		Location: k.p. 1193, KO Podgorica I, Municipality Podgorica	
Leading designer: Zagorka Božović Pejanović, dipl. ing. arh.		Type of tehcnical documentation: Adaptation project of parts of the facility	
Authorized designer: Slobodan Marković, dipl.inž.el. br. lic. UPI 107/7-1164/2		Part of tehcnical documentation: Electrical engineering project- extra low voltage	SCALE:
Assistant designer: Marko Vujović, spec.sci.el.		Inclsure:Block scheme - automatic fire alarm	No. off attachment 5 Page no. 61
Drafting date and M.P February, 2024. year		Date of revision and M.P	