VOLUME 3

TECHNICAL SPECIFICATIONS

A. TECHNICAL DESCRIPTION

1. CONSTRUCTION AND CRAFTSMEN WORKS

1.1 General

The project design documents (main project design of object) have been harmonized with the following regulations and laws:

- Law on construction of objects Official gazette 51/2008 RCG (Republic Montenegro)
- Regulation on contents of technical documentation Official gazette 51/2008/ RCG (Republic Montenegro)

1.1.1 Location of object

The object is located on a relatively plane plot of land. The plot and building line is parallel to the local traffic road. In the free part of the plot, parking of vehicles will be enabled and with the necessary garages the required conditions for the functioning and parking from the urban development – technical requirements will be complied with.

1.1.2 Function of the object

The building is a special purpose object – a fire fighter's station. It is designed in such a way, that every floor is different due to functional reasons. The access is defined towards the street in front of the planned building, the Obalski put street.

The main facility is definitely the garage space, of a capacity of 6+1 vehicles. The first garage space adjacent to the tower is dedicated for mechanical works and it will be equipped with a canal of 1,50 meters depth for repair works. At same level of the garage is a servicing area for firefighting equipment, technical workshops and a locker-room for the personnel.

Within the ground floor level and at level of the ground is also a space for relaxation of personnel, with a locker-room and a sanitary facility.

The ground floor also contains a watch tower. The tower is constructed of steel profiles, closed in with sandwich panels. The communication stairwell is also constructed of a steel structure, with all railings and platforms. On each floor level is an auxiliary platform and a ladder support for training and education of candidates.

From the hallway, a communication is established with the stairwell, which enables communication with the ground floor, upper floor and attic. The vertical communication, a two sided stairwell is positioned onto the facade wall, towards the north. For communication with the attic the same stairwell is used, with starting point at elevation +3.25, finishing at elevation +5.42.

At level of the gallery space, elevation +2.51 is the fitness hall, table tennis room, sanitary facilities and the laundry room for the entire object.

At upper floor elevation point +3.25 are the office premises, with sanitary facilities. These are connected with the ground floor and attic via vertical communication.

The attic floor at elevation +5.42 contains a conference room, apartments (2 apartments),a small kitchenette, sanitary facilities for the conference room and a terrace attached to the conference room.

In relation to the surrounding grounds, the ground floor is elevated for some 0.20 m.

1.1.3 Structure

The structure of the building is of reinforced concrete in combination with steel beams and steel structures. It consists of a brick construction, reinforced with concrete columns as vertical structure and beams with reinforced concrete slab as horizontal structure. The architectural design defines the steel and concrete structure, as well as the structural module. The foundation is made of reinforced concrete strips, especially reinforced in parts with bigger loads – like at the joint between the garages and the office spaces. The roof differs depending on which part it covers: Wherever thermal insulation is needed, the roof will be done of sandwich panels and where no insulation is needed, the roof will be made of simple, trapeze shaped steel sheeting.

1.2 Finish of surfaces and equipment of object

1.2.1 Final floor surfaces
The floors in the garages, technical workshops, fire extinguisher servicing area are all made of lightweight (fer) concrete. In the floor in the garage the concrete surface must be poured in with an inclination of 1% for drainage of water into the drain grill.
The floors structure must be protected with adequate layers of hydro-insulation.
In the sanitary facilities hydro-insulation is applied onto the slab between the floors. The floor structure is laid on top of a tampon layer of concrete. The joints between the walls and the floor layers are done in such a way that any contact between the floor mortar and final surface layer of the wall is prevented within the entire space. The final surface layers of the floors are to be separated with splints along the wall made of permanently, elastic kit.
Joints between two different floor layers to be done with a separating border rail of 5'50'1mm, made of stainless steel.

1.2.2 Ceramic tile floor
The floor is laid of faint, glazed and faint non-glazed floor tiles, dim.30/30/08cm and granite tiles. The floor is done by laying the tiles into ceramic tiles glue, with an open splint of 0.5cm in the pattern splint onto splint.
The splints to be filled with splint filling „fugomal“. Tiles of a height of 10 cm along the wall, The splints here to be filled with permanently elastic kit.
In the sanitary/wet rooms the floors to be laid with an inclination of 0.2% towards the floor mounted drain.

1.2.3 Parquet floor
Oak parquet of 2,4 cm thickness is placed onto an even and horizontal area, into wood glue. The parquet is laid in the „fishbone“pattern or another pattern as proposed by the manufacturer. The final processing is done with 3-layers of varnish, after all necessary preparation works.

1.2.4 Stairwell
The stairs in the object will be poured of concrete at site. The stairs will be covered with stone slabs and a stone slab border line along the vertical parts as per architectural detail, the railing if of metal.

1.3 Walls

The following walls are designed in the building:
Structural, supporting reinforced concrete walls with blocks of a thickness of 10.20.25, outside walls to be covered with „DEMIT“ facade system, thickness =5.00 cm.

1.3.1 Internal walls
- The walls to be painted in water –washable paints of good surface coverage properties and with all preliminary works, while the special areas and rooms that will be subject of the interior design, will be done only up to a degree where these walls are ready for application of the final surface layers.
- Laying of glazed ceramic tiles with open splint, thickness =0.3 cm. The tiles are laid into cement glue, in a pattern splint onto splint. The splints to be filled with the adequate „fugamol“ mass in color of the tiles. In the sanitary facilities tiles to be laid on the walls up to the ceilings.

1.4 Ceilings

All ceilings in the building smoothed and coated with dispersive paint. In special rooms that are defined by interior design plans the ceilings surfaces and processing will be separately determined. The ceiling in the conference hall is suspended to the height defined in the project section design and it contains all necessary installations. The ceiling is suspended with adequate dry, plasterboard panels.

1.5 Doors

All doors in the object are defined by project design. These doors to be done in accordance with the design and details /drawings of high quality wood and wooden material.
All dimensions must be measured at site, prior to delivery of these elements. The contractor is obligated, prior to the delivery and mounting, to present the customer the detailed drawings and sketches. Prefabricated samples must be tested – certified whenever requested so by the investor.

1.6 Locksmith's works

Certain aluminum elements and structures are designed for the building. Parts of the facade, windows etc. are made of aluminum profiles.

1.6.1 Metal parts

The stairwell railing is done in accordance with the project design and respective distances between the posts. The railing is done of steel profiles: metal posts of a diameter fi 40mm , with anchoring plate, the joint to the anchoring plate is done with screw connection or welding, as defined by the project designs. The final pipe has a diameter of 60 mm and all joints are to be welded.

1.6.2 Aluminum structure

For the object an outside aluminum structure shell has been designed with all outside surfaces in glass. All elements of the outside aluminum structure are made of previously defined and designed prefabricated aluminum profiles, painter with dust coated paint in designed shade of color. The glass to be used is Termopan glass. All locks and fittings must comply with the designed way of opening and must all be in adequately high quality, in identical color as the framework. The contractor is obligated to submit all workshop drawings and details and to obtain previous approval by the designer.

1.7 Tinsmith works

Rain gutters are made of galvanized tin sheets, of semi- and circular shape, with supports of flat steel strips 25/4mm placed at a distance of 90cm.
All other tinsmith works are drips of the building.

1.8 Roof works

These works are mainly the works on building the roof slabs with sandwich panels and steel sheets in trapezoid form in RAL 9001.

1.9 Equipment of the object

The following equipment is planned for the subject building:

- water supply and sewage with adequate equipment
- electric installations – high and low voltage current

Furnishing of object and drafting the interior design of the spaces in the building is not planned for this phase.

1.10 Insulation and protection

The object is protected with insulation that based on the technical properties guarantees protection against penetration of humidity and water into the building, i.e. gives protection against capillary water or water under pressure, adequate sound insulation within the building and protection against atmospheric impact from the outside (heat or cold).

1.11 Drainage of precipitation water

Drainage of rainwater from the roof is solved on the roof slabs, where the rain water is conducted to the horizontal roof gutter and from there into the vertical drainage pipes. The project of precipitation water drainage is processed in details in the project design for water supply and sewage installations.

2. WATER SUPPLY AND SEWAGE

2.1 General part

The building of the Firefighting station is located in a zone where underground infrastructure is already solved, which means that public water supply and sewage pipes network already exist. This means that the object will be connected to this public network with the newly designed, own internal network. This project design includes a separate hydrant network (indoor and outside). For supply of the hydrant network underground water from a well will be used, because the building is located immediately near the river Lim. Pumping of water from this well will be done with an adequate suction pump. The connection points to the public sewage and water supply networks are at the front side of the building so that the underground – internal pipelines are all oriented towards this public network system.

2.2 Water supply

The drinking water supply network is to be connected with the public water supply network through pipes of a diameter of Ø75mm, while pipes for internal distribution in sanitary facilities are of diameter Ø15mm, Ø20mm, Ø25mm and Ø32mm. The drinking water supply and the internal distribution of the pipes in the sanitary facilities is done with pipes type Fluidterm PPR-Random type-3, of high-molecular section weight of Ø15mm, Ø 20mm, Ø25mm and Ø 32mm, while the connection with the public network is done with PE pipes of Ø75mm. The water supply pipe network must be treated with chloride and tested for pressure before it is commissioned for usage. All these installations must be done in accordance with the valid regulations and properly tested prior to installation. The hot water need will be solved through adequate boilers.

Cold water consumers in the object are :

WC	9	x	0.25	2.25J.O
Hand washing basin	13	x	0.50	6.50J.O
Urinal	4	x	0.25	1.00J.O
Bathtub	4	x	1.00	4.00J.O
Dishwashing sink	2	x	1.00	2.00J.O
fountain	1	x	1.00	1.00J.O
trokadera	1	x	1.00	1.00J.O
MV	2	x	0.50	1.00J.O
				18.75J.O

The diameter of the water supply pipes is to be dimensioned in accordance with the hydraulic calculation, so that the pipe's diameters and the over-pressure in the pipeline fully comply with the needs of the individual water outlets in the building both in regard of pressure and volume of stream. In the building five internal, wall mounted hydrants plus seven internal hydrants will be installed, as well as two outside hydrants used to load the water tank trucks with water. A separate, wet hydrant network is designed for the building, which will be supplied from the newly designed well located behind the object. The internal hydrant network will be done of galvanized pipes of a diameter Ø75mm , the diameter of the main, outside pipeline is Ø75mm and PE pipes are used.

2.3 Sewage system

The horizontal and vertical distribution of the sewage system in the building is done of PVC pipes in different diameters from Ø50mm, Ø75mm, Ø110mm, Ø125mm and Ø160mm, installed in the walls or floors of the object. The sewage installation must be tested on water tightness before commissioning into operation. All installations must comply with valid regulations and have to be tested before mounting. Revision holes are defined at each necessary location, turns, crossings and connection points to the vertical sewage pipes, so that a possibly necessary intervention is enabled. Two revision shafts are designed for the building, one of which located in the building so that two lids/covers must be mounted to prevent any unpleasant smells, these covers to be of pressed steel sheet of 6 mm thickness.

Due to the small loads, the dimensioning of pipes is done empirically, whereas the smallest accepted diameter for fecal outlet pipes from the object is defined at ϕ160mm.
For proper functioning and maintenance of the sewage pipes, revision elements on the vertical pipes will be mounted. The number, type and position of sanitary facilities is given in the construction design of the object.

3. HIGH VOLTAGE CURRENT INSTALLATION

1. Introduction
Subject of this project design are:
- The necessary distribution panels/boxes
- Potential equalization installation
- Earthing installations (lightning rod)
- Electric installations for general consumers in the object
- Connections for general consumers of electricity
- Electric installations for illumination in the building

Cooling of the building is done with mounted air-conditioning units.

2. Connection to the public electricity distribution network – n/a

2. Distribution cabinet and distribution panels in the floors

3.1 Main distribution cabinet (GRO), this cabinet is mounted to the facade of the building, immediately next to the entrance, on the right side, so that the center of the cabinet is positioned at 1,4 meters above the threshold. The GRO must be of protection level IP54. From the TS the cable PP-00 4x50 mm2 is connected, from the generator a cable PP-00 4x25 mm2.

3.2 Distribution panel of boiler room (network) (RT – 0m), this panel is mounted in the boiler room, as shown in the situation drawing. It is connected with the GRO cable type PP-Y 5 x 10 mm2. The panel is plastic and contains the following equipment:
- ZUDS 40/0,5 A - pieces 1
- Automatic fuses 16 A - pieces 5

On this RT the installations is to be wired in accordance with the sketch/situation drawing and the single pole scheme of RT-0.

3.3 Distribution panel of boiler room (network - generator) (RT – 0a), this panel is placed in the boiler room, as shown in the situation drawing. It is connected with the GRO cable type PP-Y 5 x 6 mm2. The panel is made of plastic and contains the following:
- Automatic fuses 10 A - pieces 2

On this RT the installations is to be wired in accordance with the sketch/situation drawing and the single pole scheme of RT-0.

3.4 Distribution panel of ground floor (network) (RT – 1m), this panel is to be placed in the ground floor, as shown in the situation drawing. It is connected with the GRO cable type PP-Y 5 x 10 mm2. The panel is plastic and contains the following:
- ZUDS 40/0,5 A - pieces 1
- Automatic fuses 16 A - pieces 18

This RT is connected to the installations as presented in the situation drawing and the single pole scheme RT-1.

3.5 Distribution panel of ground floor (network-generator) (RT – 1a), this panel is to be placed in the ground floor, as shown in the situation drawing. It is connected with the GRO cable type PP-Y 5 x 6 mm2. The panel is plastic and contains the following:
- Automatic fuses 10 A - pieces 5

This RT is connected to the installations as presented in the situation drawing and the single pole scheme RT-1.

3.6 Distribution panel of ground floor (network) (RT – 2m), this panel is to be placed in the ground floor, as shown in the situation drawing. It is connected with the GRO cable type PP-Y 5 x 16 mm2. The panel is plastic and contains the following:

- ZUDS 40/0,5 A - pieces 1
- Automatic fuses 16 A - pieces 38

This RT is connected to the installations as presented in the situation drawing and the single pole scheme RT-2m.

3.7 Distribution panel of ground floor (network-generator) (RT – 1a), this panel is to be placed in the ground floor, as shown in the situation drawing. It is connected with the GRO cable type PP-Y 5 x 10 mm2. The panel is plastic and contains the following:

- Automatic fuses 10 A - pieces 7

This RT is connected to the installations as presented in the situation drawing and the single pole scheme RT-2m.

3.8 Distribution panel in gallery (network) (RT – 3m), this panel is to be placed into the gallery, as presented in the situation drawing. It is connected with the GRO cable type PP-Y 5x10 mm2. The panel is plastic and contains the following:

- ZUDS 40/0,5A - pieces 1
- ZUDS 16/0,03A - pieces 2
- Automatic fuses 16A pieces 11

This RT is connected to the installations as presented in the situation drawing and the single pole scheme RT-3.

3.9 Distribution panel in gallery (network-generator) (RT – 3a), this panel is to be placed into the gallery, as presented in the situation drawing. It is connected with the GRO cable type PP-Y 5x6 mm2. The panel is plastic and contains the following:

- Automatic fuses 10A pieces 3

This RT is connected to the installations as presented in the situation drawing and the single pole scheme RT-3.

3.10 Distribution panel in upper floor (network) (RT – 4m), this panel is to be placed in the upper floor, as presented in the situation drawing. It is connected with the GRO cable type PP-Y 5x10 mm2. The panel is plastic and contains the following:

- ZUDS 40/0,5A - pieces 1
- Automatic fuses 16A pieces 10

This RT is connected to the installations as presented in the situation drawing and the single pole scheme RT-4.

3.11 Distribution panel in upper floor (network-generator) (RT – 4a), this panel is to be placed in the upper floor, as presented in the situation drawing. It is connected with the GRO cable type PP-Y 5x6 mm2. The panel is plastic and contains the following:

- Automatic fuses 10A pieces 10

3.12 Distribution panel in attic (network) (RT – 5m), this panel is to be placed in the attic, as presented in the situation drawing. It is connected with the GRO cable type PP-Y 5x16 mm2. The panel is plastic and contains the following:

- ZUDS 40/0,5A - pieces 1
- Automatic fuses 16A pieces 29

This RT is connected to the installations as presented in the situation drawing and the single pole scheme RT-5.

3.13 Distribution panel in attic (network-generator) (RT – 5a), this panel is to be placed in the attic, as presented in the situation drawing. It is connected with the GRO cable type PP-Y 5x10 mm2. The panel is plastic and contains the following:

- Automatic fuses 10A pieces 9

This RT is connected to the installations as presented in the situation drawing and the single pole scheme RT-5.

4. Electric installations for general consumer

The installation for general electricity consumers is done with cables PP-Y 3x2,5 mm2 and PP-Y 5x2,5 mm2. The cables are laid on the wall, under the plaster, horizontally at 30 cm under the ceiling. In the garage the sockets must be of OG type, supplied by cable that passes through the concrete floor slab and placed on the columns. Connection and further laying of cables is done with distribution boxes and adequate clamps.

For the general electricity consumers a certain number of three-phase and mono-phase sockets must be installed as defined in the electric installations plans and single pole schemes.

The sockets are positioned:

- In the rooms at 0,3 meters above floor
- In kitchen at 1,2 met above floor
- In the bathroom at 1,6 meters above floor and 0,6 meters from the water outlet /tap a socket with a protective cover must be mounted, which is additionally protected with ZUDS 16/0,03A .

The control cabinet in the tower is supplied with a GRO cable type PP-Y 5x4 mm2.

5 . Electric installations for illumination

The electric installation for the illumination of the building is done with cables PP-Y 3, 4, 5x1,5 mm2. The cables are laid on the wall, under the plaster, horizontally at 30 cm under the ceiling. Connection and further laying of cables is done with distribution boxes and adequate clamps.

Switches are mounted on the wall, 1,2 meters above floor. In the common hallways of the residential part of the building illumination will be mounted that is controlled via switch mounted in the stairwell. At the exit from each apartment panic lights are mounted with 3 hours of autonomous operation. Panic lights are also planned for the common hallways.

In the bathroom, above the mirror one fluo-lamp of 1x18W is mounted, with a socket for the shaving machine, complete with a transformer 220/220V. The lamp and the transformer must be mounted in such a way that the electric connection is at 60 cm above bathtub edge, with a protection class IP44, insulation class 2 (lamp with insulated support), all in accordance with the standard JUS N.B2.771.1988.

The outside illumination is not subject to this project design, except for the lamps that are mounted onto the outside building's walls.

By this project design the installation plans define the positions for the mounting of lamps, while the design doesn't define the type of lamp to be used, which is left for the interior designer to decide.

6 . Potential equalization installation

All metal distribution cabinets and panels, sockets. Metal parts of lamp fittings, central heating pipes, metal water and sewage pipes must be properly and mechanically be connected with the earthing strip.

Metal masses in sanitary facilities – like tubs, showers, water supply installation, sewage installations etc., must all be connected with the conductor P-4 mm2, yellow-green color, to the potential equalization box in the RT and KPO.

7 . Earthing installation

Protection against contact with dangerous voltage in the object is solved with an earthing system and a mounted ZUDS 40/0,5A.

In accordance with the standard JUS N.B2.754, for the earthing a common earthing is designed for all installations in the building, made of a strip Fe-Zn 25x4 mm, which strip is located in the lower zone of the foundation steel, welded to the reinforcement steel on each 2-3 meters.
The strip is to be positioned in right angle. From the strip in the foundations, outlets must be laid for the KPO and single-potential collector (JS) to the GRT and individual outlets, as shown in the attached drawing.
The connections between the vertical strips and the earthed part is done directly, without any interruptions.
As main connection to the earthing of the building a single potential collector in the distribution panel is used, which needs to be connected to:

- protective rail in GRO with conductor PP-OO 1x25 mm2,
- KPO cabinet that is directly connected to the foundation earthing
- foundation earthing with strip Fe-Zn 25x4 mm
- main water pipeline PP-OO 1x16 mm2
- main sewage pipe PP-OO 1x16 mm2
- PTT cabinet PP-OO 1x16 mm2

The inter-connection of the strips is done cross-pieces of strips, strips in accordance with JUS N.B4.936.
The TN protection system is not calculated because the connections to the building in regard of electricity supply are not defined jet and this protection must be checked.
The connection of the neutral and protective conductor is done in the GRO and after this their inter-connection is prohibited anywhere else in the installations.

8 . Cooling of building

The building is cooled with natural ventilation and by application of high quality thermal insulation materials and with air conditioning units.

4. LIGHTNING ROD INSTALLATION

In order to warrant protection of the building against atmospheric discharge an outside and internal lightning protection installation is designed.
The outside lightning rod consists of:

- receiving part
- vertical conductors
- earthing system

The receiving part of the object is the steel sheeted roof.
The vertical conductors will be made of galvanized steel strips Fe-Zn 20x3 mm to the measurement joints and from the measurement joints with strip type Fe-Zn 25x4 mm to the earthing system.
Since the protection level is I, the biggest distance between the vertical conductors can be 10 meters, which means that 14 vertical conductors of the lightning rod will be mounted on the building.
The connection of strips –metal sheets is done with overlapping of 10 cm and fixation of joint with two screws M12.
A test connection is placed onto these vertical conductors. These test connections/joints are done in the facade, in standard boxes for such testing connections, placed at 1,7 meters above the pavement.
For efficient protection against atmospheric discharge (lightning) an earthing is designed in the foundation of the building, which is used as integrated system and warrants full and complete protection (against lightning and protection of electric installations).
For the earthing, the mean geometrical semi-section may not be less than, L1'', r > L1 (L1 – in function of the desired protection level and specific ground resistance).
The total length of the strip Fe-Zn 25x4 mm in a trench around the building is 115 m.
The mean geometrical semi-section, r'' of the earthing is 21,78 m, which is above the demanded L1 = 5 m (table of minimum length of earthing strips in function of protection).

5. LOW VOLTAGE ELECTRIC INSTALLATION

5.1 Introduction

The Firefighting station in Berane has a basement, ground floor, gallery, upper floor and attic.
Subject to the project design is the ground floor, upper floor and attic.
This project assesses the following:

- telephone and computer network
- video surveillance system

The vertical cable distribution is solved through the vertical cable route for telecommunication installations, into which the cable support is mounted, or such cables are laid through plastic pipes under the walls plaster layer.
For all installations in the building cables with non-halogen mass to be used (the cables will be laid in dry and wet spaces and don't demand any additional protection). When passing through fire suppressing walls, all openings for the cables must be closed with Flammastick mass, and cables sprayed with the same mass, which is fire resistant.
All installation material (pipes, distribution boxes, clamps etc.) that are not mounted under the plaster or are not covered with concrete must be made of plastic without chloride content.
All technical solutions are applied in accordance with the valid regulations and standards for electrical installations and the fire protection and fire prevention regulations.

5.2 Telephone and computer network

The structural cabling represents the application of a unified cable system for all installations used for transfer of any data in a transfer range of up to 250 MHz (valid category standard 6). This includes also transfer of sound, pictures, control signals, but also very fast data transmission. The only interface to the user is a socket with RJ45 connector for connection of either PC's or a telephone (or both), which then is led via cable system to the distributors and active devices (telephone switchboard or LAN switches). The network structure is designed in such a way that after its installation, without any interventions on the cables as such, the entire network can be reconfigured in a completely different way, all depending on the needs of the users. This is accomplished with the routers that are constructed in a special way for easy reconnection and configuration based on needs.
Besides the great flexibility it offers, structural cabling enables – due to its systematic properties – simply and easy administration of network, easy extension of installation and maybe the most important of all, it is completely independent from the type of active devices used for both the telephone and computer network.
Connection of new work stations can be even done during the time the network is used and is done simply by connecting a cable into the individual socket. Whenever needed, by simple rearrangement of cables in the cabinets with concentrators, the entire network can be reconfigured.
This project design solution enables the development of the network in phases, by application of a lesser number of communication devices that is proportional to the number of computers owned by the investor at a certain moment of time and a great level of flexibility in their inter-connection.
The project design contains the realization of a standard type of network, which enables the investor not to be bound with equipment of only one manufacturer, because the designed equipment can be found in the offer of many other manufacturers of LAN equipment.
It is planned to accommodate the communication equipment into 19" cabinets, sufficient for all devices necessary to develop and implement the network with maximum capacity and sufficient space for routing the cables. Adequate connector fields are built into these cabinets for the inlet of installation cables to the connectors of the concentrator – the patch panel. The connection between the connector field and the concentrator is done with short patch cords. For each work station sockets of type RJ-45, category 6 is planned. One socket is dedicated to a direct phone line; the other is for connection onto the telephone switchboard and the third for the computer network. All sockets are mounted on modular panels, at 0,30 meters above floor level and in accordance with the interior design. The connection of the work stations and/or telephone on such installation is done with adequate cabling. When laying the FTP cables care must be taken that energetic and communication cables are laid at legally defined distances, since any violation of these rules would result in potential risk for induction of faults in the communication cables.

Taking into consideration the entire concept for the network to offer full capacity utilization that is granted through the topology of the passive part of the network, the active portion of the network must also be chosen in such a way that it contributes the overall availability of this network.
For Internet access a router type Cisco 2801 Integrated Services Router or similar is planned. This type of router must enable the transmission of multiple, high quality, simultaneous services, from cable transmission to multiple T1/E1/xDSL connections. The routers must offer an improved encryption acceleration and voice DSP (digital-signal-processor) slots, a system for the prevention of intrusion (IPS) and firewall functions, with optional integrated call processing and voice mail support, very densely distributed slots for a wide range of interfaces for the different needs and sufficient reserves for future expansions and advanced applications.
For maximum protection of the computer network a hardware firewall device similar to Cisco ASA 5510 will be used.
In order to establish voice communication towards the public telephone network, for each work station one direct telephone line is planned. The telephone distribution in the building is done via panels with RJ-45 connectors of category 3, within the main switch panel and the distribution panels of the structural cables systems in each floor. The connection between the ITO cabinet and the main telephone distributor and between the main and the individual distribution panels in the floors is done with multi-paired copper cabling type J-H(St)H 2x2x0.6 mm.
The wiring of the installation cables must always be done under permanent supervision of technical staff employed with the chosen company, which staff will perform the mounting, connecting, testing and commissioning of the mounted installation and the subsequent handing over of such installation with adequate warranties.
The disposition of the equipment and the cable routes are presented in the drawings in the graphical part of the project design. The disposition of the designed and planned elements and devices must be harmonized with interior, mechanical, hydro and electric installations prior to their mounting.

5.3 Video surveillance system

A video surveillance system is planned for the building. This system is meant for surveillance and monitoring of the entrances and internal spaces in the object.
The video surveillance system consists of central equipment, TV cameras and cable installations.
The central equipment comprises a PC work station with adequate surveillance software, a multiplexer with integrated recording device on hard disc and a monitor/screen.
A built in motion detection system checks all cameras at entrances and enables priority recording by those cameras where a motion was detected. Each picture recorded by the cameras can be „frozen“ on the screen and the cameras can be viewed in sequences.
The multiplexers via Ethernet connectors are linked to the computer network, which enables protocolling and viewing of recorded material on the work station.
The cameras are all color cameras, with auto-iris shutter and continuous operation 24/7, with a minimum light level of 0,2 lux .
For internal spaces fixed, mounted cameras are planned in dome housings for internal installation, that are mounted onto the ceilings. The entrances into the building are controlled by cameras for external mounting, with built in heaters and a shade against sunlight and these are mounted onto adequate supports, at a minimum height of 2,5 met.
The criteria for the selection of type of camera to be used on fixed, solid supports is the number of parameters the operators is simultaneously following. The permanently defined scene on the cameras enables easier follow up on the situations and immediate detection of any changes. The detection system of movements defines alarming situations on cameras where a change happened in the field of vision, thus enabling control over defined locations.
The cable installation is done with coaxial cables type RG59 B/U-HF and power supply cables of type N2XH 3x1,5 mm2 .
For all cameras a special energetic distribution grid is designed – a distribution panel of 220V, 50 Hz, located in the space where the main distribution cabinet is positioned. Each camera has power supply device mounted into the suspended ceiling or in the camera housing.
The ends of the signal transmission cables is done with connectors at both ends. The power supply

cables will have serial clamps at the end.
The wiring of the installation cables must always be done under permanent supervision of technical staff employed with the chosen company, which staff will perform the mounting, connecting, testing and commissioning of the mounted installation and the subsequent handing over of such installation with adequate warranties.
The disposition of the equipment and the cable routes are presented in the drawings in the graphical part of the project design. The disposition of the designed and planned elements and devices must be harmonized with interior, mechanical, hydro and electric installations prior to their mounting.

5.4 Installation material

For the laying of the cables within the object perforated cable shelves and installation pipes must be used.
The perforated cable shelves are mounted in the suspended ceiling and the vertical opening and are attached on supports onto the ceiling or the wall, with adequate suspension material. Changes in directions and outlets from the shelves are supported with adequate angle pieces and T-pieces.
The installation pipes are used at places where no cable shelves are installed and are built into the walls, floor and ceilings. Plastic distribution boxes are used for changes in directions and outlets.
Small installation material is used for the cable laying and mounting of cable shelves and installation pipes, like binders, screws, glue, insulation tape etc.)
All installation material (pipes, distribution boxes, binders and clamps) that are mot mounted under the plaster or into the concrete must be done of plastic mass without any chloride content.

6. HEATING INSTALLATIONS

6.1 General

The building has a ground floor, upper floor and attic. In the construction project design thermal insulations of all construction elements are designed in accordance with the applicable standards of thermal (heat) insulation of buildings.
In the souterrain the boiler room is located. The ground floor contains the horizontal pipe network. In the boilers heating water of 90/70 ºC is prepared.
For the radiators in the residential part a system of 90/60 ºC is designed. The garages are heated with electric heaters. In the residential part heating is designed with radiators. A two pipe system with valves and 100% flow is designed.
The distribution network is done of seamless steel pipes passing along the halls.
In ground floor and upper floors the vertical pipelines are insulated with mineral wool and hidden in the interior. In the ground floor/souterrain the pipes are insulated with mineral wool in an aluminum cover.

6.2 Radiators

Aluminum radiators of type Fondital, Global Vox or adequate are designed for the object height 600, type 100.
The radiators are wall mounted as defined by design. At all locations where space allows, the radiators must be mounted under the windows, onto the window parapet wall. In rooms with French windows without parapets, the radiators are mounted at the side of the windows, on the wall.
Radiators are mounted wherever possible under the windows, at a height of 10 – 15 cm above floor, in the halls they can be mounted higher up the wall.

6.3 Pipe networks

For the supply of the radiators a pipe network of steel, seamless pipes for up to 95oC is used. The verticals in the halls of the residential part and the stairwell are insulated with mineral wool and hidden in the interior. Horizontal pipes are insulated the same way.
The network for the radiators in the residential part of the building is led in one single line from the boiler room to the stairwell under the basements ceiling. In the stairwell vertical pipes are laid into the ceiling of the 2. floor. Here the pipes are distributed in two horizontal branches to the verticals for the

apartments. There are two heating pipes branches. Onto the horizontal pipe network in the ground floor the verticals for the upper floor and attic are connected. These verticals all pass through the ground floor without any interruptions.
At all needed locations the pipes have an automated air-relief and also taps for discharge of water.
In the passages through the floor slabs and walls the pipes are to be wrapped in paper to enable a smooth dilatation of the pipe network.
Pipes are painted in protective paint before and after their mounting. Undamaged parts of the pipes are painted after the mounting of the pipes with one layer of protective paint and welding spots and damaged parts with two layers of protective paint. Visible parts are painted in same color as the radiators, all in accordance with request by investor.

6.4 Boiler room

The overall heat volume circulating through the installations is 130.000 W. This volume is accomplished by a boiler of 130 KW. Based on project design, a solid fuel boiler is chosen. Also, a closed expansion vessel will be used. Maintenance of the pressure in the system will be enabled with compressors. The calculation resulted in a vessel of 100 liters.
Safety valves are installed as protection against excessive pressure.
The boiler has a safety valve with a spring. On each vessel a safety valve is also installed.
A stack of 350 mm diameter and height of 12 meters will be constructed.
Speaking of mechanical equipment in the boiler room, a boiler, collectors with pumps and valves as a substation and an expansion vessel will be mounted.
For safety, safety valves in the boiler and a safety valve in the return pipeline will be used.
Additional safety is given by a protective, safety thermostat valve in the boiler.

6.5 Automatic regulation

Double automatic regulation/control will be applied.

6.5.1 Local regulation

Thermostat valves are mounted on approximately half of the radiators. In rooms where two or more radiators are installed, every second radiator must be equipped with a thermostatic valve.
Thermostatic valves are not designed for the radiators in the bathrooms. On the connection schemes, for each radiator with a thermostatic valve a symbol is entered in form of a square with the letters TR.
2 distribution branches for heating are designed.
For the residential part a system with central regulation of the necessary temperature of the supply pipes is designed, all in dependence with the exterior temperature.
The temperature control and regulation functions always depending on the outside temperatures.
The regulation of the outgoing temperature from the boiler is done with three-branched valves with adequate sensors and regulators.
The micro-processor regulators regulates the heating circle in the offices.
All pumps attached to the pipeline branches and boilers operates independently from the regulator. Regulators will start pump operation as protection against freezing.
The regulating valves are built into the return pipes and work as distributing valves, whereas these valves dosage the necessary water quantity for the decrease of the temperature of the water leaving the boiler onto a set temperature value.

6.5.2 Water circulation

A circulating water pump is mounted at the boiler. Each installation branch has an own pump and a short connection for usage of operatio0n of boiler pumps will be installed, especially when a part of the installation is out of function.
The circulation of water through the heating system is done with circulation pumps. On both pipeline branches one pump is mounted that is started through the automatic regulation/control system. One circulating pump is installed at the boiler. This boiler pump is started to accomplish the set temperature of the water of 55 ºC and when this pump stops operation, the working pumps are started.
As protection against corrosion at low temperatures, a boiler vessel circulating pump is installed that is

started/shut down by the pipe thermostat.
The boiler vessel has an protection, pump, safety valve and expansion vessel.
The project designs also plans for chemical water treatment, softening.
A single pipe stack is designed. This stack starts from the boiler with a diameter of 300 mm. In the construction part of the project design the solution for the stack is given. This solution defines the stack constructed of heat resistant blocks with slag –blocks.
For stability and additional protection the construction design also defines the construction of a protective coating around the stack, made of bricks with anchors onto the structural part.
Pipelines in the boiler room are insulated with mineral wool, with an aluminum foil coating or Armaflex coating.
For the pipes this insulation must be 50 mm thick and for the stack 50 mm.
Air inlet into the boiler room is enabled through the grill in the boiler room door and also in the construction design through adequate windows on the boiler room.
The smoke exhaust from the boiler room is designed through a ventilation duct with a fan and a grill/grate.

6.6 Ventilation of boiler room

The ventilation of the boiler room is designed as forced ventilation.

6.7 Fire extinguishers

For extinguishing of fire on installations and the boiler fire extinguishers type S6 with foam and one type S50 at the tank are planned, as well as a sand box and the mandatory hydrant.

6.8 Testing of the entire installation

Test of installation/pipes with cold water pressure test at 6 bars, during a period of 24 hours.
Other necessary data is contained in the calculation and graphical part of the project design and the preliminary calculation and preliminary bill of quantities. The designed interior temperature in accordance with project design and applicable regulations.

6.9 Air relief from installations

At all highest elevation points automatic air discharge/relief taps are mounted type NO 15. All radiators are equipped with manual air relief taps.

6.10 Discharge of installations

On all drowned radiators and collectors in the boiler room discharge taps are mounted.

7. FURNISHING OF SURROUNDING AREA

This project design contains the furnishing of the surrounding area with hydro-technical installations. For furnishing of this surrounding area it is planned to cover the plane area outside the garage and the access, internal traffic routes with asphalt (in total two traffic routes). One of the traffic routes passes to the right of the building and connects the planned traffic road in front of the object with the existing traffic road that is located behind the object. The width of the traffic road is 5,00 met, the longitudinal drop in elevation is varying with the task of leveling of the height differences of the existing traffic road and the planned traffic road in front of the object. The other traffic road leads to the boiler room. 10 parking spaces are designed.
It is planned to construct a tampon layer of 25 cm thickness, with an asphalt cover BN22 of 4 cm thickness and a wear layer AB16 of 4 cm thickness. For drainage of precipitation water and the water from the roofs, a sewage system is designed that will lead such water into the adjacent recipient inlet. This network includes a concrete canal in the garage, used for the collection of the water from the garage floor. Seven drain holes are designed with single bodied inlet grates and longitudinal inclination of pipes of 1%. For this purpose PVC pipes of Ø160mm and Ø200mm are installed. The

installation of this sewage system must be tested prior to commissioning on water tightness. The entire installation must be done in accordance with the valid regulations and tested prior to mounting. The drain holes are made of reinforced concrete elements of a diameter of Ø1000mm. The landscaping of green surfaces is also designed, whereas such green areas are separated from the asphalt with curbstones of 18/24cm.

B. GENERAL TECHNICAL REQUIREMENTS

I. CONSTRUCTION – CRAFTSMEN WORKS

1. Introduction

1.1 Notes and obligations

-The installations must be manufactured and installed in accordance with the project designs drafted by the main, responsible project designer and all used materials must comply with their designated application. For the above, the contractor is obligated to submit all necessary certificates and attestations.
-After mounting of the installations the contractor must perform defined testing of this installation on cold water pressure, under presence of the supervising engineer, at which point it is determined that this installation is properly functional and safe in regard of possible damages. The test results must be entered into the construction log-book or in a separate protocol.
-Welding works on the entire installations and plants must be done exclusively by qualified welders, for whom the contractor must present adequate certificates.
-When working at certain elevations, the contractor must supply all his workers with necessary safety belts (on scaffoldings) and equip the scaffoldings with safety railings, i.e. these works must be done in compliance with the provisions on safety at work.
-Operation and continuous maintenance of installations may only be done by adequately qualified and trained professionals for this type of installation and plant.
- The control of protection against electric current and lighting is done in accordance with the regulations and instructions given by the electric installation designer and the contractor of works must be timely informed about these.
-When performing all welding works or any other works with open flame, all inflammable materials must be removed and a fire extinguisher is to be kept at hand of type S6 – dry foam.
-As prevention measure, i.e. preliminary manual fire extinguishing manual extinguishers of type S-6, S-9 are used, placed at visible and easily accessible locations.

1.2 General

All provisions of the subject technical requirements are considered as integral part of the description of each individual item. All the works are to be performed in accordance with the individual item description and these technical requirements for each group of works. In the description, the static calculation, project design and details, the unit prices all contain the following:

1.2.1 Material

Under price of material, the purchase price of the main, auxiliary and small/binding material is meant as well as all costs relating to acquisition, internal and external transport and loading/discharge operation costs.

1.2.2 Work

The value of works means all main and auxiliary/supporting works with all necessary items of the preliminary bill, all works include horizontal and vertical transport.

1.2.3 Supporting/auxiliary structures

All types of scaffoldings, without regard to their height, are part of the price of works wherever such scaffoldings are needed and which scaffoldings must be erected in time, while the quoted price must also contain the disassembly of these scaffoldings. All this comprises the railings, protective porches, accesses and in case of excavation works all necessary formworks of all types.

1.2.4 Measures and calculation
If an individual item does not give the calculation of the works, the applicable norm and mean values in construction works will be applied.

1.2.5 Other
All subject works must be fully performed in accordance with the valid technical regulations, at adequate quality and in a professional manner.

2. WORKS

2.1 Excavation works

All excavation works to be done in a wider scope in regard of the foundation pit and in accordance with the project design details and plans, as well as instructions of the supervising engineer and in line with applicable laws. The excavation works to be done with clear cut off of the sides and fine leveling of the bottom of the pits.
Support of the foundation pit sides against collapsing and pumping out possible rain water, identification of all excavated pits and maintenance of defined, fixed points is all included in the excavation works and may not be charged separately. Prior to any excavation works the area must be cleaned of all obstructions.
From the moment of handing over the pegging off plans of the object, all necessary additional markations must be done by the contractor at own costs. The evenness of the basic layers, the filled in material etc. Must be of such preciseness that it doesn't deviate more than 2 cm from the defined level L=4met. The tampon layer with crushed aggregate is to be done without any organic substances or add ons. The calculation of excavation works based on quantity of material is done in accordance with the regulations.

2.2 Masons works

2.2.1 Wall construction
All material used for the construction of brick walls must comply with the technical regulations and requirements. The brick laying must be performed in proper rows, while the vertical splints are filled with mortar. The bricks must be dry, well burned without lime, clear sound and required shape.
The lime for the mortar must be properly cooled and sufficiently stored. Portland cement in accordance with the regulations. Humid or outdated cement must not be used. The brick walls must be of a vertical plane on 2.5 m =1 cm. If the deviation is bigger, the contractors work will not be accepted. The wall construction works includes all works on mounting of windows/doors and the surface of these windows and walls is deducted with the lintel above the window, all in accordance with the masons calculations.

2.2.2 Plastering
Only first class material to be used for plastering works, the lime must be well burned, properly cooled and the cement for the mortar and plaster must be fresh, slow binding Portland cement. All processed surfaces must be sprayed with fluid cement mortar.
Plastering is done in 2 layers of an average thickness of 2,5 cm. The plastered surfaces must be even, without waves. The price to include all supporting and necessary additional material, all work, internal and external transport, tools, mobile or fixed scaffoldings etc.

2.3 Concrete and reinforced concrete works

All the concrete works to be performed only by qualified staff and in accordance with the provisions and rules for this type of works. The material used must comply with the technical regulations for these works. When pouring concrete structures and elements only one type of cement must be used. The formworks must be clean, dry and properly supported. Prior to pouring of concrete the formworks must be sprayed with water. Mixing of concrete is done mechanically; only in case of very small quantities can it be done manually. After pouring of concrete the fresh structure must be protected against freezing and sun impact at least for a period of seven days. The price of 1 m3 of concrete includes:

Material and tools, transport, formwork and support, scaffolding and everything else. The price includes the measures of protection of freshly poured concrete against the elements. Reinforcement steel must be cleaned of rust prior to cutting and bending. Cutting, bending and mounting is done based on the steel reinforcement sketches and plans and instructions by the supervising engineer. Prior to concrete pouring the steel must be properly and correctly mounted and lifted onto supports. The main reinforcement steel is connected with burned wire. The price of 1 kg of installed steel includes the material, tools, transport, supporting formworks, scaffoldings etc.
Concrete reinforcement steel is separately paid.

2.4 Carpenter works

The woods with timber are to be done with dry, healthy timber without any defects or holes. Pine wood of II. class to be used.
All works to be done in accordance with the project design details and instructions by the supervising engineer and the price includes material, tools, internal transport, scaffolding etc.

2.5 Roof works

Top quality material must be used in accordance with adequate, applicable standards. During performance of works special attention to be paid to the individual openings/passages and laying the cover over uneven parts or gaps. The price includes as measurement unit the material, works, tools, internal and external transport, scaffoldings etc.

2.6 Steel sheeting works/tinsmith's works

All works to be performed in accordance with the regulations for such works and with adequate steel sheets, all metal parts in contact with the steel sheets must be galvanized and in case of concrete or brick support/mortar, bitumen glue must be applied. The price contains material, work, tools, internal and external transport, scaffoldings, formworks etc.

2.7 Carpenter works

All wooden windows and door structures to be made in accordance with the sketches and descriptions of dry timber, cut in winter, without cracks or knots, all visible parts clean and smoothly processed. These elements must be delivered to the site after previous basic treatment. All fittings in accordance with the description of the design.

2.8 Locksmith's works

All these works must be performed in accordance with their description, details and instructions by the designer. Materials complying with applicable regulations must be used. The contractor is obligated to draft all workshop drawings and one sample/prototype if requested by the investor.
The fittings are mounted onto aluminum profiles and surfaces glassed in with Thermopan glass. The color of the aluminum profiles is chosen by the designer. The fittings must have a thermal interruption. The price includes all material, works, tools, transport, necessary scaffoldings etc.

2.9 Glass works

All frames and windows and doors that will be glassed, must be properly cleaned of mortar prior to installation of the glass panels. The glass is colorless, without air bubbles and stains and must comply with applicable regulations. In aluminum frames glass is mounted with box-shaped or sealed profile strips/tapes of plastic or vinyl rubber, all based on details from the scheme.
The price of the unit measure includes all material, works, tools, internal and external transport, scaffoldings etc.

2.10 Ceramic tile laying works

For all ceramic tiles laying works only I. class material may be used. The choice of color, size and pattern of the tiles is done by the supervising engineer under approval of the main project designer.

2.11 Painting works

All material must be of adequate, requested quality, on all painted surfaces no traces of the rolls or brushes must be visible, no stains, the surface smooth and evenly painted, the painted surfaces may not

peel.

2.12 Various works
All these works must be done in accordance with the description for the individual item.

3. HEAT – AND HYDRO INSULATION

3.1 HEAT INSULATION

3.1.1 General
The structural system is composed of a reinforced concrete skeleton with reinforced concrete screens and slabs (horizontal structures – beams and slabs). The outside walls are made of bricks, plastered on both sides. The roof or floor slabs are thermal insulated and well ventilated, all in accordance with the project design. The ground at location is both thermal and hydro insulated with adequate insulation.

3.1.2. Material
For outside and internal walls bricks are used of a volume weight of 1100 kg/m3 and hollow blocks for internal partition walls of a volume weight of 1400 kg/m3. The bricks must be healthy, without any damaging or dangerous materials, proper shape, of minor water intake and all joints must be well filled with mortar. Concrete and reinforced concrete is to be manufactured in accordance with the technology defined by the designer and in accordance with the approved construction works project design.
The thermal insulating panels are made of polystyrene and mineral wool. At the joints of the thermal insulating panels no gaps may be left and the insulation panels must be of designed thickness.
The final processing of the facade must be resistant against precipitation waters and their penetration into the building, but also be able to pass diffused steam.
The roof structure must be ventilated so that on the inclined roof slab and the fronts ventilation openings are created, special profiles – Aerators – facade openings.
The outside door and windows are of aluminum profiles with thermal insulating glass, with an interim layer of 12 mm and designed thickness of the glass. All these profiles must be properly sealed with rubber gaskets. The contact of the aluminum profiles and the walls must be done properly and filled with adequate material. The delivered aluminum profiles must confirm with the attests and values from attestation: – for doors K= 4.00w/m2K, for windows K=2.90 w/m2K.

3.1.3 Outside walls structure (facade elements)
Based on provision of the standard JUS U J5 600 all facade elements to be included (walls, lintels, parapets and columns).
The provisions of the standard define that all facade elements must comply with the criteria of minimum heat insulation at any given point, i.e. that no heat bridges are allowed for this type of structure.
The outside walls must comply with the following heat insulation requirements:

For climate zone I – k max = 1.225 W/m2k
For climate construction zone II – k max = 0.93 W/m2k
For climate construction zone III – k max = 0.83 W/m2k

3.1.4 Partition walls towards the stairwell
For this category of partition walls the heating system in the building is of relevance and the requirements are:

For climate zone I – k max =1.94 w/m2k
For climate construction zone II – k max = 1.85 w/m2k
For climate construction zone III – k max = 1.61 w/m2k

These requirements are applicable for walls towards non-heated areas like stairwells, hallways, basement spaces etc.

3.1.5 Floor slabs above rooms
By this the concrete slabs between any two rooms that are heated in the building are meant, so that we have the same requirement for all climate zones k max = 1.38w/m2k.

3.1.6 Floors on ground
This type of construction element defines that the layers under the hydro-insulation are not taken into account when calculating the heat resistance; the required heat insulation for this category is:

For climate zone I – k max = 0.93 w/m2k
For climate construction zone II – k max = 0.76 w/m2k
For climate construction zone III – k max = 0.68 w/m2k

Summer regime has no impact onto this type of structure.

3.1.7 Floor slab structure with open passage
With this all structures are meant that are located above cold rooms and spaces in which a more intensive ventilation of air is enabled, open halls and passages, passages towards stairwells.
For this category of partition elements the heat insulation requirements are:

For climate zone I – k max = 0.50 w/m2k
For climate construction zone II – k max = 0.46 w/m2k
For climate construction zone III – k max = 0.43 w/m2k

3.1.8 Even or inclined roof areas – attic spaces above heated rooms. The heat insulation requirements for these structures are:

For climate zone I – k max = 0.78 w/m2k
For climate construction zone II – k max = 0.65 w/m2k
For climate construction zone III – k max = 0.55 w/m2k

3.2 HYDRO INSULATION

3.2.1 Description of works
These works comprise the works on protection of the building against humidity, i.e. further capillary raising of humidity up the foundation walls, i.e. floors. Hydro insulation with bitumen layers is to be applied, under the assumption that ground waters are outside the building's structure.

3.2.1.1 Hydro insulation on or above ground (floors or foundation walls)
- cold bitumen layer „Bitulit“ ''A''
- hot bitumen layer PK 85/25
- bitumen sheet with glass voal insert, coated on both sides with bitumen mass
- hot layer of bitumen PK 85/25

3.2.1.2 Hydro insulation of floors in sanitary spaces
- cold bitumen layer „Bitulit“ ''A''
- hot bitumen layer PK 85/25
- bitumen sheet with glass voal insert, coated on both sides with bitumen mass
- hot layer of bitumen PK 85/25

3.2.1.3 Hydro insulation of terraces, loggia
- cold bitumen layer „Bitulit“ ''A''
- hot bitumen layer PK 85/25
- bitumen sheet with glass voal insert, coated on both sides with bitumen mass
- hot layer of bitumen PK 85/25
- two PE foil sheets

3.2.1.4 Steam barrier on plane roof
- cold layer of „Bitulit“ ''A''
- a sheet layer for equalization/balancing of steam pressure and as steam barrier with an

aluminum foil insert 0.02 cm, coated with bitumen mass thickness=4 mm. On the lower side quartz sand of bigger granulation, fine granulation on upper side.

- hot bitumen layer PK 85/25

3.2.1.5 Hydro insulation of the plane roof, inclination above 1%

- cold layer of „Bitulit“ ’’A’’
- bitumen sheet with glass wool insert
- bitumen sheet with glass fleece insert, on both sides coated with bitumen mass of thickness 4 mm
- hot layer of bitumen PK 85/25
- bitumen sheet with glass fleece insert, on both sides coated with bitumen mass of thickness 4 mm
- separation layer, 2 x PVC foil laid dry.

II. WATER AND SEWAGE PIPES

1. Preparation measures

Before the beginning of the works on the installations, the investor must submit the installation project design to the municipal company in charge for water supply and sewage for their approval. One copy of the designs that is used for the construction works by the contractor must be kept at site. The contractor is obligated to fully comply with the approved project design. Before start of the works, the contractor must compare the project design of installations with the true status at the site and discuss all open issues with the supervising engineer. Before an eventual change, the contractor must inform the supervising engineer in time and he then informs the municipal company in charge for water supply and sewage.

2. Laying of pipes

The contractor must check all outer elevation points in the project and balance these with the real elevation points at site. When constructing the sewage network, first a connection with the street canal must be established, then the network in the foundations and finally the vertical pipes with all branches. All horizontal pipes are laid with an inclination towards the lowest outlet point. If there is more than one outlet this needs to be taken into consideration. Changes in directions of water supply pipes will be done with bows and not knee profiles. Bending of galvanized pipes may not be done in hot or cold state. Pipes may not be laid inclined through walls, but in straight angle against the wall.

3. Pipes in the ground

All pipes in the ground are laid into a layer of sand that coats the pipes from all sides at a thickness of minimum 5 cm. In filled in areas, a thick layer of sand is to be placed at the bottom of the pipe trench and it must be well compacted. Fertile soil, construction material waste, rocks and similar may not be used to fill in the trenches. Pipes may be laid into the trenches only when the supervising engineer approved the trench made in accordance with the project design. The trench may not be filled before the supervising engineer inspected the pipes, i.e. before the installation has been tested.

4. Pipes in the buildings structure

Pipes that are firmly lodged into the walls and other structures are not allowed. The openings for the pipes through the building’s structures must be of sufficient size and the space between the structure and the pipe must be filled with plastic material, to prevent any damage to the pipes. Water pipes will be protected by a protective pipe in parts of their passages through solid building structures, with a diameter that is 4 mm wider than the outer diameter of the pipes and the free space will be filled with permanent, elastic mass or rope in bitumen. The sewage pipes may not be firmly built into parts of their passage through the building structure, the free space must be filled with wet clay, rope in bitumen or a permanently elastic mass. Possible unforeseen cutting into the walls and other structural parts may be done only after previous approval by the supervising engineer.

5. Protection of pipes

Water pipes must not be laid through walls of stacks/chimneys and ventilation ducts, ventilation shafts, under the floor of the toilets or the urinal or elsewhere where these pipes may be subject to pollution, freezing, heating and /or corrosion. At parts of crossing pipes, the pipes must be properly protected. When crossing with outlet pipes, the water supply pipes must be laid at a higher elevation, and the space between the pipes filled with compacted clay, of at least 20 cm thickness. If the distance between the pipes is smaller , the pipes must be laid into a protective pipe, like in passages of pipes through walls. Parts where pipes are exposed to freezing must be adequately insulated. The insulation is to be applied carefully and the pipes may not be closed or covered before the supervising engineer inspects them. The same is applicable to sound insulation. Insulation damaged during the works must be immediately, carefully repaired. In case of break or interruption in works, the pipes must be temporarily closed not to be polluted, filled with material and rubble in the inside or damaged.

6. Joints and connection points

The joints between the pipes and the profiles/elements and fittings must be done carefully. When connecting the internal diameter may not be narrowed by the ends, parts of fittings, sealant or in any other way, nor may the pipes be deformed in their joints. PVC pipes are connected with glue or rubber rings. The connections of pipes in walls, ceilings and other structures must be avoided.

7. Support of pipes

Pipelines must be mounted to walls and ceilings with suspended supports or binders, placed at distances depending on diameter and type of pipe.

8. Fittings

Water pipe fittings must be previously inspected in the workshop and only after inspection may they be installed. The fittings must be installed carefully, taking into consideration their easy handling, esthetics of the outlets, mixer tap and other fittings that are manually operated. Fittings must be wall mounted, with wall plates.

9. Equipment

Equipment must be mounted properly, precisely and taking into account easy usage and esthetics of the whole. Sanitary elements are mounted to the wall with plastic or metal supports. Items mounted onto consoles must be able to carry 100kp at the most inconvenient spot.

The heights onto which sanitary equipment is mounted (if not differently defined in the work description), measured from the level of the finished floor:

- Hand washing basin, front edge 80cm
- Mirror – central part 155cm
- Towel holder 75cm
- Wall mounted tap 110cm
- Sink 85 or 90cm
- Kitchen drain, front edge 70cm
- Water tank for WC, bottom 200cm
- Toilet paper box 80cm
- Wall mounted urinal, front edge 65cm

10. Testing of installations

The mounted, but not jet insulated or covered installation network must be tested for water tightness before it is approved. The water supply pipeline (if not differently defined by regulations), is to be placed under test pressure that is twice bigger than the operating pressure during 30 minutes. The sewage network is tested by being filled completely or in sections with water, after previous closing of the inlet and outlet. The testing is done in presence of the contractor, the supervising engineer and the representative of the municipal company for water supply and sewage A protocol must be drafted on

the test. The testing is paid by the contractor. Only after completed test the pipes may be insulated, the pipe t5renches filled in and the passages through structural parts closed.

11. Duties of the contractor

The contractor is obligated, at own costs to remedy all faults that might appear within the contracted warranty term. The supervising engineer may approve only the installed and built in materials and quantities. All material found as inappropriate or faulty by the supervising engineer must be immediately removed from the site. The contractor must construct the entire installation in good cooperation with other contractors at the building.

III. HIGH VOLTAGE CURRENT INSTALLATIONS

1. Introduction

These requirements are integral part of the project design and such they are obligating the investor and the contractor to among other, when working on the designed installation, fully comply with these requirements, since they contain many elements that are not specified in the technical description and other text, but are crucial for the subject works. Accordingly, when constructing the designed installations the below requirements must be met.

1.1 The entire electric installation must be constructed based on attached plans, these requirements and the valid JU standards and regulations applicable for high and low voltage power installations, i.e. the Regulations on technical norms for low voltage installations.

1.2 Prior to the start of the works, the contractor must properly review the project designs and submit his remarks and comments, if any, to the investor, i.e. the supervising engineer.

1.3 The investor is obligated, throughout the duration of the building's construction, to arrange professional supervision over the works.

1.4 The contractor is obligated, prior to the start of works, to personally visit the site and object and if he finds that certain changes are necessary due to changes in construction, he must inform the supervising engineer and obtain approval and consent for such possible changes.

1.5 If during the performance of works the certain deviation from the project designs are justified, the contractor is obligated for every such deviation or change to obtain consent and approval by the supervising engineer prior to implementation of changes/modifications. The supervising engineer will inform the designer about these changes and demand his approval.

1.6 Based on the submitted study, the contractor will after an inspection and obtained approval by the supervising engineer start with works.

1.7 All installation material and equipment that is necessary for the performance of these works must comply with the standards and be of top quality. Material that doesn't comply with this requirement may not be used.

1.8 When performing these works, the already performed works and constructed structures may not be damaged. Also, all works must be properly coordinated in order to prevent mutual obstruction in performance of the individual works and phases of works.

1.9 During the performance of the works, the contractor must keep a building works log-book with all data that must be entered into such log-book. All requests and information/notifications from both the supervising engineer and the contractor must be communicated through the log-book.

1.10 The contractor warrants the quality of his works. All faults that emerge during the warranty period, either for reasons of poor quality of used material or faulty performance of works by the contractor, have to be remedied by the contractor at his own costs.

1.11 After completion of the works, the contractor must perform the necessary tests and inspections of installations and obtain adequate attestations and certificates.

2. General provisions

2.1 Devices and equipment for electric installations must comply with the designed operation and function of the installations and the nominal voltage of the subject installations.

The electric equipment must operate under the current during nominal operation and also in

extraordinary situations, that are controlled by the protection devices installed into the devices and /or the installation.
Electric equipment when switched on/off may not negatively impact other equipment. Equipment, including conductors and cables must be placed and mounted in such a way, that it can be easily checked, maintained and is accessible. The above is also applicable for equipment mounted in casings.
2.2 Plates with inscriptions and other identification must be placed onto the switches for identification of their dedication/function.
Control elements and signalization elements must be placed at easily visible places and always enable access.
2.3 Insulated conductors and cables must be laid and marked in such a way that they are easily identifiable during testing, repair or replacement. The protective conductor (PE) or the protective neutral conductor (wires) (PEN) are marked in a combination of green/yellow and the neutral (N) with light blue color. These colors may not be used for any other markation/identification purposes. The marks can be attached to the conductors/wires also at their ends, near the connection points, especially when the conductors are not insulated.
2.4 Protective devices must be placed and marked in such a way that they are easily recognizable and attributable to their individual power circuit. Protection devices must be placed in the distribution block (distribution cabinet).
2.5 Schemes, drawings , diagrams and tables must be placed at locations with several power circuits, so that they mark the nature and content of such power circuits and the properties of the protective devices (switches), their start/shut down and the place of their installation and insulation.
2.6 In this distribution block (cabinet) the electric equipment must be grouped by same type of current and voltage so that the installations don't interfere one with the other.

3. Electric installation distribution

3.1 The connection points between the conductor and other electric devices and equipment must be done in a safe and solid way and always enable a check, which means that these connection points must be done at an accessible place. The connection must be accessible after the cover from the box is taken off or a partition is dismantled with a tool, the same assess requirement exists for the protection levels of at least IP 2X , in accordance with JUS N.A5.070.
3.2 Insulated conductors and cables may not be connected in installation pipes and ducts. The connections can only be done in adequate installation boxes with cable clamps or in distribution cabinets (switch blocks), while the connections must be insulated with an insulation that complies with the type of the electric installation.
3.3 The connections between the electric installations and electric equipment must be done in such a way that the electric installation distribution is not subject to bending and extraction forces. If the impact of such forces cannot be avoided, a relief system must be introduced.
3.4 The connection itself must be done in such a way that the section of cables and conductors is not reduced, nor is the insulation damaged. At the ends of the electric installation distribution and especially at inlets and outlets and passages of electric installation through walls and electric equipment, permanent sealing must be established.
3.5 The minimum distance between the electric installation and other non-electric installations is 30 mm. If any heating installations or pipes carrying warm air or a stack are locate near electric installations, the electric installations must be heat insulated or laid outside the impact of such heating installations.
3.6 Electric installations may never be laid under non-electric installations in which water condensation is possible.- Electric installations may not be laid in the same installation duct with non-electric installations and if this cannot be avoided, protection against direct contact must be installed with insulation for equipment class II.
3.7 If the electric installations are laid onto walls, the minimum permitted distance between the installation and the wall is 5 mm. Electric installations of low voltage may not be placed into the same casing or pipe with installations of high voltage, except when a partition is installed between these two types of installations as insulation.

3.8 The electric installation must be laid in such a way that in case of any fault or malfunction the environment is not endangered. For mounting of electric installations only supports may be used that do not deform the insulation of such installations.
3.9 Cables that are directly laid under plaster and into the wall must be covered with a plaster layer of at least 4 mm. Extraordinarily the cables may not be covered with plaster if they are laid in hollows of the attic/ceilings.
3.10 Horizontally laid cables are mounted at a distance from 30 – 110 cm above floor or at 200 cm above floor, under the ceiling. Vertically laid cables must be mounted at least 15 cm distant from the windows and doors. Inclined mounting of cables is allowed only on ceilings, not in walls.
3.11 Mounting of cables onto the walls is allowed only when the cable has an insulation of thermo-plastic mass with filling and shell, if the cables are laid along the wall with clamps and if such cables are laid 2 meters above floor and are additionally mechanically protected.
3.12 Cables without filling like type PP/R, may be used only in dry rooms and under plaster. Such cables may not be laid in cable coils/bundles, they may not be laid through installation ducts or under dry wall panels.

4. Distribution panels

4.1 Distribution panels of closed or hermetical type are mounted at 1,7 met above floor and open panels at 2,5 meters above floor. Distribution cabinets in installations must comply with the following requirements:

- the exterior of the cabinet should be adequate to the interior design solution
- the cabinets must be mounted to the wall or into the wall or free standing
- the electric meters must be separated from the other equipment
- the doors must have a lock with a key
- all clamps on the mounted equipment must be accessible from the front side

4.2 Parts under voltage in the control or distribution cabinet must be at a distance from the casing of at least 20 mm and a smaller distance is allowed only when insulation partitions are installed.

5. Checking and testing

Each electric installation must be checked and tested during mounting or after completed mounting, but always prior to the handing over and approval. All measures must be introduced for the safety and protection of persons and protection against damages to electric and other equipment. If the electric installation is changed, the changes part also must be checked and tested.

6. General remarks and duties

6.1 When drafting this project, all requirements of applicable, valid technical regulations have been taken into consideration.
6.2 The electric equipment and materials defined by this project design must comply with standard JUS.
6.3 The contractor is obligated, 8 days prior to the start of the works to inform the authorized body about such start of works.
6.4 The contractor must draft all legally define acts and norms from the field of safety at work and inform all his employees with the working conditions and sources of danger and risk, as well as the applicable safety measures.
6.5 The contractor must define all working positions with special working conditions, if such working places exist.
6.6 Wherever defined by law, visible inscriptions and signs must be mounted with warnings in regard of:

- voltage ,
- dedication of certain equipment
- other important notifications

6.7 During interventions in TS, RT and on installations adequate safety and protective assets and means are used.

7. List of applied technical regulations and standards

During the draft of the project documentation the designer used and applied the following technical regulations, standards and literature:
- Regulations on technical normative for low voltage electric installations (Gazette of SFRY 53/88),
- Yugoslav standards – Electric installations in buildings – Safety requirements JUS N.B2.741/1989 ,
- Yugoslav standards – Electric installations in buildings – General properties and classification JUS N.B2.730 ,
- Yugoslav standards – Electric installations in buildings – Protection against excessive currents JUS N.B2.743 ,
- Yugoslav standards – Electric installations in buildings – Special technical requirements JUS N.B2.771,
- Yugoslav standards – Lightning installation – Calculation of average number of days with thunder JUS N.B4.803,
- Yugoslav standards – Lightning installation – Calculation of protection level JUS IEC 1024-1-1 ,
- Regulation on technical normative for electric-energetic plants of nominal voltage above 1.000 V (Gazette SFRY No. 13/78)
- Law on Fire protection (Gazette SRMN 47/92)
- Law on spatial development and building of objects (Gazette SRMN 51/2008)
- General conditions for supply of electric energy (Gazette RMN 1/90)
- Technical recommendations for connections of objects – consumers into the low voltage distribution grid, No. 10-00-4873

and all other technical standards and regulations for the unification of elements in distribution networks.

8. Supervision

8.1 All changes to the approved project must be entered by the contractor into the project documents, which he will then hand over to the investor after completion of works as „as built status“.
8.2 The warranty term for the performed works will be defined by Building contract.
8.3 The project contains delivery of all necessary material, transportation, mounting and preparation – final works.
8.4 For the performance of planned and un foreseen works the approval of the investor is needed.
8.5 Commission of installations into operation may be done only after completed technical inspection and obtaining of operation permission.

9 . Testing

9.1 The results of the loop resistance between the individual wires/conductors and between the conductors and the ground must be entered into the log-book.
9.2 Blind/false current in each measured section of the installation, in dry and wet spaces, may not exceed 1 mA, i.e. the loop resistance must be at least 1.000ohm for each Volt of nominal voltage (for voltage 380/220 V, the resistance is 380/220 kilo ohm).

IV. LOW VOLTAGE CURRENT INSTALLATIONS

4.1 General

These technical requirements are integral part of the project design and the contractor is obligated to fully comply with these.
- During performance of the works the contractor must apply and comply with valid laws, JUS standards, recommendations and all other requirements contained in this project design

documentation.
- The contractor must be in possession of a license for the performance of subject works and contracts (certificates) with manufacturers of equipment.
- For all eventual changes in the project or deviation from the project design, the approval of the investor and the project designer must be obtained.
- Before the start of the works the contractor must familiarize in detail with the project and present timely all eventual remarks and comments in writing to both the investor and the supervising engineer.
- Only persons that are qualified and have experience in the contract works may perform these works.
- During performance of the works, the contractor must enter all eventual deviations into the project design and present these differences in red in a graphical copy.
- During performance of the works, the contractor must keep a log-book and an inspection book with all data that must be entered into such books.
- All requests and notifications from the supervising engineer and the contractor are communicated through the building works log-book.
- The contractor must give the investor a warranty onto installed equipment and performed works.
- The warranty term and its beginning are agreed upon in the contract signed between the investor and the contractor.
- Anything not assessed by these technical requirements has to be rendered by the contractor based on valid and applicable regulations on construction of subject installations.

4.2 TT installations

These technical requirements are integral part of the project study and as such are mandatory for the contractor.
The entire installation must be mounted in accordance with the attached documentation and the JUS standards on internal electric installations.
The materials used for the installations must be of good quality and comply with the applicable regulations. After transport of the material to the site, the supervising engineer must check the material and state its condition in the building log-book. If the contractor uses material for which it was later found to be not compatible, the contractor must remove such material after order by the supervising engineer and replace it with adequate material.
Along with the material's quality, the works must also be done at adequate quality level. Every item that would subsequently show as being done improperly must be remedied by the contractor at his own costs.
Before starting the works, the contractor must mark all positions for the boxes, the cable routes and cabinet. All pipes and distribution boxes used for the installations must be of insulated material and coated with steel sheets. The inside diameter of pipes must comply with the section and type of conductor that is led through such pipes, all in accordance with JUS standards.
The pipes must be mounted onto walls and ceilings and ducts under plaster, after plastering of the walls.
When mounting the pipes onto the walls special care must be paid to prevent more damages than necessary to the walls.
The pipes are mounted in such a way that between two distribution boxes there is no position at which condensate water can accumulate.
At horizontal cable lines, the pipes between two distribution boxes must form a mild bow shape with a declination towards the distribution boxes.
Cables can be connected only in sufficiently dimensioned distribution boxes. The minimal internal diameter of the distribution boxes for connections between conducting cables and outlets may not be less than 70 mm. The connections are to be properly insulated and brazed. It is forbidden to continue a cable line by pulling it into a pipe.
When cable lines are laid parallel (high and low voltage cables) the high voltage lines are laid 30 cm under the ceiling, 10 cm above them the signalization lines and other installations are mounted and 10 cm above these the telephone cables. Telephone cables are laid must be laid at a distance of at least 20 cm from the high voltage current lines. The distribution boxes in such lines are usually positioned one against the other under an angle of 45º. When laying the cables parallel, the distance between the

individual installations must be at least 5 cm.
Crossing of telephone installations and installations of high voltage must be avoided. At places of crossing, these crossings must be done under a right angle, the distance between the cables must be at least 10 cm and where this distance cannot be insured, an insulation insert of 3 mm thickness must be inserted.
All conductors used for this installation must be of copper, while their number, cross diameter and type of insulation is defined in the plans, descriptions and bill of quantities. Pulling cables into cable pipes is done after plastering of the walls and the telephone connection boxes are mounted after painting of the walls.
Prior to the mounting of the cables, the cables must be protected against any damage. At places where the cables change directions, mild bows must be created, with a semi-diameter not less than fifteen times the cross diameter of the cables.
If during the mounting works on the installations, for any reason, the need for changes and/or deviations from the installation plans emerge, so each such change and deviation from the plans previously consent must be obtained from the supervising engineer who is nominated by the investor or the project designer. Major deviations may not be implemented without previous approval by a review committee that has approved the subject project design.
The investor is obligated to define in the contract with the contractor the warranty period for the subject installation. This warranty term may not be shorter than two years and starts from the date all installations were approved and handed over to the user. In this warranty term the contractor must remedy all faults or deficiencies in the installations that are subject of improper works or poor quality of installed materials at own costs.
The cause of deficiencies or faults in the installations or their operation is determined by a commission. The decision of this commission is binding for both parties. The commission is composed of 3 members: the investor, the contractor and a third, mutually chosen person.
All debris, waste and rubble left over from the works, must be disposed by the contractor away from the construction site. The place of disposal is to be defined by the investor when executing the contract with the contractor.
Before the completion of all works, the contractor must invite an authorized body for testing of installations in accordance with the regulations. The results of such tests must comply with the defined legal values, after which a certificate/attestation is issued.
If the installation fails the test, the contractor must establish compliance of the installation immediately and at own costs.
The approval of the installation b y the investor can be given only after completion of all works and successful testing of the installation.

4.3 Structural cable system

Rooms in which equipment is mounted must comply with optimum climate conditions: room temperature must be 22 - 26 ºC and humidity 45 - 55 %.
The horizontal cable routes/distribution represents the connection between the end users of the system accomplished via telecommunication sockets and connection panel within the floor concentration of this installation to the active equipment/device. The connection between the horizontal and vertical cable routes is allowed at one position only, within the floor concentrating point.
Such laying of this installation enables connection of each end user of the system with all other resources of the network, thus creating a unified IT system. The physical topology of the horizontal cable distribution must have a star shaped structure, whereas the distances between cables and the connection panel in FD and BD – telecommunication socket may not exceed an overall length of 90 meters.
The maximum cable pulling force depends on the number of cables that are pulled at the same time and is defined as follows:

- 1 x 4 pairs - 100 N
- 2 x 4 pairs - 150 N
- 3 x 4 pairs - 200 N
- n x 4 pairs - n x 50 + 100 N

All boxes and cabinets must be earthed through a special, separate collector within the nearest energetic one. Prior to the works the contractor is obligated to identify all positions where electro-magnetic interference is expected and avoid such positions by adjusting the cable routes and complying with the prescribed distances.
The table below shows the minimum distances between telecommunication and energetic cables (voltage up to 480V), all based on recommendations by IBM (Installation and planning guide – Chapter 5/5.5.2 Cable separation).
After the final mounting of the entire installations of the overall system until full operational status of the system,, each cable link must be adequately identified /marked with a unified sign both on side of the TO and on side of the BD, at a visible place that is immediately noticeable.
The contractor, together with the supervising engineer is obligated to inspect all links and perform adequate tests and measurements in accordance with the ISO 11801 standards (latest edition) for the subject category 6 and use for these measurements attested and certified measurement equipment.
Before the system is handed over and commissioned into operation, the user must be given a table of all the connections and links in the system, together with the remaining technical specifications (as built project designs) for administration and maintenance of the system.

V. HEATING AND AIR CONDITITIONING INSTALLATIONS

5. HEATING INSTALLATION

5.1 General

5.1 The installation must be mounted in accordance with the project design.
5.2 Prior to the works, the contractor is obligated to review the designs and compare these with the objects and in case he finds any deficiencies or faults or sees the need for changes and modifications, he must inform the investor and demand further instructions.
5.3 Elements of the installation that are nor mass/serial products but are custom made must be manufactured of materials of high quality, i.e. the maximum quality for such products/works. The surface protection must be as defined by project design and where this is not specified in the designs, it must comply with the standards for such works and products contained in regulations on quality.

5.2 Heating devices

5.2.1 As heating devices radiators, convectors, heaters, pipe registers of smooth pipes and other heating devices of modern structure can be used. If during the works a heating device is replaced by another type, the investor must previously give his approval.
5.2.2 For all mounted heating elements attestations on quality and operation properties must be obtained, which certificates must be issued by an authorized body.
5.2.3 The heating element must be generally placed free in space, on consoles, in the parapet wall of the window, extraordinarily at other positions when necessary because of structural reasons or because of type of heating element used. If a cover is placed in front of the heating element, this cover must enable maximum air flow and must be easily dismantled.
5.2.4 Sanitary- hygienic requirements for the mounting of heating elements define easy overview and accessibility to all surfaces and heating elements for cleaning purposes.
5.2.5 The mounting and construction requirements are as follows:

-that the dimensions of the heating elements do not exceed the size of the window or window niche;
-that the connections of the heating element onto upwards pipelines are not done with too many bends;
-that the heating elements are mounted in horizontal position.

5.2.6 If radiators are used as heating elements, the following requirements must be met when mounting them:

-the clearance between the back side of the radiator and the wall must be 20-70 mm,

depending on type of radiator;

- the height of the radiator measured from the floor must be 100 -150 mm, depending on the height of the parapet;
- if the radiator is mounted into a window niche or if a wooden board, the minimum distance from the upper edge of the radiator to the lower edge of this board must be 70-120 mm.

5.2.7 When mounting radiators on consoles, the console is to be done in such a way that it carries the radiator and not that the radiator is hung onto it. The number of consoles will be defined in such a way, that a radiator with up to 10 ribs has two consoles and for each additional 10 ribs, one additional console must be mounted. The number of supports is always one less than the number of consoles.

5.2.8 If possible, in the object the same type of radiators must be mounted (same manufacturer) and of course care must be taken that the radiators have the same depth and height.

5.2.9 After setting up the adequate number of ribs for each radiator, these are to be flushed properly of any internal impurities.

5.2.10 After completed mounting and after successful pressure test, the radiators must be dismantled, properly cleaned of any rust and impurities and coated in protective paint. The varnishing of the radiators is done after they are re-mounted and at a temperature of at least 50°C in the radiators. The paint applied onto these radiators must be special paint and varnish that is resistant against high temperatures. Usage of metal (bronze) paint is not recommended because of the reduction of the coefficient of heat emanating surface of the radiator, i.e. less emanating heat.

5.2.11 Electric air heaters as heating elements are primarily used to heat the workshop and especially in cases when besides heating the space needs to be ventilated. The exhaust of such electric heaters into the atmosphere must be as short as possible, in diameter equal to or bigger than the connection to the heating body. The noise emitted from the heater during operation must be within the legally defined values for noise emission for ventilation devices.

5.3 Pipeline network

5.3.1 All pipes in the horizontal and vertical pipe distribution must be certified and comply with the standards JUS C. B5. 221, DIN2440, DIN 2441, i.e. DIN 2448 and JUS C. D5. 501 for copper pipes.

5.3.2 The routes of laying these pipes and positions of the pipe supports may not be altered without consent by the project designer.

5.3.3 The horizontal pipeline in objects with a basement is to be hung from the ceiling of such basement or supported on wall mounted consoles. In objects without basement pipes may be laid into floor canals, equipped with light revision covers at every 8-10 meters distance. Prior to filling in the canal with the pipes, the pipeline must be cleaned and protected against corrosion and properly insulated.

5.3.4 At places where the pipes pass through solid structural parts of the building, the pipes may not be firmly mounted into the structure, there must always be sufficient space for free dilatation of the pipes under temperature impact.

5.3.5 The vertical pipelines and connections of pipes with the heating elements must be mounted freely, along the walls. On vertical pipes, immediately behind the connection/joint to the horizontal pipeline, adequate valves or gates must be installed and above these discharge taps.

5.3.6 At places of crossing of connections for the heating element with a vertical pipeline, the connection/joint must have a bypass bow that must be done in the horizontal straight line.

5.3.7 The connections for the heating elements may not be shorter than 30 cm.

5.3.8 Upwards supply pipes are always mounted on the left side and supported with necessary pipe clamps.

5.3.9 When bending pipes into the necessary shapes, the opening diameter of the pipe may not be decreased and all joints and fittings must be for copper pipes.

5.3.10 The ventilation of the pipes must be done centrally, over a ventilation – air exhaust network and via expansion vessels.

5.3.11 At places where upwards pipes pass through the floor slab of the building, the pipes must be wrapped with cardboard, except in wet spaces, where metal profiles are installed of a wider diameter than the pipe, for free movement of the pipe. The space between this metal profile and the pipe is to be

filled with a sealant that is resistant against operating temperatures. In passages of pipes through floors, these metal profiles must be lifted 5 cm above floor level.
5.3.12 For straight sections of the pipelines of over 30 meters, if possible compensation profiles are to be used.
5.3.13 Those parts of the pipeline that are not meant for heat emission and pass through unheated spaces, must be insulated with good thermal insulation. This insulation is to be applied in such a way that during expansion of these pipes under higher temperatures the insulation is not damaged.
5.3.14 The horizontal pipe network must in all of its parts be mounted at an inclination of 0,5-1% towards the aeration/ventilation vessels, i.e. valves and discharge taps.
5.3.15 The pipes are connected by welding or, if necessary to establish a joint that can be cut off when necessary, with flange joints. The welded parts must be properly processed, with sufficient weld strength, but also without changing the pipes original diameter. The welding works must be done at high quality.
5.3.16 For each welded joint the following works must be done:

-grinding of the edges on the parts of the pipes that joined. Pipes with wall strengths of below 3 mm are welded without inclining the edges. Pipes with walls above 3 mm must be ground in such a way that edges are inclined under an angle of 60-70°;

-all welding seams must be cleaned of rust and impurities;

-slag must be cleaned off all the welding seams and the welding seams must be treated with anti-corrosion agent;

5.3.17 Pipes are supported with flexible and solid supports, single or multiple pipe clams and rings and placed on consoles. The maximum allowed distances between the supports are given in the table below:

Pipe dimensions (mm)	Maximum distances (m)
17,2 x 1,8	2,0
21,3 x 2,0	2,0
26,9 x 2,3	2,0
33,7 x 2,6	2,0
42,4 x 2,6	2,5
48,3 x 2,6	2,5
57,0 x 2,9	2,5
60,3 x 2,9	2,5
70,0 x 2,9	3,0
76,1 x 2,9	3,0
88,9 x 3,2	3,0
108,0 x 3,6	3,5

5.3.18 When setting up the flange joints, standard flanges are to be used in accordance with the defined dimensions for a certain operating pressure. When connecting the pipes and fittings with flanges, sealing gaskets /rings must be used made of klingerit, minimum thickness 3 mm and graphite – asbestos seals of square cross section. These seals must be cut under an angle of 45°, never vertically.
5.3.19 Consoles and other supports of the pipelines must enable free movement of the pipes under heat impact, without creation of any bends. Supports and consoles must be wall mounted with cement mortar, never with gypsum.
5.3.20 Bends and profile parts in pipelines may be done by bending of the pipes (for diameters of up to 26,9mm) or by usage of adequate bow profiles made of same material. Fittings and profiles may

not be mounted into structural elements. At parts of passages of pipes through walls and the floor slabs, as well as in spaces where humans spend time, on both sides of such passage a collar must be mounted.
5.3.21 All pipes, fittings and other metal parts must be well cleaned of all rust after they are mounted and after the pipelines were tested. After this the pipes must be treated with adequate basic coating. After this the pipes in the walls may be wrapped in cardboard, insulated and painted with oil paint resistant against high temperatures.
5.3.22 The installation of gates, valves and taps must be done in such a way that the wheel is set vertically onto horizontal pipes. All fittings must be easily accessible for possible interventions. All radiator valves must be set in accordance with the specification from the project design.
5.3.23 On all installed fittings arrows must indicate clearly the flow direction of the heating fluid.
5.3.24 At adequate positions space must be insured for the installation of a cabinet with the connection fittings and also a heating energy meter for each apartment or one part of the business premises.
5.3.25 The cabinets for the installation of the connection fittings/the pipes manifold must be of standard type, with a unified lock for the entire complex. The cabinets also must be properly and sufficiently dimensioned to enable easy and normal mounting/dismantling of elements. The height of the manifold (distributor and collector) in these cabinets must be h =1,5 m above floor level of the room in which the heating elements are installed. Detail of the cabinet, its location must be harmonized with the architectural – construction designs and the verification of such harmonization of the location and space must be evidenced by seal and signature of the designers, all attached to the investment – technical documentation.

5.4 Automation

5.4.1 Automation equipment is installed in compliance with the attached scheme and individual elements of this system must be installed at locations defined by project design.
5.4.2 The contractor is obligated to request the supplier of automation equipment all detailed wiring schemes, instructions for installation, regulation and control/operation and the costs of one responsible, professional of the supplier of automation supervising the works at site should be included (supervision of installation and setting up the automation equipment).
5.4.3 After all parameters have been set for the automation equipment, a test operation must be performed under all operating modes and a report and protocol drafted on such test, signed by the supervising engineer.
5.4.4 The location and installation of the heat consumption meters is to be done at the return flow pipes, under compliance of all requirements and recommendations by the manufacturer of these meters. A dirt filter must be installed immediately before the meter.
5.4.5 For all the heat consumption meters a separate electric cable must be laid from the distribution cabinet of the circulating pumps in the heating substation, with connections in each cabinet for supply of the computer units with adequate current voltage.

5.5 Electric installation

5.5.1 The electric installation must be done with application of water resistant elements and fittings, all I accordance with a separate project design based on data on the designed installation.
5.5.2 Centrifugal circulating pumps must operate at a minimum of noise and vibrations and where this is impossible, adequate silencers of noise and vibrations must be installed. Pumps are delivered together with an electric drive of closed construction (in a closed casing) with an operating voltage of 220/380V and 50 Hz frequency.
5.5.3 The electric drives must be delivered together with inlets and fuses/switches. Also, all electric control/distribution panels must be equipped with all inlets and fuses.
5.5.4 The distribution and control panels must contain an ampere meter and voltage meter, as well as signals for faults and proper operation. The panel must also contain all relays and other elements that

are part of the automation and control system of the plant or are part of the equipment that acts like a link between the automation and the electric drives.

5.6 Mounting of installation

5.6.1 The contractor hast to install and mount all the equipment from this project design in accordance with the defined technical documentation, technical descriptions and these technical requirements.
5.6.2 Mounting works comprise the entire heating installation, the connections of the pipes with the heating substation, connection of the water and sewage pipes with the public network, via substation where the ducts will be laid by the contractor of the water and sewage installations.
5.6.3 All masons works that are necessary for the fixation of supports, shelves, binders for the cables, ducts and other installation elements are duty of the contractor who works on the installations.
5.6.4 Before each carving of cable canals or cutting/drilling of concrete the consent of the supervising engineer of the structural works must be obtained, i.e. it must be requested that a certain construction work is done and instructions must be given on how these works are to be performed. The contractor has to close all carved canals and cut open parts after installation of the elements in a way that complies with the type of mounted elements.

5.7 Test of installations

5.7.1 All devices, pipelines and fittings must be subjected to a full technical testing on pressure, based on which test it will be determined whether the structure of these devices, fittings and pipes complies with the project requirements in regard of technical safety. The success of such testing is to be entered into the work log-book.
5.7.2 The full technical testing is done: visual inspection on the outside, test of strength, internal inspection and inspection of tightness.
5.7.3 The visual, outside inspection is done during an interruption of the plants operation, whereas the entire plant is to be viewed, but also all elements, in particular the fittings.
5.7.4 The strength test is done prior to commissioning of the plant into test operation. Before this strength test, the entire plant must be cleaned and all elements of the installation must be firmly in place so that there is no leakage or damage caused by the inspection/test. The value of the test pressure is defined based on the below equation:

$$p_{pr} = 2{,}0 + p_p + p_{st,}\ \text{bar}$$

whereas p_p represents the loads of the pump and p_{st} the static pressure of the water column in the installation.
The measurement of the pressure value is done with a control manometer, which controls simultaneously all other installed manometers. The test pressure must be maintained over 180 minutes and then the plant is monitored for another 60 minutes. It is considered that the devices and pipelines passed this test if no signs of damage appear and if there are no deformation son the installations elements. The test results are considered successful if besides the above conditions the pressure value doesn't drop during the first 120 minutes of testing for more than 2% after the test pressure was achieved. The test pressure can also be done during the technical approval inspection of the entire building if request so by the technical commission.
5.7.5 During internal inspection of the devices (where such inspection is possible), special care must be given to the status of walls, seams, joints and connections.
5.7.6 The water tightness test is done immediately after the strength test. The pressure for this test is identical to the operating pressure. It is considered that the test was successful if the plant doesn't leak and if the pressure doesn't drop more than 2% during the next 24 hours.
5.7.7 After completed inspection in regard of cleanliness, the installations must be checked in order to see if all operating parameters are met, i.e. a so called "hot test" must be performed. This test especially checks:

-if the designed parameters are achieved in all parts of the installation;

-if the fittings and devices properly function and if the system functions and operates without noises or blows;
-are the heating elements properly distributed in the building and rooms;
-are all elements of the installation properly and solidly done and are they resistant onto thermal dilatations;
-does the system properly ventilate.

Within this test the internal temperatures in all heated rooms are measured. The measurement of these internal temperatures is done at an outside temperature of minimum t = -5°C. The measurement is done at a height of h=1,2 m from the floor, with a thermometer of an accuracy of 0,5°C, three hours after start of operation of the installation.
5.7.8 Necessary fuel, electric energy and other costs of the tests, except labor, is carried by the investor.
5.7.9 After successful completion of the functional test, the installation is handed over to the investor. At this point the contractor must also hand over two copies of written instructions for control and operation (manuals) of the installation, of which one copy must be framed and hung at a visible place in the boiler room.
5.7.10 All tests must be done in accordance with the standards and normative for this type of installation .

6. AIR CONDITIONING AND VENTILATION INSTALLATION

6.1 General technical requirements

6.1.1 The installation has to be done in accordance with the project design and may be assigned only to that contractor who is able to proof and obligate himself to be capable to deliver, mount, regulate, test the entire installation, to perform a commissioning operation, including the automation, all precisely as per project design.

6.1.2 All elements must be fully compliant with the specified properties and be of such dimensions that they fit into the dimensions set by project design.

6.1.3 Elements of the installation that are not mass/serial products but are custom made, must be manufactured at adequate quality in both material and works for the certain dedication. The surface protection must be done in accordance with the project design and where this is not specified in the project documents, it has to be done in the usual way applicable for such works and based on regulations on quality.

6.1.4 The contractor of the installations declares to Ito have the know-how and capacities that are required from a contractor of such installation works, i.e.:

a) to be able to procure, deliver, mount, connect with other elements of the installation, regulate and commission into operation all elements of the installation defined by project design, both domestic equipment or imported items and also to be able to obtain brochures, instructions and manuals that are needed in regard of this;

b) to have the know-how and capacities to solve all details within the mounting of the installations at an adequate technical and aesthetic level, especially the installations for which no workshop drawings are given like suspension of pipes and air ducts, setting up fixed and gliding supports, setting up aeration vessels, heating elements, equipment onto swimming, elastic or solid foundations, blending of the equipment into the architectural – buildings design, etc.;

c) to dispose of the capacities necessary for the regulation of the operating parameters of the installation: the flow speed, water temperature and air temperature, humidity of air, applying all regulation and control devices contained in the project design;

6.1.5 Equipment, material and fittings used for the setting up of the installation must be of new production and fully compliant with the valid regulations. Fittings and measurement instruments must be of solid construction and fully comply with their designated usage.

6.1.6 The contractor of the installations must install and mount all of the equipment from this project design based on drawings, technical descriptions and these technical requirements. The

contractor must insure all qualified and other labor, own tools, machines, instruments and all other assets that are needed for the mounting of this installation.

6.1.7 Works on foundations for equipment are part of the contracted works for the installations and the contractor is obligated to perform these works as well. Also, all masons works necessary to fixate the supports, binders, suspension supports and means to carry elements of the installation are part of the duties of the contractor of this installation.

6.1.8 Control loops and all other elements that are part of the automatic control must be mounted in accordance with the attached documentation. The contractor is obligated during the mounting works, to fully comply with the instructions of the manufacturer of measuring and control equipment, i.e. detailed schemes of wiring/connections, instructions for mounting and instructions for control and handling.

6.1.9 After completed mounting works of the entire installation, the contractor is obligated to control and fine tune the measuring and automatic control equipment based on parameters from the project design.

6.1.10 Electric installation is part of the project of electric installations, but the connection of all electric devices in the system of designed mechanical equipment must be done by the contractor of these mechanical installations, with own labor, materials and tools.

6.1.11 Each electric equipment that must be mounted into the designed installation must be adequate for connection into the network 3 x 380 V, 50 Hz, i.e. 220V and 50Hz for single phase connections.

6.1.12 Electric drives must be delivered together with fuses and inlets.

6.1.13 Electric control – distribution panels must contain all elements for control, operation and protected devices (fuses, inlets, control lamps, etc.). On the electric control panel all necessary relays and other electric instruments must be mounted, which are part of automation or are parts of the equipment that is connecting the automation and the electric drive.

6.1.14 The contractor of the installation must ensure all material that is necessary to wire/connect electrically all electric drives and other electric devices that are part of the installations, as well as the connections with the electric control/distribution panel.

6.1.15 Insulation and painting of the installations is done after completed mounting works and successful installation tightness test. Prior to the insulation and painting all metal parts of the installation without manufacturer's surface protection must be properly cleaned with a steel brush and coated with protective paint in two layers. The insulation is to be done properly and completely in accordance with the project design. Painting of installation is done with color chosen by the investor. The paint used must have good surface coverage properties and be resistance onto the maximum operating temperature.

6.1.16 After completed mounting works, a test run of the installations and the regulation/control test must be performed. During this test run all preparation activities must be done, like discharging air from the pipelines, preliminary regulation, setting the gates and valves into operating positions etc. and then the installation must be put into operation. After remedy of possible faults that appear in operation of the installations, the installation must be fine tunes using all regulation/measuring equipment and devices. The regulation of speed of flow and temperatures must be done precisely and under compliance with the designed and specified requirements.

6.2 Special technical requirements

6.2.1 The pipeline must be mounted in such a way that the pipes can freely elongate, without stressing the pipes overly. The movements of the pipes under elongation/expansion under temperature impact may not cause and damages or breaking off of supporting elements of the pipes or the structural part of the building. All fixed points must be properly done so that the pipes can move even at such points. Duct pipes are used for the pipeline wherever passing through walls and floor slabs. Connecting the pipes with welding means that the pipes must be previously prepared and after welding is completed the weld seam must be processed, whereas the opening diameter of the pipe may not be narrowed. Hollanders must be accessible.

6.2.2 The distribution of pipes is done in such a way that the pipes are positioned with a certain inclination and on suspending supports, binders, clamps and consoles. The distances between these pipe supporting elements, if not differently specified in the documentation is given below:

Type of pipe	Distance between supports (m)
DN 10	1,5
DN 15 ÷ DN 20	2,0
DN 25 ÷ DN 32	2,5
DN 40 ÷ DN 50	3,0
DN 65 ÷ DN 80	3,0
DN 100	4,5
DN 125 and more	5,0

6.2.3 For making straight pieces and profiles of a duct, always galvanized sheet of the following strength must be used:

Higher edge of duct (mm)	Thickness of steel sheet (mm)
Up to250	0,5
251 ÷ 499	0,75
500 ÷ 999	1,0
above 1000	1,25

For reduction pieces and other parts the strength/thickness of the steel sheets is done based on the dimensions of the higher edge at the end of the smaller diameter.

6.2.4 For flanges rolled, profiled steel is used as follows:

6.2.4.1 for parts of steel sheet of a thickness 0,5 to 0,75 mm L 25 x 25 x 4 mm.

6.2.4.2 for parts of steel sheet of a thickness 1,0 to 1,25 mm L 30 x 30 x 4 mm.

6.2.5 The connection of the steel sheet on straight and profiled parts and the air duct must be done with a double overlapped seam. At the ends of the straight and bended profiles flanges of angled iron must be mounted. The ends of the steel sheets of individual parts must be bend over the flange. Between the flanges a sealant of asbestos mesh 5÷8 mm, or asbestos glue of 3÷4 mm must be mounted. For the connection of the flanges screws Ř 1/4" with hexagonal head to be used.

6.2.6 Suspension supports and consoles for the ducts must be of rolled steel of ø 10 mm and L profile of dimensions from 25x 35 x 3 mm to 35 x 35 x 3 mm, with screws M10 and flushers.

6.2.7 The ducts must be done with as less as possible sharp bends. Each knee in the duct must be done with direction shovels, the same goes for branching. Ducts with a longer dimension of cross section of above 500 mm must be properly fixated to avoid “banging”.

6.2.8 Gates for air control must be of a solid construction with rigid parts on the lower and upper edge in order to avoid their vibrations in any direction. The gates must have axis outside the ducts, i.e. chambers and may be manually operated or with a motor.

6.2.9 All fans in the installation must have a capacity of static pressure and revolution number defined in the specification and be of such dimensions that they can be mounted into the designed

space. The fans must be “silent” type, i.e. they must produce the less possible sound a certain number of revolutions. The fans must be connected with the electric drives via toothed belts and joints. These toothed belts must have guards.

6.2.10 The electric drives for the fans must be types for connection onto a three phase system of alternate 380 V, 50 Hz. Electric drives must be in a fully closed construction, with gliding rings and adequate rotor inlets. Electric drives are mounted onto gliding rails of cast iron or pressed steel.

6.2.11 Cooling plants must have the capacity and properties defined by project design and be equipped with all devices for their operation, control and maintenance of operating parameters and safety elements. The cooling plant must be mounted in accordance with the instructions of the manufacturer.

6.2.12 Equipment that must be placed onto foundations must be set on foundations of adequate dimensions in accordance with such equipment.

6.2.13 Equipment in the mechanical rooms must be mounted in accordance with the project design taking into account the accessibility requirements for such equipment in regard of control and maintenance/dismantling. Special care to be given to the mo9unting of safety – technical and protective equipment like connections of expansion vessels, safety valves, fire suppressing/prevention gates and other fire prevention devices, silencers etc., all in accordance with the project design and laws and regulations listed below.

6.2.14 The tightness test is done in both the water carrying and air carrying part of the installation. The water carrying part is tested with cold water onto operating pressure that is defined as sum of hydro-static pressure and pump loads, increased for 2 bars. The installation must operate under test pressure for 2 hours. During this period there must be no leakage i.e. drop in pressure at control points.

6.2.15 The air tightness of the air carrying part of installations operating under high pressure is tested with measurement of flow at the outlet connection – air conditioning chamber and the current elements. The balance of air volume/quantities may not differ more than 10%. At low pressure installations only the air carrying part is tested for air tightness.

6.2.16 During the technical testing of the installation it must be checked if the mounted equipment, devices and automation complies with the designed one. Also, the quality of the mounting works is checked and the designed parameters on the installation and air-conditioned spaces.

6.2.17 The temperature of spaces in winter operation is checked when the outside temperature is -5°C or less and in summer when the outside temperature is 29°C or more and the weather is sunny. After three hours of continuous operation, if the rooms were normally air-conditioned the day before, the temperatures defined by the project design must be reached. During this measurement all other parameters and/or settings must be checked on the installation that are necessary for their conversion onto the conditions of the outside designed temperatures.

7. LIST OF APPLICABLE USED LAWS, STANDARDS AND REGULATIONS

7.1 Laws

-	Law on protection against pollution	SRS 8/1973
-	Law on explosive substances, liquids and gasses	SRS 44/1977
-	Law on measurement units and measures	SFRJ 9/1984
-	Law on fire protection	SRS 37/1988
-	Law on safety at work	RS 42/1991
-	Law on designing and construction of objects	RS 47/2003
-	Law on pipe transport of gas or hydrocarbon	SRJ 29/1997

7.2 Standards

	Elements of pipelines. Definition and selection of nominal diameter	JUS ISO 6708
-	Steel, seamless pipes with defined properties	JUSC.B5.021
-	Steel, seamless pipes for gas and water pipes	JUSC.B5.023
-	Pipes made of steel 1212, seamless	JUSC.B5.122
-	Steel seamless pipes	JUSC.B5.221
-	Coated electrodes for electric welding of steel	JUS C.H3.010-020
-	Welding. Technical requirements and procedures of control	JUS C.T3.001-082
-	Corrosion protection. Basic paints	JUS C.T7.311-374
-	Thermal electric devices for control of flame for fire extinguishers	JUS EN 125
-	Welding. Certification of welders	JUS EN 287-1
-	Quantification of electric welding technology for steel	JUS EN 288-3
-	Metal, manual pipe gates for house gas installations.	JUS EN 331
-	Recommended practice for radiographic testing of welded melting seams	
-	Frontal connections over the pipe diameter	JUS ISO 1106-3
-	Electric welding. Criteria of faults acceptability	JUS ISO 5817
-	Polyethylene pipes – measures and allowed deviations	JUS G.C6.601
-	Pipes and connecting elements of polyethylene mass	JUS G.C6.602
-	Polyethylene pipes for gas lines, Measures and technical requirements	JUS G.C6.661
-	Polyethylene fittings for connection with subsequent drilling	JUS G.C6.664
-	Gas like fuels	JUS H.F1.001
-	Measuring of the gas flow in closed pipelines. Measuring devices with turbine	JUS ISO 9951
-	Units of gas volume with deformable walls	JUS L H2.100
-	Pipe screw connections	JUS M.B0.057
-	Metal flanges . Steel flanges	JUS ISO 7005-1
-	Dimensions of gaskets/sealants for flanges from ISO 7005	JUS ISO 7483
-	Steel bows for welding	JUS M.B6.821
	Steel fittings with screw pipe connection	JUS M.B6.850
-	Single pipe screw connection for measuring devices of gas volume with diaphragm	JUS M.B6.851
-	Elements for closing pipes- valves and ball taps	JUS M.C5.004-041
-	Regulation valves	JUS M.C5.084-092
-	Safety valves. Calculation and selection	JUS ISO 4126-1
-	Internal gas installations	JUS M.E3.001
-	Measurement of pressure in gas pipelines and plants	JUS M.E3.151
-	Pressure regulators for gas, inlet pressures of up to 100 bar	JUS M.E3.379
-	Signaling devices for gas supply, operating pressure up to 100 bar	JUS M.E3.381
-	Devices for additional aeration of house chimneys/stacks	JUS M.E3.484
-	Metal gas pipelines that can be dismantled	JUS M.E3.507
-	Gas pipelines and house connections. Insulation pieces	JUS M.E3.509
-	Internal installations. Definition of pipe diameter	JUS M.E3.510
-	Internal gas installations. Compensators with bellow	JUS M.E3.521
-	Profiles for smoke carrying connections	JUS M.E3.522
-	Gas pipelines. Flexible connections	JUS M.E3.525
-	Safety hoses and hoses for fixed joints	JUS M.E3.530
	Internal installations. Stainless steel hoses for gas	JUS M.E3.535
-	Filter for internal gas pipelines	JUS M.E3.571
-	Setting and complex setting devices for gas fuels	JUS M.E3.573
-	Pressure regulators for gas consumption meters	JUS M.E3.576
-	Classification of explosive gasses and steams	JUS N.S8.003
-	Protection against explosion. Danger zones in spaces under explosion risk by mixtures of gasses and steams	JUS N.S8.007

- House chimneys, design and construction JUS U.N4.030
- Smoke carrying systems. Design and construction JUS U.N4.035
- Safety at work. Maxim allowed concentrations of dangerous gas, steam and aerosols in the atmosphere JUS Z.B0.001
- Classification of flammable liquids based on temperature of ignition and boiling temperatures JUS Z.C0.007
- Manual fire extinguishers with dry foam JUSZ.C2.035

7.3 Regulations

- Regulation on storage of fuel oil SFRJ 45/1967
- Regulation on technical measures and conditions for heat energy in buildings SFRJ 28/1970
- Regulation on Yugoslav standards for thermal techniques in construction works SFRJ 3/1980
- Regulations on safe transport and normative for liquid and gas hydrocarbons in main pipelines and pipelines /fuel lines for international transport SFRJ 26/1985
- Regulation on technical normative for ventilation and air-conditioning systems SFRJ 38/1989
- Regulation on technical normative for design, building, operation and maintenance of gas boiler rooms. SFRJ 10/1990
- Regulation on technical normative for hydrants for fire fighting SFRJ 30/1991
- Regulation on technical normative for internal gas installations SRJ 20/1992
- Regulation on technical normative for design and laying of distributing gas pipelines made of polyethylene pipes for operating pressure of 4 bar SRJ 20/1992
- Regulation on technical normative for solid installations for detection of explosive gasses and steams SFRJ 24/1993
- Technical requirement s for the construction of gas stations based on system "NIS-GAS"

VI. FURNISHING AND LANDSCAPING OF SURROUNDING AREA

1. Laws, standards and regulations

All works must be done in accordance with the project design, technical requirements and valid standards. Regulations for execution of works : JUS U.E1.010 Excavation works on construction of roads

1.1 Excavation works (underground, filled in parts, bedding, pegs at the objects)

For insurance of defined quality when working and processing the underground layers for filled in parts and setting up of the bed layer of the traffic surface, operative mobile laboratories must perform the following analysis- tests:

Analysis of material quality:

- Definition of specific weight U. B1. 014.
- Definition of granulometric content U. B1. 014.
- Definition of consistency borders U. B1. 020.
- Definition of changes in soil volume U. B1. 022.
- Definition of organic or combustible content U. B1. 024.
- Definition of the equivalent of sandy ground U. B1. 040.
- Definition of Californian strength index (CBR) U. B1. 042.

Testing of quality of materials to be mounted

- Sampling U. B1. 010.
- Definition of humidity of ground/soil U. B1. 012.
- Definition of volume weights U. B1. 016.

- Definition of optimum water content U. B1. 038.
- Definition of density module by method of circling plate U. B1. 046.

Depending on the type of applied material, the operative laboratory will perform adequate tests and analysis.

1.2 Structure of the traffic area

a) Establishment of lower layer (tampon layer)

b) Test of material quality :

- Pressure strength B. B. 012.
- Volume weight (loose state) B. B8. 030.
- Specific weight B. B1. 014.
- Aggregate wear and tear after „Los Angeles“ method A. S. T. M.
- Resistance and durability of aggregate against frost B. B8. 044.
- Content of dust particles B. B8. 037.
- Content of particles of unfavorable shape B. B8. 048.
- Granulometric composition B. B1. 018.
- Content of particles smaller than 0.09 B. B8. 036.
- Content of organic material/substances B. B8. 036.
- Contents of clay clumps B. B8. 038.
- Optimum water content U. B1. 038.
- Californian strength index U. B1. 042.
- Technical conditions for construction U. B1. 042.
- Classic and modern basic layers for roads U. E9. 020.
- Technical conditions for the making of mechanically stabilized layers U. E9. 022.

c) Making of carrying layers and finish layers of bituminized aggregate

For the construction of the carrying layers of the traffic surface, following regulations are applicable:

- Volume weight (loose) B. B8. 030.
- Specific weight B. B1. 014.
- Wear and tear of aggregate by method „Los-Angeles“ A. S. T. M.
- Frost resistance of aggregate B. B8. 044.
- Content of wear particles B. B8. 037.
- Content of particles of unfavorable shape B. B8. 048.
- Adhesiveness of bitumen and aggregate DIN. 19/96.
- Granulometric composition U. M8. 102.
- Content of particles smaller than 0.02 B. B8. 036.
- Content of light particles B. B8. 034.
- Content of organic substances B. B8. 039.
- Content of clay clumps B. B8. 038.
- Filter for hydrocarbon mixtures B. B3. 045.
- Bitumen for traffic road layers U. M3. 010.
- Bitumen emulsion for traffic road layers U.M3.020./96.
- Technical requirements for stone aggregates of modern traffic road layer B. B8. 050.
- Technical requirements for the making of asphalt concrete U. E4. 014.
- Technical requirements for poured asphalt U. E4. 020.
- Technical requirements for classic and modern basic layers for traffic roads U. E9. 020.

1.3 Concrete works

For the concrete works, along with the technical specifications that are given with every structure, the following regulations must be applied:

➢ Volume mass (loose-compacted)	B. B8. 030.
➢ Specific weight	U. M1. 021.
➢ Wear and tear of aggregate – method „Los-Angeles“	A. S. T. M.
➢ Wear and tear resistance of the aggregate in concrete	U. M8. 044.
➢ Frost resistance of the aggregate	B. B8. 044.
➢ Content of unwanted particle shapes	B. B8. 048.
➢ Content of wearing particles	B. B8. 037.
➢ Granulometric composition	U. M8. 020.
➢ Content of particles smaller than 0.09	B. B8. 036.
➢ Content of particles smaller than 0.02	B. B8. 036.
➢ Content of light particles	B. B8. 034.
➢ Content of clay clumps	B. B8. 038.
➢ Content of organic substances/material	B. B8. 039.
➢ Content of amorphic silicate	lav. method
➢ Content of hazardous chemical substances	B. B8. 042.
➢ Drainage compounds	U. S4. 062

2. EXCAVATION WORKS

2.1 Removal of humus layer

In the area that is subject to excavation works, the humus layer with grass and shrubs is to be removed in a thickness of 15 cm, in the designed layer thickness. If during the works the humus appears in wider or narrower layers, the supervising engineer will enter these changes into the construction works log-book and the contractor will act accordingly.

The excavated humus is to be placed on both sides of traffic road route or a landfill in a proper form. The humus may not be used to fill in areas, but for landscaping of the green areas next to the sidewalk and logistic routes.

The cubage of such excavated humus is defined by the supervising engineer by measuring of the average thickness of excavated layer in natural state.

For the completed and finished works each m2 of excavated humus will be calculated, disregarding the category of soil, the excavation and transport methods.

2.2 Excavation of soil in ground of III and IV category in a wide dig

In general these works must be done with machines, so that manual work is kept at a minimum. All excavated material from the digs must be used as defined by project design and technical requirements.

All digging works must be done in accordance with defined profiles, elevation points and inclinations as per design, i.e. the instructions of the supervising engineer. When performing the excavation works adequate safety measures must be implemented and all necessary organization of objects and communications established. In this phase of works effective drainage of the area must be insured.

The inclinations of the slopes must be done in accordance with the project design, i.e. instruction of the supervising engineer. This work demands the insurance of bulk zones, if such works are not already contained in other work items like protection of any slopes of cuts in accordance with the properties of the soil material, geological findings and other situations in the excavated and processed ground which must be take into account by the contractor during these works and accordingly in case of such situations the contractor is not entitled to an increase and change in quoted unit prices.

During the works care must be taken that there is no obstruction of the balance or damage to the slopes of the digs that are defined as such by project design. Each such case must be rehabilitated subsequently by the contractor based on instructions of the supervising engineer, without charging any extra for more or unforeseen works.

During the excavation works all impacts that would obstruct the traffic flow must be brought onto a minimum, all necessary signalization for traffic and safe traffic must be used based on special approval of the authorized body to be obtained by the contractor. In case these obstructions cannot be

avoided, the contractor must remedy them immediately at own costs.

2.2.1 Disposal of local material and analysis/tests

Before and during the woks on all changes in the excavation works, i.e. quality of soil material, adequate samples must be taken for analysis of the adequacy of the material for the defined designation. A certificate must be obtained from an authorized organization in regard of the adequacy of such material from every significant cut or where it is possible to reuse the existing local material. If it is planned to use the excavated material than it must be used for filled in parts or be disposed at locations instructed by the supervising engineer, if it is excess.

2.2.2 Measuring

The measuring of quantities for calculation of the excavated material is done based on real cube meter volume of natural material that is excavated, based on measurement of cross section profiles and final excavations based on project design, i.e. changes approved by the supervising engineer. Excess excavated material is not paid extra if excavated by fault of the contractor. For determination of quantities of various materials excavated, the following criteria is applicable:

- Based on the cross section profiles, during the construction works, individual types of excavated soil are defined based in the percentage of the overall surface profile, which is then basis to calculate the overall quantities for each category – type of ground/soil. When excavating a wide dig, in mixed material, the categorization is mandatory, disregarding the fact if the contractor requested this or not.

The categorization of the soil/ground in the excavations is defined by a commission composed of: representative of investor at site, supervising engineer (if there is a chief of supervision at site, such person must be a member) and a representative of the contractor . The commission drafts a protocol on its findings and based on approved percentage and with the protocol the representative of investor will calculate the categories and enter these into the log-book (apply GN 200).

Caverns and hollows between the individual types of soil/ground that do not exceed 1m2 are not deducted from the surface /cube volume of the surface for the individual type of soils.

Hollows exceeding 1 m² are deducted. All excavated material that is used for other purposes besides filling in works and if it was not compensated by the contractor from spare soil material, will be deducted from the overall mass of excavated quantities. Excavation from spare soil material that is not used for filling in works is deducted from the overall quantities.

3. PROCESSING OF UNDERGROUND LAYER – PLANUM OF BASIC LAYER

3.1 Description

This works comprise the processing of the leveling of the underground- basic layer and filling in with rough and fine material for leveling and subsequent compacting of coherent and mixed materials. In case the compacting is impossible due to excessive humidity of the ground, i.e. poor weather conditions, a deeper dig can be done for another 15 cm, with mechanical and/or chemical stabilization of this dig, then the dig is filled in with a leveling layer of 15 cm thickness, after which this layer is mechanical and chemically stabilized. Decision on this is made by the supervising engineer.

The above described works must be done up to the defined elevations, at the full width of the leveled area and in accordance with the technical requirements.

3.2 Material

For the making of the bed layer all inorganic material under these requirements is to be used. Regulations based on which control of material quality is done are listed in the beginning of this chapter.

3.3 Evenness

The plane of the finish layer of the basic layers must be such that maximum deviations of ± 2 cm in the measurement elevation are permitted. This evenness is measured with cross and rope in each profile and all directions (parallel, longitudinal and diagonal).

The elevation points of the finish layer of the bed layer at any point may deviate from the design a maximum of ± 2 cm. The elevation points of measuring points must be determined with adequate spirit levels, while those points will be defined by the supervising engineer.

Cross sectional and longitudinal slopes/inclinations of the bed layer must be done in accordance with the project design. Ž

The below constructed bed layer is filled with additional material for the basic carrying layer at costs of the contractor.

3.4 Compacting of bed layer

The entire width of the bed layer – plane must be stabilized mechanically or chemically as per design.

Material that was excavated or filled into the bed must be immediately compacted.

In case that the compacted bed layer – plane has been exposed for a longer period to the elements or has been damaged in any other way, it must be brought into the designed conditioned by the contractor.

The regulations for the quality control of used material is at the beginning of this chapter.

3.5 Scope of current analysis and tests

Compactness test at every 50 – 100 m;

Definition of the CBHR for each change in material before and after application of such material. Humidity to be checked daily.

3.6 Approval of the works

The approval on the constructed bed layer will be given or refused by the supervising engineer before the next phase of works. During this approval all requirements from these technical requirements must be met. All faults in regard of meeting the requirements must be remedied by the contractor at his own expense.

4. MAKING BANKS

4.1 Scope and content of works

The construction of banks means filling in of material, spreading and distribution of such material, rough and fine leveling, humidification and compacting of material in the banks – all in line with dimensions from the project design. All these works to be done in accordance with the project design, these technical requirements and JUS U.E1.010 – excavation works in soil during road construction.

4.2 Material

For the construction of the bank's non-organic material of defined quality must be used. Organic waste, roots, shrubs and material that would change mechanical – physical properties due to biochemical impact may not be used. The material for the banks can be the one from the cuts.

Regulations for quality control of material can be found at the beginning of this chapter.

The definition or organic and combustible materials and changes in the soil volume must be performed only in specific cases (suspect material).

Prior to the analysis of adequacy of the soil materials for the construction of the banks, the material from each cut and every change of material must be analyzed. These analysis to be performed on at least two samples for each type of material.

4.3 Transport and filling in

The transport and filling in material onto the previously prepared basic ground or an already constructed layer of the banks may begin only after the supervising engineer has approved the

previous works – layers. Each individual layer must be spread in longitudinal direction, horizontally or maximum in an inclination equal to the designed longitudinal slope inclination. In the cross section, each layer must have a one-sided inclination of 2 – 5 %. This inclination is necessary for drainage of rain waters, which means that the surface of this layer when applying coherent soil materials, must be properly distributed and immediately compacted (daily). Each individual layer must be filled in and created base on designed cross section profile. When filling in soil material the passages for transportation vehicles must be properly distributed over the entire width of the processed area and banks.

4.4 Compacting

Each layer in the filled in banks must be compacted in full width with adequate mechanical means, whereas the compacting works must be done from the edge towards the central part. All locations that are hard to reach with mechanical means or where mechanical compactors are not usable for different reasons (filling in behind the object, supporting walls etc.) other tools for compacting must be used, as approved by the supervising engineer.

Each layer must be sprayed with water prior to the compacting works or dried up to a humidity level that is in accordance with the previous humidity analysis based on which the subject material can be compacted to the designed compactness. Along with this each layer of the filled in parts must be crushed mechanically into smaller fragmentations. If after completion of compacting works an quality control the next layer is not immediately filled in, but will be filled in after a longer period of time and under different weather conditions, the compactness of the previous layer must be checked prior to filling in the new layer.

The filling in of new layers must be done in such a way that the layers in their longitudinal sense are as much as possible horizontal and that sudden elevation differences between the layers of different height are avoided and are done under an adequate sloping on which proper compacting works can be performed.

Works on filling in of material into these banks will be stopped whenever the designed and wanted results cannot be achieved, especially in case of rain or other poor weather conditions. In such a case the contractor is not entitled to any additional compensation. The material for the parts that are filled may not be applied onto frozen layers or onto snow or ice.

The regulations for the quality control are given in the beginning of this chapter.

4.5 Scope of current control tests and analysis

Compactness test of layers at every 50 – 100 m; with two samples in immediate vicinity that give one result. This applies to filled in banks of less than 50 meters length. Humidity of material to be checked daily. The next layer can be started only after approval of quality of the previous layer.

3.6 Approval of the used material

The approval on each layer of the filled in area- banks will be given or refused by the supervising engineer based on defined criteria All faults in regard of meeting the quality requirements must be remedied by the contractor at his own expense.

4.7 Measurement

The quantity of built in material is measured in cubic meters, based on real applied quantities within the project works, including the bank.

4.8 Payment

The contracted prices must include all works in spreading – distribution of material over the processed area, humidification or drying, compacting, leveling the slopes of the filled in parts and banks with an accuracy of ± 5 cm, in relation to the designed values, including all material and works, transport and internal transport and the contractor is not entitled to demand any additional compensation for the banks and filled in areas. The quantity of the banks is defined by cross profiles.

5. CONSTRUCTION OF ROAD BANKS

5.1 Description

This item includes the construction of a road bank covered with sand, gravel, stone aggregate in a layer of 5 cm , all based on project design.

5.2 Material

The material of building part of the road banks above the tampon elevation may be such material that complies with requirements for material to be used for the construction of finish layers from these technical requirements and the finish layer of the road banks must be processed with small stone aggregate in a thickness of 5 cm, all in accordance with project design.

Up to the elevation of the tampon layer, the road bank is made of same material and same thickness of layer as the lower, carrying tampon layer.

For covering of the road bank with a sand and crushed stone layer, sand made of healthy stone material may be used, of a fragmentation of 0/8 mm, of quality like defined in JUS U. E 9.020, while the gravel and crushed stone aggregate may be of fragmentation 0/30 mm.

5.3 Execution of works and quality

All works must be done as per detailed drawings from the project documents, if not differently defined by these requirements.

The material for the banks must be compacted. Generally the properties for construction of filled in area sand banks from these technical requirements must be complied with.

The surface of such filled in layers must be done in diagonal and longitudinal slope/inclination as per project design, whereas the decrease of elevation point for the thickness of such compacted layer of sand, gravel and stone aggregate must be taken into consideration.

The covering of the road banks with the designated materials and the 5 cm layer must be done precisely based on designed profile, with special increment for compacting reasons. The compacting must be done with a roll of 3 tons weight.

Horizontal edges of the road bank must be done in accordance with project design. Deviations from the project design lines are allowed if they don't cause visual obstructions.

The elevations of the final surface of the road banks may be 1 cm under the designed surface.

Deviations from the designed thickness of layers in compacted status and in regard of the designed values are allowed within ± 1 cm.

5.4 Approval of works

The approval of the works is done by the supervising engineer based on quality requirements and these findings. The quantities for calculation are defined in m2 of constructed and completed road banks covered with sand, gravel etc., based on real work within the project design. The construction of these road banks must be included in the cubic volume of the tampon layer.

6. UPPER LAYERS

6.1 Mechanically stabilized lower carrying/bearing layer – tampon

6.1.1 Description

This work includes procurement, transport, distribution – spreading of material and compacting. The thickness of the constructed and compacted layer is 25 cm under the traffic lane layer and 15 cm under the sidewalk, as per project design.

6.1.2 Construction

The lower carrying layer is applied onto a bed layer prepared and constructed in accordance with these requirements. Only after the bed layer was approved by the supervising engineer, the carrying layer can be constructed. Vehicles carrying material for this layer that have muddy wheels may not drive over spread or compacted material. After supply of material, the material is to be distributed properly over the processed surface, in such a way that by compacting of this material the necessary

thickness of the designed layer can be achieved with compacting machines.

The plane of compacted layer must comply with designed elevation points, width and inclination.

6.1.3 Quality control

The quality control contains previous and control tests and analysis of material and control of compacted layer.

The curve of the granulometric (fragmentation size) content of material is given in acceptable values below in the table:

Sieve opening mm ²	Passage through sieve %
45	100
31.5	85-100
22.4	68-93
16	56-85
8	38-69
4	27-56
2	20-44
1	15-35
0.5	11-30
0.25	8-23
0.09	2-11

Besides the above the granulometric properties of material must also comply with:

- Content of particles smaller than 0.02 mm, may not exceed 5%
- Irregularity of granulometric content U= 15-100
- Strength of material used based on Californian strength index must be CBR 30%, at relative compactness of 95%, in relation to the maximum volume mass based on modified Proctor proceeding
- Content of organic material/substances and light particles may not exceed 5%.

6.1.4 Control of applied layers

Control is done by analysis of compactness in regard of the modified Proctor procedure at least on every 500 m². Compactness level Sz(%)>98%.

Control of granulometric content is done on every 1000 m2. The evenness is to be checked with spirit lever of 4 meters length on each diagonal profile. Allowed deviation is 10 mm. The height of the finished carrying layer at any possible point may deviate from the designed value up to a maximum of 10 mm, which is checked with leveling measurement. Deviation of the finished layer may not exceed 15 mm. Higher deviation values are forbidden. In case the deviations remain as permanent, the supervising engineer and investor may give their opinions on this and propose adequate measures for maintenance and sustainability of the designed work quality, i.e. define measures to be applied when calculating the scope of works.

6.1.5 Measuring and payment

Calculation based on 1 m3 of installed and compacted lower carrying layer.

7. CONCRETE AND REINFORCED CONCRETE WORKS

7.1 Material

All used material must comply in quality and properties with the requirements and standards, as well as these technical requirements.

7.2 Execution

Pouring of concrete into supports and coating walls is done in various strengths, leaving an operative connection on every 3 meters and filling in with closing mass. Compacting of concrete to be done with vibrating machines, surface to be smooth, even and without pores. Supporting and coating walls to be reinforced with steel as in the project design, for structural reasons.

7.3 Quality

All finished concrete surfaces to be done in accordance with the project design in required longitudinal inclinations and diagonal inclinations and surfaces. Absolutely no unevenness is allowed, the working surfaces must be spotless.

7.4 Quality control

The supervising engineer must control elevation and inclination and quality of used materials and works. If the works are not done based on required quality, the supervising engineer will stop the works and demand remedy of faults.

8. APPLYING HUMUS ON SLOPES AND SETTING UP OF HUMUS FILLED ROAD BANKS

8.1 Description

On the slopes previous grubbing must be done based on details from the project design, the division lanes must be leveled and the layer under the road banks must be brought into desired elevation, after which a humus layer is filled in accordance with the project design values. The humus layer is to be leveled.

8.2 Material

Humus - active humus material must be used, that guarantees long life of the planted plants.

8.3 Execution

Humus is applied as top layer after completion of filled in parts and banks or cuts. Prior to bringing in the humus the following must be checked in order to achieve stability:

- That the excavated area and filled in part have been constructed in such inclination that the stability of the layers beneath is guaranteed. If the cause of instability of layers is water, the slopes must be properly drained.
- Surface water flowing into the area must be collected and rerouted
- Slopes of banks, especially cuts into the area must be roughly leveled to achieve a required roughness that insures adhesiveness with protective vegetation. On the slopes with smooth surfaces with possibility of slides, a roughness with 15 cm wide grubs must be established, which grubs must be created at every 1 meter distance.

8.4 Measuring

This item is not measured separately but only controlled in the sense of achieved thickness of required layer.

9. GRASS SEEDING ON HUMUS SURFACES

9.1 Description

The works contain preparation, seeding, watering of surface until the grass growth, rolling and fertilizing.

9.2 Material

Grass seeds. Seeds of such properties (mixture of grasses and clover) to be procured that complies with ecological requirements and guarantees durability of growth. Seeds in corns must be used. For fertilization Tomas phosphorous fertilizer, potassium salt and nitro-oniol to be used.

9.3 Execution

Seeding of seeds, either on a blanket with bitumen emulsion or over humus surfaces. The surfaces must be properly covered by grass growth.

Grass on slopes and banks and cut ins, soil islands and division lanes to be seeded only based on instructions by the supervising engineer. These instruction will be given only if the natural growth is insufficient or the naturally grown grass has such properties that it needs to be supplemented with additional grass seeding.

After the humus layers are applied and the slopes leveled if necessary the area must be treated with biological means against weed, all based on instructions of the expert and done by the contractor.

Seeding is done only under adequate favorable weather, as follows:

- First fertilizer must be spread over the slopes surfaces, Tomas fertilizer in powder, quantity 400kg/ha and potassium salt 200kg/ha.
- Now the humus is prepared for the seeding. If the slopes have a mild inclination of 1:2, grubs must be created in the izohips. After seeding the surface, the surface must be rolled over with an adequate roll so that the seeds are pushed into the ground.
- If the slopes have bigger inclinations, the grubs are done from the upper towards the lower edge and immediately seeded with grass seeds. Only after seeding the first grubs, the second grub is done and seeded.

In case of dry weather the contractor must water the seeded surfaces, since only the seeded surfaces are calculated for payment. The type of seeds chosen must comply with properties of soil and the selection is done by an expert. Possible applied biological means against weeds will be selected by an expert and applied by the contractor. Seeds and fertilizer to be procured by the contractor.

9.4 Quality control

For proper selection of plants and fertilizer the contractor must take into consideration the geological properties of the ground. Analysis results must be presented to supervising engineer.

Quality control of grass seed must be approved based on generally applicable regulations. Certificates of the seed producer must be presented to the supervising engineer.

9.5 Measuring and payment

This item is not measured separately. It is paid based on 1m2 of seeded surface calculated by calculation profiles.