

# **VOLUME 3**

## **TECHNICAL SPECIFICATIONS**

**TENDER REF.: MarketplaceSjenica/TD01/WRKS/15-08-17**

**Construction of the Market place facilities in Sjenica**

**Location: Sjenica, Republic of Serbia**

## LIST OF ABBREVIATIONS

BoQ – Bills of quantities  
DIN – German Standards  
DN – Nominal diameter  
EN – European Norms  
FP – Fire Protection  
GMRO – Main metering and regulation switchboard  
HSE – Health, Safety and Environment  
IEC - International Electro technical Commission ISO -  
International Organization for Standardization LAN –  
Local Area Network m1 – linear meter  
m2 – square meter  
m3 – cubic meter  
OSHA – Occupational Safety and Health Administration PA  
– Provisional Acceptance  
PBAB – Rulebook on concrete and reinforced concrete (Pravilnik o betonu i armiranom betonu)  
PEHD – High Density Polyethylene  
PP – Polypropylene  
PPA – Partial Provisional Acceptance  
PAC - Provisional Acceptance Certificate  
PVC – Polyvinyl Chloride  
RAL – colouring system (Reichs-Ausschuß für Lieferbedingungen und Gütesicherung)  
RC – Reinforced Concrete  
SRPS – Serbian standards

## 1. PREFACE

### 1.1 General

This Technical Specification for works execution will be an integral part of the Tender Documentation, which being an Annex to the Contract on Works Execution, therefore will be considered as the integral part of the said Contract on Works Execution.

The Contractor is fully familiar with all details of the Main Design, as well as with all local regulations, local standards (SRPS), common practice of trade and circumstances for their execution, nevertheless, it is understood that, whenever local regulations, local standards (SRPS), or any common practice of trade, are subject to any interpretation, clarification, ambiguity, or dispute, a ruling by the Supervisor will prevail, always provided that such ruling will be fully in compliance with and will be based on the subject local regulations, local standards (SRPS), including, but not limited to:

ICS Number	Standard Number	Year	TITLE
91.200	SRPS ISO 3443-1	2003	Tolerancesforbuilding-Part1: Recommendations for basic principles for evaluation and specification
	SRPS ISO 3443-8	2005	Tolerances for building - Part 8: Dimensional inspection and control of construction work
	SRPS ISO 7077	1994	Measuring methods for building - General principles and procedures for the verification of dimensional compliance
	SRPS ISO 12491	2002	Statistical methods for quality control of building materials and components

and in accordance with common practice of trade and any such ruling by the Supervisors and subsequent instruction in that respect, will not constitute any ground for variation order and/or any additional payment.

All works must be carried out precisely and professionally. Prior to application, the Supervisor must examine all material and all his comments referring to material and quality of work will be obligatory for the Contractor. The agreed prices include all fully completed works, the final product, and ready for use.

**Note:**

*Any reference to specific brand names of the equipment and/or materials found in the design documentation (including but not limited to technical specifications, bill of quantities or drawings) is to be interpreted as only guidance for definition of performance and not as obligatory to be supplied by the Contractor. The Contractor is free to provide equipment and/or materials from any source, which are compliant with Technical Specifications and in accordance with Rules of Origin.*

ICS Number	Standard Number	Year	TITLE
03.120.10	SRPS ISO 9001	2008	Quality management systems-Requirements
	SRPS ISO 10001	2008	Quality agreement-Customer satisfaction-Guidelines for codes of conduct for

			organization
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The Contractor will be responsible for any and all damages caused by the Contractor during any works, to any third party, structure, main building or adjacent buildings, and any and all repair works and compensations of any kind will be at the Contractor's expense

The Contracting Authority will provide to the Contractor the area necessary for organization of the building site. The Contractor is obliged to respect safety and protection regulations set up by the Beneficiary when organizing the building site. All other matters in this regard will be the competence of the Contractor.

Supply of water, electricity and all other raw materials to the building site, all the time during the execution of the works, will be the sole liability of the Contractor, including all costs and necessary administrative procedures.

Prior to the commencement of the works, and also in the course of the execution of every work item, the Contractor will ask the Supervisor for any explanations and clarifications required, therefore, the Contractor will solely bear full material responsibility for all works not completed in accordance with the concept and details of this Main Design.

It is also considered that the Contractor will be responsible for safeguarding of the building site and maintenance of existing structure and/or building all the time during the progress of the works until the final completion and acceptance of the building by the Contracting Authority.

Upon the completion of the works the Contractor will remove from the building site and other used areas all his tools, machinery, surplus material, etc. so as to have the site neatly arranged as defined in the investment-technical documentation and all other areas restored in same condition as before the construction.

## **1.2 Standards to be used**

Coding of each specific technical specification for any type of works given in this Technical Specification, and subsequently in the Breakdown of Prices, is based on the International Classification for Standards – ICS, providing comprehensive correlation between the international and local standards. The Institute for Standardization of the Republic Serbia (Institut za Standardizaciju Srbije, Stevana Brakusa 2, 11030 Beograd, <http://www.iss.rs/kataloge.htm> within its Catalogue provides numerous updated tables enabling connection between international and local standards, as well as, updated review of old SRPS standards which have been either withdrawn, or replaced, or simply renamed.

*Any reference to SRPS standards are to be understood as minimum requirement. The Contractor is free to execute any of the works in accordance with other local or international standards providing equal or better characteristics of the material, products or workmanship.*

For all construction and construction-craft works it is mandatory to use appropriate labour and good quality materials which must comply with existing technical regulations as well as descriptions in respective items of the Breakdown of the Lump-sum price.

## **1.3 Obligation to execute works in accordance with Design for Building Permit**

Prior to commencement of the works, the Contractor is required to study the design and to timely prepare comments and request all the necessary explanations from the Supervisor. The Design for Building Permit is already prepared and the Contractor has obligation to prepare corresponding Design for Execution of the works. See more details in Article 1.8.2.

The Contractor is obliged to execute works according to the design, TS-s and signed contract. For any changes according to the design and deviations of any kind, both in terms of technical solutions and in terms of material selection, the Contractor must obtain the consent of the Supervisor.

All designs prepared by the Contractor have to be submitted to the Supervisor for approval. After completion of the works, the Contractor has to prepare documentation, designs and any other document needed and requested for Technical acceptance.

## **1.4 Certificates**

For each material or equipment that is installed, the Contractor shall submit the manufacturers "type" test certificates, or recent test results carried out on similar items, i.e. CE-certification, certificate of origin, etc. Certificates are to be submitted to the Supervisor in advance.

Any Equipment and Materials which will be incorporated in the Works, or Services used for the execution of the Works, shall comply with the rules of origin published in the PRAG current at the Base Date and shall have their origin in an Eligible Country including the areas.

The origin of Goods is distinct from nationality of the Supplier.

The origin is to be determined according to the Community Customs Code.

A product can not originate in a country in which no production process has taken place. On the other hand, the country of production is not necessarily the country of origin but only when the relevant provisions of Council Regulation (EEC) 2913/92 and its implementing regulation are fulfilled. Furthermore, the country of origin is not necessarily the country from which the goods have been shipped and supplied. Where there is only one country of production, the origin of the finished product is easily established. However, in cases where more than one country is involved in the production of Goods it is necessary to determine which of those countries confers origin on the finished goods. The country of origin is deemed to be the country in which the Goods have undergone their last, economically justified, substantial transformation and the provisions of Article 24 of the Community Customs Code must therefore be applied on a case by case basis to those goods.

The Contractor must certify that the Goods tendered comply with the origin requirement specifying the country or countries of origin. To this end, the Contractor shall provide "Certificate of Origin", which must be made out by the competent authorities of the supplies' or supplier's country of origin and comply with the international agreements to which that country is a signatory.

All the materials for which a Supervisor determines that they do not comply with the agreed Breakdown of the Lump-sum price and the required quality, the Contractor shall immediately remove from the construction site, and the Employer may order suspension of the works if the Contractor tries to use it.

## **1.5 Health and Safety**

The Contractor is obliged to prepare a study on occupational health and safety on the construction site, according to the "Occupational Health and Safety Regulations in the Construction Industry". The Contractor shall take all necessary and prescribed occupational health and safety measures during the execution of works (supports, protective fences on slab and staircases, covering the openings on slabs, disposal of wood and other material to the area designated for storage, construction of protective canopies at the height of the first floor slab, scaffolds). All these works are calculated within the item for which the price is calculated, and are not calculated separately.

## **1.6 Site documentation**

The Contractor shall keep a measurement book and a construction log book according to existing legislation, and enter the necessary information on a daily basis, and these books shall be reviewed and each page certified and signed by the Supervisor.

## **1.7 Environmental considerations**

### **1.7.1 General**

The environmental conditions and protection measures shall be analysed in Environmental Plan prepared by the Contractor and measures will be observed during the execution of the works.

### **1.7.2 Demolition material**

Reuse of demolition materials as backfill for trenches and excavations or/and hard fill for construction foundations and roadways is possible, unless contaminated or hazardous materials such as asbestos are identified. The Contractor will be responsible for environmental sound disposal of any material resulting from the demolition and other site materials under permission from the relevant local Authorities and shall be disposed of in a licensed deposit areas.

### **1.7.3 Excavated soil**

Reuse of excavated natural soil, which is free of cohesive components, salt, sulphate and/or clay materials as backfill for trenches and excavations. The Contractor will be responsible for environmental sound disposal of surplus materials under permission from the relevant local Authorities.

### **1.7.4 Ground water**

It is estimated that the ground water table is below top of the ground level. Temporary and/or permanent groundwater lowering may be required for deep foundations and trenches during construction to proceed. The Contractor will be responsible for ensuring of these measures, as well as day- and surface water discharge.

### **1.7.5 Air pollution**

Construction may give rise to dust and vehicle exhausts. Due note is to be taken of the proximity of residential housing to the works. The normal health and safety controls will be required to safeguard construction and the residential and passing population.

### **1.7.6 Noise pollution**

Construction may cause annoyance caused by noise. The normal health and safety controls will be required to safeguard construction and the residential and passing population.

### **1.7.7 Maximum Noise Levels**

The Contractor shall comply with the local and National requirements and the issued permission for construction. The Contractor shall be legally responsible and financially liable to observe environmental legislation.

The noise levels shall be in accordance with the relevant noise environmental legislative.

The noise level at a distance of 1.0 m from each sound-producing item of mechanical or electrical plant or equipment shall not exceed 72 dB(A). The Contractor shall estimate and substantiate by calculation to be submitted at design submission stage the equivalent noise levels.

Noise and disturbance shall be kept to the reasonable minimum as far as required for this project. The Contractor's attention is drawn to the close proximity of some working sites to buildings in continuous use. All plant and tools used at such sites above or near ground level shall be silenced or of a silent type.

The Contractor shall take all necessary steps to ensure that his workmen carry out their duties in a quiet manner particularly when working at night.

Where compressors or generators are to be used for less than one-month suitable baffles or other provisions to reduce noise emission shall be provided with suitable acoustic baffles to reduce the emission of noise. Acoustic screening shall be provided for outside plant equipment to the satisfaction of the Supervisor.

The Contractor shall perform take noise intensity readings as required by the Supervisor and shall submit the results to the Supervisor. The Contractor shall comply with any additional measures required by the Supervisor to keep noise and disturbance, e.g. odours to the minimum.

### **1.7.8 Pollution Prevention**

The Contractor shall not pollute or unnecessarily disturb lands, roads and other places on and around the Site. No trees or other vegetation shall be removed except to the extent necessary for the Works.

The Contractor shall take all reasonable precautions to prevent:

- Silting, erosion of beds and banks and pollution of rivers and watercourses;
- Interference with the supply to or abstraction from underground water sources;

The Contractor shall provide, maintain and remove on completion of the works, settling lagoons and other facilities to avoid pollution caused by the Contractor's operations such as but not limited to quarrying, aggregate washing, concrete mixing and grouting.

## **1.8 Quality Assurance System**

### **1.8.1 Quality Assurance Plan**

The QAP shall, as a minimum, cover the following issues:

- Staff and management organization (organisation chart, staff qualifications & experience etc)
- Management plan (procedures, information system etc)
- Quality control plans (procurement, design, construction etc)
- Document Control (information system, storage, dissemination, archive, Progress Photographs etc)
- HSE Plan, Traffic Management and Control Plan

The person responsible for the Contractor's QAP shall be authorized and qualified to take decisions on quality assurance issues, and his reference and communication lines to the Company's overall quality assurance organization and its responsible management shall be clearly shown. His duties shall as a minimum be as follows:

- Management of documents.
- Management of procurement.
- Management of Sub-Contractors and suppliers, and requirements to their QAP's.
- Control of materials and workmanship, defects and material reconciliation, procedures for corrective actions, etc.
- Handling of the deviations, additions or variations to the Contract Documents.

Persons performing quality control and testing shall be independent of those executing or supervising the Works.

The Contractor's system of management of documents for the execution of the Works shall include his Sub-Contractors and suppliers, and shall be designed to ensure the following:

- Only valid and approved documents are used for the execution of the Works;
- A complete record of changes and amendments to documents is maintained

The Contractor's shall present with his Tender a preliminary Control Plan describing important and critical control activities which shall be based on the Tender Document and the Contractor's own consideration in respect of execution.



The tenderer must submit in the tender the list, CV's and copies of diploma/degrees and employers certificates of all the staff listed above.

### **1.8.2 Design Control**

The Contractor is obliged only to prepare corresponding Design for Execution of the works if it differs from the Design for Building Permit. Design for Building Permit is already prepared and Building Permit issued. See Article 1.9 below.

The Contractor's designer shall institute a quality assurance system to ensure that his design is completed with due care and attention as per the technical requirements.

The designer must maintain a documented Quality Control Plan (QCP) which is compatible with the Contractor's QCP plan. Sub-providers shall either agree to comply with the providers QCP or have their own documented QCP in place.

The QCP for design shall cover the following activities:

- Selection and assignments of appropriate qualified professionals to perform the project tasks
- Appointment of qualified specialists to oversee and review all elements of the work and carry out a consistent, deliberate program of quality control
- Creation of a design team with a management structure conducive towards quality and continually improving the quality process
- Procedures to ensure that all personnel involved in performing the work have a clear understanding of the scope, intent of the overall project as well as their own responsibilities
- Procedures to prepare appropriately design criteria and environmental assessment
- Procedures for preparation and dissemination of the project schedule to ensure that all personnel involved in performing the work are aware, and understand the importance of meeting intermediate deadlines as well as final completion dates
- Procedures for peer reviews to be conducted by qualified personnel outside of the design team
- Procedures for maintaining documents recording the quality control process properly, to the degree appropriate to each project

The Contractor must present for the approval of the Supervisor his quality assurance plan and quality control plans.

### **1.8.3 Construction Control**

The responsibility rests with the Contractor to produce work which conforms in quality and accuracy of detail, to the Contract Requirements.

The Contractor must, at his own expense, institute a quality control system and provide experienced Engineers, foreman, surveyors, material technicians, other technicians and other technical staff, together with all transport, instruments and equipment to ensure adequate supervision and positive control of the Works at all times. All quality controls shall be recorded by documents which format and content shall be approved by the Supervisor.

A comprehensive Quality Assurance System (QAS), covering all aspects of the Contract and the Works must be implemented, documented and maintained by the Contractor during the period of the Contract.

The QAS shall as a minimum consist of:

- Quality Assurance Plan(QAP)  
Control Plan(CP)

The QAS system shall be presented to the Supervisor for approval within one month from the commencement of the works.

#### **1.8.4 Quality Control Plan for Construction (QCP)**

Within one month of the commencement of the works, the Contractor shall present for the Supervisor approval his detailed CP for all quality assurance efforts or measures for the works or sections thereof. However, such CP shall be presented to the Supervisor not later than one week before any actual construction activity.

The QCP shall include controls as specified in the Contract as well as any other normal and special controls that the Contractor finds necessary in order to ensure the quality of his work.

The QCP shall for each control activity describe type, method, range, time/frequency, criteria for approval and documentation and who is responsible for performing the activity.

If the Employer does not approve the QCP as submitted, then the QCP shall be amended for further approval. Subsequent changes in the range and contents of the quality assurance work will not be allowed as a reason to extend agreed deadlines or to increase contract sums.

#### **1.8.5 Documents Control**

During the Contract period, the Contractor shall, to the satisfaction of the Supervisor, document that the Works comply with the quality assurance requirements stipulated in the Contract or approved during the Contract period.

Consequently, based on the approved QAS and the QCPs, the Contractor shall during the execution of the works carry out and document the quality control and its compliance with the stipulated requirements.

The Contractor's quality control does not limit his responsibility for completing the Works according to the Contract.

At any time during the period of the Contract, if the Supervisor can substantiate that the Contractor's control and/or documentation is not functioning as planned or is not being adhered to, the Contractor must propose improvements to remedy the situation at his own cost and within the agreed time for completion.

All control activities specified in the Control Plan shall be documented.

The QCPs and all other issues related to the QAS shall be kept and maintained by the Contractor in the Quality Manual.

On the basis of the QAP and QCPs the Contractor shall produce the necessary form for registration, log books, and check lists, etc. before the Works are commenced.

All documentation shall be provided with identification, the date and signature of the person responsible for the documentation. The identification shall as a minimum comprise: name of project; activity number as defined in the CP; time and place of control activity.

All original documentation shall be inserted in Control File in the Quality Manual, which shall be kept and maintained by the Contractor at the project site throughout the period of the project. In addition to the control documentation the Control File shall also include all other relevant quality documentation. The Supervisor shall have full access to the Control File at all the times.

## **1.9 Design for Execution of the works**

The Design for Building Permit is prepared by the Employer and presented in Volume 5. Based on this Design, the Contractor shall submit prior to any commencement of work to the Supervisor for his approval Design for Execution of the works.

The Supervisor approval of the Drawings, Contract Records etc. and of the Workshop test records etc, shall not relieve the Contractor of the obligation to meet the terms of the Specification and any of the plant which upon delivery to site is found to be incorrect or unsatisfactory, or which fails to perform its duty satisfactorily during commissioning or during the Defects Notice Period shall be replaced to the Supervisor's satisfaction.

The Design for Execution of the works, which have to be produced by the Contractor shall be made and submitted in accordance with the following requirements.

- All dimensions shall be in metric units and each drawing shall be properly identified by a drawing head and a numbering code in the form prescribed by the Supervisor upon commencement of the Works. ISO or DIN standard size sheets shall be used. Drawings shall not be larger than DIN A1;
- The Drawings of all parts of the construction shall be clear and complete. The scales indicated on the Contract Drawings can generally be used. A further choice of recommended metric scales are 1:100, 1:50, 1:20, 1:10, 1:5 and 1:1 depending on the kind of drawing and or details to be presented;
- The Contractor shall submit a softcopy and six hardcopies of all Drawings and calculations to the Supervisor when seeking his approval and the Engineer will return one copy of the Drawings and calculations to the Contractor with his comments;
- Any changes or modifications to the Working Drawings that the Supervisor considers necessary shall be made by the Contractor promptly and the drawings resubmitted for approval in three copies until final approval is obtained;
- 6 copies of each set of the approved Drawings including a softcopy and calculations shall be submitted to the Supervisor;

Approval of Design for Execution of the works will be given by the Supervisor in the form of a stamp "RELEASED FOR CONSTRUCTION" together with the date and the authorized signature of the Supervisor. Only those Drawings carrying the signature of the Supervisor and dated stamp shall be used for execution. Drawings carrying other signature than those of the Supervisor shall not be used for execution. Commencement of work on any part of the Works construction will only be permitted after the approval of the Design for Execution of the works by the Supervisor.

All cost related to the above mentioned Design for Execution of the works submitted to the Supervisor shall be covered by the lump sum amounts.

All modifications requested by the Supervisor in accordance with the Technical Specification shall be carried out without any additional charge. If the Contractor disagrees with the alterations requested by the Supervisor, the Contractor shall send written notice to the Supervisor within seven days of receiving the altered drawing(s). In such a case the Contractor shall resubmit the particular drawing(s) and calculations if needed, in five copies to the Supervisor subsequent to the Contractor's consideration of the Supervisor's comments.

Should it be found at any time after approval has been given by the Supervisor to a Design for Execution of the works submitted by the Contractor that the said Design for Execution of the works does not

comply with the terms and conditions of the Contract or that the details do not agree with the Design for Execution of the works previously approved, such alterations and additions as may be deemed necessary by the Supervisor shall be made therein by the Contractor and the work carried out accordingly without entitling the Contractor to extra payment on account thereof, except where such alternations and additions are to be made in direct consequence of written order by the Supervisor to vary the Works.

No examination by the Supervisor of any document submitted by the Contractor or of the Design for Execution of the works, nor the approval expressed by the Supervisor in regard thereto, either with or without modification, shall absolve the Contractor from any liability imposed upon him by any provision of the Contract. Notwithstanding the Supervisor's approval of the Design for Execution of the works the Contractor shall be responsible for any dimensional or other errors.

### **1.10 As-Built Drawings**

Concurrently with the progress of work on Site the Contractor shall prepare all necessary drawings and diagrams of the "As-Fitted" / "As-Built" Works. Such approved Working Drawings as have been selected by the Supervisor shall be correctly modified for inclusion in the As-Built Drawings incorporating such variations to the Works as have been ordered and executed. During the course of the Works, the Contractor shall maintain a fully detailed record of all changes from the approval to facilitate easy and accurate preparation of the As-Built Drawing.

The As-Built documentation shall be prepared according to what has actually been built and it shall include all electrical, mechanical and building requirements and in sufficient detail to fully define the location, size, line, level purpose and nature of all elements.

The As-Built drawings shall incorporate full topographical surveys of all alignments, including roads, pavements, existing services, project pipes and service connections, inspection chambers, street names, property limits, etc.

The Supervisor shall approve the title block and numbering system to be used.

The Contractor shall submit 1 (one) reproducible copy and 3 (three) prints of all As-Built Drawings clearly named as such to the Supervisor for approval before applying for the Taking-Over Certificate for the respective Section of the Works. After approval of the As Built Drawing the Contractor shall supply an electronic copy of the drawing that shall become the property of the Employer.

Drawings shall be prepared on computer-assisted design and drafting software of a form and version compatible with the systems which will be operated by the Final Beneficiary (ACAD or similar compatible format). Each copy shall be durably bound in a volume or volumes depending on bulk. All material except Drawings shall be A4 size. Drawings shall be on international A size sheets and shall be bound into volumes. Volume titles shall be clearly inscribed on the front cover and on the spine of the cover. Drawings shall be marked "AS-BUILT". All design, structural, electrical and mechanical Drawings shall be filed on CD as AutoCAD Drawings in DWG format and shall be handed over to the Employer 2-fold. The operating manual shall be filed on CD as Word or Excel files.

As-Built Drawings shall be submitted before the issue of Taking-Over Certificate. Irrespective of the other contractual prerequisites no Section of the Works will be considered substantially completed until the respective As-Built Drawings have been approved by the Supervisor.

### **1.11 Sampling and Testing**

Sampling and testing of materials includes the provision of samples of materials and workmanship as well as the testing and quality control for pipes, manholes, fittings, soils, concrete, asphalt, and other building materials as well of mechanical and electrical installations.

The Contractor shall provide for the approval of the Supervisor, samples of all construction materials and manufactured items required for the Permanent Works. All samples rejected by the Supervisor shall be removed from Site. All approved samples shall be stored by the Contractor in a sample room, at a location approved by the Engineer, for the duration of the Contract, and any materials or manufactured items subsequently delivered to Site for incorporation in the Permanent Works shall be of a quality at least equal to the approved sample. The approved samples may only be disposed of with the Supervisor approval.

Samples shall be submitted and tests carried out sufficiently early to enable further samples to be submitted and tested if required by the Supervisor. Samples for testing will generally be selected by the Supervisor from materials to be utilized in the project and all tests will be under the supervision of the Supervisor.

Material and installations requiring testing shall be furnished in sufficient time before intended use so as to allow for testing. No materials represented by tests may be used prior to receipt of written approval of said materials.

The Contractor shall give the Supervisor at least 14 days' notice in writing of the date on which any of the materials and/or installations will be ready for testing or inspection at a certified laboratory.

If required by the Supervisor, the Contractor will organize, on his expense, additional testing by the independent laboratory.

Also, if required by the Supervisor, additional soil investigations have to be organized by the Contractor too.

The Contractor shall in any case submit to the Supervisor within 7 (seven) days after every test such number of certified copies of the test readings as the Supervisor may require.

Approval by the Supervisor as to the placing of orders for materials or as to samples or tests shall not prejudice any of the Supervisor powers under the Contract.

After all construction is completed and before applying for taking-over, the Contractor shall perform field tests as called for in the Specifications. The Contractor shall demonstrate to the Supervisor the proper operation of the facilities and the satisfactory performance of the individual components. Any improper operation of the system or any improper or faulty construction shall be repaired or corrected to the satisfaction of the Supervisor. The Contractor shall make such changes, adjustments or replacement of equipment as may be required to make the same comply with the Specifications, or replace any defective parts or materials.

In addition to any special provision made herein as to sampling and testing materials by particular methods, samples of materials and workmanship proposed to be employed in the execution of the Works may be called for at any time by the Supervisor and these shall be furnished without delay by the Contractor at his own cost. Approved samples will be retained. The Supervisor will be at liberty to reject all materials and workmanship that are not equal or better in quality and character than such approved samples. The tests required for quality control shall include but not be limited to:

- a) tests conducted at the premises of the Contractor, Subcontractor, manufacturer or supplier which are normally or customarily carried out at such premises for the items or materials being supplied for the Works;
- b) tests which are normally or customarily conducted on the items or materials being supplied for the Works by the Contractor, Subcontractor, supplier or manufacturer but which have to be conducted at an approved laboratory because the necessary testing facilities are not available on the premises of the Contractor, Sub-Contractor, supplier and manufacturer;
- c) tests on locally obtained materials or items either on the Site or at an approved laboratory for the purpose of obtaining the approval of the Supervisor to the classification, use and compliance with the Specifications of such items or materials;
- d) routine quality control tests conducted by the Contractor to ensure compliance with the Specifications;
- e) regular testing of concrete and other materials as specified in the relevant Chapters of the Technical Specifications;
- f) standard shop and Site acceptance tests, including trial assemblies, of mechanical and electrical installations.

## **2 CIVIL ENGINEERING WORKS**

### **2.1 PRELIMINARY WORKS**

#### **2.1.1 Site preparatory works**

Prior to commence earth works, or any other works, the Contractor shall be under obligation to undertake all necessary preparations to provide the placement, maintenance and removal of required installations and devices, electric power distribution (for operation of machines and lighting) and other installations. The Contractor shall provide the safety of structures and property, prevent any trespassing, taking care that all works are performed in full compliance with the design documentation, safety regulations set up by the Beneficiary for the operation of the prison and time schedule of the Contracting Authority.

The work must be executed during normal working hours on normal working days. Deviation from these rules will be allowed only under extraordinary circumstances like a previously written request or special permission of the Supervisor and Contracting Authority.

The Contractor must set up his own temporary buildings, sheds and barracks to operate as changing rooms and lunch rooms for the working members and as storing for materials and equipment. The size, lay-out and place for them will be approved by the Supervisor. The installation, maintenance and dismantling of the changing rooms, canteens, offices and tool sheds and materials, etc, shall be done on the account of the Contractor and before the work is accepted provisionally.

The Contractor shall be fully-responsible for the stored materials and equipment. He must lock his-sheds and secure the stored items and make arrangements for protecting them against extreme heat, cold and moisture. Only approved materials may be stored and rejected materials must be removed immediately from the site.

All ancillary works (excavation, backfilling, etc.), shall be considered as preliminary works that must be performed by the Contractor fully in compliance with the instruction of the Supervisor. Such work shall involve engagement of the work force and equipment, for excavation, transport and disposal of excavated material, fully observing provisions prescribed for transportation of surplus materials as defined in this document.

### **2.1.2 Visibility**

The Contractor shall provide erect and maintain for the duration of the contract a water resistant signboard at the entrance to the Sites or other location approved by the Supervisor. The design of the signboard and information given is to be approved by the Supervisor prior to manufacture and erection. Further requirements regarding the signboard can be found in the “Communication and Visibility Manual for EU External Actions” on the following address: [http://ec.europa.eu/europeaid/work/visibility/index\\_en.htm](http://ec.europa.eu/europeaid/work/visibility/index_en.htm)

The signboard and in particular its construction design and location should be approved also by the Employer.

After completion of all the works, the signboard shall be replaced by commemorative plaque. The commemorative plaque shall be installed as stationary on the approved location by the Beneficiary. The Contractor will be responsible for the maintenance of the commemorative plaque during the Defects Notification period. No other advertisements may be placed on the site unless the prior approval of the Employer is given.

### **2.1.3 Facilities and equipment for the Supervisor**

Office accommodation, equipment and facilities for the Supervisor will be provided by the Contractor, prior to the Commencement of works.

During construction stages, the Supervisor will be based at the construction site. The Works Contractor will provide and maintain the following site office facilities for the Supervisor for the duration of the construction works:

The Contractor shall provide prefab (container type) offices at site for Supervisor’s team.

The office for Supervisor shall have the minimum surface of 30 m<sup>2</sup>, consisting two rooms, one toilet and small kitchen, equipped with fire extinguisher, first aid kit, and window type AC unit (cooling & heating) in each room. The Contractor shall within 2 weeks of being ordered to do so hand over to the Supervisor fully equipped all the office accommodation as specified.

The cost of office and accommodation shall be borne by the Contractor and shall be included in the lump sum price.

All the offices, furniture and equipment, provided to the Supervision and Beneficiary for perusal during the implementation of the works remain property of the Works Contractor. The assets will be returned back to the Contractor in one month time after the date of issue of the Provisional Acceptance for the works.

The Contractor will provide communication facilities of a telephone set, e-mail and fax for the use of the Supervisor and his staff at the Supervisor’s Site office. The Contractor will install telephone line to the Supervisor’s offices to supply the telephone, fax machine, Internet and e-mail. The cost of connection, rental and telephone bills for the communication facilities will be borne by the Contractor.

The Contractor will provide safety equipment (helmet, reflective jacket and boots).

Any charges for the above mentioned facilities to the Supervisor shall be provide by the Contractor and the costs thereof shall be included in the rate set forth in the Breakdown of Prices.

### **2.1.4 Personal protective equipment (PPE)**

The wearing of protective equipment and/or clothing will be in conformance with applicable regulations. Only equipment complying with regulations or other applicable regulations/standards will be used. Equipment that has been altered in any way will not be worn on the work. Welders are required to wear head protection (hard hats) during welding operations. Soft cap welding or cutting may be authorized only at the direction of the Supervisor.

All personnel are required to have the company logo and name displayed prominently on their hard hat. The name will be applied above the brim of the hat using block letters. Hard hats are required to be worn at all times with the following exceptions:

- Administration building (offices work)
- Lunch and break periods providing no work is in progress in immediate break area
- Other buildings

Hard hats will not be altered in any way and must be worn with brim to the front, but not during welding. Hard hats will be homologated to conform to the European OSHA Standards.

All personnel on the project will wear approved protective eyewear during working hours. Eyewear must have vendor/manufacturer trademark on lenses and homologated stamp on frames.

Tinted lenses are prohibited inside buildings or other structures with limited illumination. This includes prescription glasses.

Safety glasses will have side shields.

In cases where employees perform work in tight or enclosed spaces on the project, goggles, face shield, and other protective equipment are required to be worn to prevent any eye injury.

All grinding operations will be performed with a full-face shield and safety glasses or goggles.

People who wear prescription or corrective eyeglasses will wear goggles (or covered safety glasses) over the eyewear or have prescription glasses with frames, lenses, and side shields that meet the OSHA standards.

Welders will wear dual eye protection while welding.

Safety glasses are required to be worn at all times with the following exceptions:

- In administration buildings (office work)
- During lunch and break periods (providing no work is in progress in immediate break area)
- In project offices
- When goggles are worn

Respiratory equipment will be selected on the basis of the hazards to which the worker will be exposed. Respiratory equipment will be used, stored and maintained in accordance with the manufacturer's requirements. Only approved respiratory protection equipment will be worn. Approved hearing protection will be worn by all personnel in designated areas.

The Contractor's HSE Manager is responsible for establishing areas under control of the construction group where hearing protection may be required to be worn. This includes the use of required protective equipment when operating equipment produces sound level above the 90 dB (A) level.

## **Dress requirements**

All personnel are required to wear appropriate clothing for the work being performed. Shirts worn by personnel must have sleeves at least 10 cm in length. Knit shirts, sleeveless shirts, sleeves rolled up onto the ball of the shoulder and other such apparel or practices are prohibited. People working near moving machinery must prevent clothing and body parts from being caught by the moving components. Clothing soaked with grease, paint, thinners, solvents, or similar materials will not be worn. Sturdy leatherwork safety shoes or boots are required.



### **2.1.6 Construction and striking of scaffolding for facade works**

Carry out all works in accordance with health and safety regulations. Scaffold must be lined with perforated PVC sheets, earthed, stable and tied into the building. Provide decked platforms every 2.5 m of height. Scaffolding has to be approved by the relevant committee. Maintain the outdoor scaffolding throughout the duration of all related works (removal of old mortar, facade plastering, painting, tin-smith works, roofing replacement), then strike down and remove from the construction site (upon Supervisor's approval).

## **2.2 TECNICAL DESCRIPTION**

Marketplace is located on the plot on cadastral parcels no 2278/1 and 590/2 in Sjenica.

The building is ground floor with a dull shape of the base. The maximum width and length of the base are 45.20h43.32m. The building has three completely separate roof structures.

The building is oriented towards the street of Ahmet Abdagic, where the main pedestrian access is located. Cargo entrance is provided on the opposite side of the parcel, while the cargo exit is on the Ahmet Abdagic Street.

### **2.2.1 FUNCTION**

The existing marketplace is reconstructed in such a way that, within the existing area in the function of the market, the area of the green and dairy market is projected, along the periphery of the plot there is a traffic road and parking space for parking of delivery vehicles and uninterrupted movement of the interventional vehicles is provided.

The new site of the dairy market is designed as a freestanding, with a plateau of green market, which is partly covered and has the possibility of opening in the summer period, and full closing in winter.

The dairy market facility contains a part for the sale of meat, dairy products and eggs. In addition to the sales area, the accompanying premises are provided (sanitary knots for tenants, sanitary knot for visitors, lockers for renters, cleaning room and maintenance of the building, entrance hall control room, sanitary inspectors room, packaging room and scales, rooms with cooling chambers, office drinking water department with associated sanitary facilities, independent restaurants with sanitary facilities that can be rented and a coffee shop next to the plateau of green market).

Within the sales part, the room is equipped with cooling cabinets (operating mode of -20 ° C to + 4 ° C) with cabinets for disposing of dishes and personal belongings of the sellers and part for the table scale. In the area of refrigerated showcases, a part-area washbasin with a photoelectric photo detector, a liquid soap dispenser and a hand drying phenomena is foreseen in the area used by the sellers. A trough with a wash basin with hot and cold water, as well as a waste bin with a lid and a pedal is planned.

### **2.2.2 STRUCTURE**

The constructive system is designed as a combination of reinforced concrete, steel and LLD. Part of the facility envisaged for the dairy market area is designed with pillars and roof beams in the LLD as well as the covered part of the green market, while the rest of the facility is projected in reinforced concrete with reinforced concrete pillars, beams and steel cornices to which the roof cover (pile sheet). The foundations of the building are reinforced concrete (based on male, ab beam and base strips).

### **2.2.3 MATERIALIZATION AND TREATMENT**

Exterior walls are built with a 20 cm thick, block with thermal insulation and plaster with a facade mortar on the rack in the final facade in the color of the designer's choice. All outer holes are made of aluminum profiles, glazed with thermal insulation glass. The roof cover is provided with shingles and pillowcases.

As floor treatment, granite anti-slip ceramics are used in all rooms except in offices where laminate is provided, while in the enclosed windows it is covered with ceramic tiles. The walls are plastered with cement mortar, coated and painted in color according to the designer's choice. In the windows, the walls are coated with ceramic tiles, as well as in a packer, a room for scales, substations and dressing rooms. The inner walls were built with a 20 mm and 12 cm block. Ceilings are made of gypsum-board board on metal substructure, smooth and painted according to the designer's choice.

## 2.2.4 INSTALLATION

Facility is fully equipped with the necessary electrical installations, water supply and sewerage installations and heating installations in accordance with its purpose.

### TABELARY OVERVIEWS OF AREAS

No.	TITLE OF THE AREA	Space m <sup>2</sup>	Extent m	Finishing		
				Floor	Wall	Ceiling
1.	PASSAGE	42.70	30	Behaton	Glass	Facade paint
2.	DAIRY MARKET – HALL 1	165.60	58.40	Granite ceramic	Dispersive paint	Dispersive paint
3.	DAIRY MARKET – HALL 2	165.60	58.40	Granite ceramic	Dispersive paint	Dispersive paint
4.	COVERED GREEN MARKET	357.00	7.80	Behaton	Facade paint	Tile sheet metal
5.	CORRIDOR	16.80	22.20	Granite ceramic	Dispersive paint	Dispersive paint
6.	WINDSHIELD	6.20	10.00	Granite ceramic	Dispersive paint	Dispersive paint
7.	PORTIR DESK	4.60	86.70	Granite ceramic	Dispersive paint	Dispersive paint
8.	SCALE	13.40	15.20	Granite ceramic	Ceramic	Dispersive paint
9.	PACKING	11.80	14.50	Granite ceramic	Ceramic	Dispersive paint
10.	PREMISES	40.10	28.35	Granite ceramic	Dispersive paint	Dispersive paint
11.	TOILET	1.60	5.60	Ceramic	Ceramic	Dispersive paint
12.	PREMISES	40.10	28.35	Granite ceramic	Dispersive paint	Dispersive paint
13.	TOILET	1.60	5.60	Ceramic	Ceramic	Dispersive paint
14.	PREMISES	40.10	28.35	Granite ceramic	Dispersive paint	Dispersive paint
15.	TOILET	1.60	5.60	Ceramic	Ceramic	Dispersive paint
16.	PREMISES	40.10	28.35	Granite ceramic	Dispersive paint	Dispersive paint
17.	TOILET	1.60	5.60	Ceramic	Ceramic	Dispersive paint
18.	CHAMBER-REFRIGERATING EQUIPMENT	25.70	20.30	Granite ceramic	Ceramic	Dispersive paint
19.	INSPECTOR'S OFFICE	17.50	16.90	Granite ceramic	Dispersive paint	Dispersive paint
20.	CORRIDOR	5.00	9.60	Granite ceramic	Dispersive paint	Dispersive paint
21.	CORRIDOR WITH KITCHENETTE	9.30	13.90	Granite ceramic	Dispersive paint	Dispersive paint
22.	TOILET	7.00	15.90	Ceramic	Ceramic	Dispersive paint
23.	OFFICE	7.50	11.10	Laminate	Dispersive paint	Dispersive paint
24.	OFFICE	7.50	11.10	Laminate	Dispersive paint	Dispersive paint
25.	OFFICE	13.90	15.40	Laminate	Dispersive paint	Dispersive paint
26.	TOILET FOR DISABLED PERSONS	5.50	10.00	Ceramic	Ceramic	Dispersive paint
27.	FEMALE TOILED	9.40	20.40	Ceramic	Ceramic	Dispersive paint
28.	MALE TOILET	9.40	20.40	Ceramic	Ceramic	Dispersive paint
29.	PREMISES	30.30	23.40	Granite ceramic	Dispersive paint	Dispersive paint
30.	TOILET	2.50	6.40	Ceramic	Ceramic	Dispersive paint
31.	TOILET	1.50	5.00	Ceramic	Ceramic	Dispersive paint
32.	TOILET	1.50	5.00	Ceramic	Ceramic	Dispersive paint
33.	STORAGE	2.40	6.40	Ceramic	Ceramic	Dispersive paint
34.	COFFEE BAR	50.20	38.50	Granite ceramic	Dispersive paint	Dispersive paint
35.	PREMISES	28.80	23.60	Granite ceramic	Dispersive paint	Dispersive paint
36.	TOILET	2.50	6.40	Ceramic	Ceramic	Dispersive paint
37.	PREMISES	20.70	19.50	Granite ceramic	Dispersive paint	Dispersive paint
38.	TOILET	2.50	6.40	Ceramic	Ceramic	Dispersive paint
39.	TOILET	2.50	6.40	Ceramic	Ceramic	Dispersive paint
40.	PREMISES	30.20	24.00	Granite ceramic	Dispersive paint	Dispersive paint
41.	STORAGE FOR EQUIPMENT AND MAINTENANCE	9.00	15.30	Granite ceramic	Ceramic	Dispersive paint

42.	SUBSTATION	27.90	15.30	Granite ceramic	Ceramic	Dispersive paint
43.	MALE DRESSING ROOM	13.10	15.00	Granite ceramic	Ceramic	Dispersive paint
44.	FEMALE DRESSING ROOM	13.10	15.00	Granite ceramic	Ceramic	Dispersive paint
45.	CLEANING FACILITIES	6.70	10.90	Granite ceramic	Ceramic	Dispersive paint
46.	TOILET	4.00	10.20	Ceramic	Ceramic	Dispersive paint
47.	TOILET	4.00	10.20	Ceramic	Ceramic	Dispersive paint
<b>TOTAL NET</b>		<b>1,324.00</b>				
<b>TOTAL GROSS</b>		<b>1,398.80</b>				

## **2.2.5 STRUCTURAL DESIGN**

### **2.2.5.1 FOUNDATION STRUCTURE**

The foundation structure of the facility is designed as a foundation slab, dimensions  $d=40$  cm, which lies on elastic bedding. This thickness of the foundation slab provides protection against penetration of all pillars through the slab, i.e. its dimensions have been adopted according to the criteria of maintaining shearing stresses below the limit, along the sides of the skew truncated cone below the pillars. By performing a detailed analysis in the main design, the actual shearing stress has been tested and measures for the reinforcement of the foundation slab under the pillars have been taken.

The level of groundwater is at a depth of about 1.6 m from the ground level (basement), and 1.2 m from the level of the foundation slab bottom and it can be considered that it does not have much influence on the foundation structure.

### **2.2.5.2 STRUCTURAL SYSTEMS: COMBINED SYSTEM STRUCTURE ABOVE GROUND**

The load bearing structure of the facility is designed with structural systems based on monolithic reinforced concrete structures. Combined construction consists of RC pillars, RC beams, RC slabs and RC canvases, which are used for stiffening the facility, whereby RC pillars are dominant. A unique cross-section of pillars has been adopted: 30/30 cm, while for the beams the cross-section of 30/40 has been adopted. Pillars are executed through all levels as monolithic elements with constant dimensions along the height of the facility. Reinforced concrete canvases are designed to reduce the structure oscillation period and to increase the stiffness of the structure in both directions, as well as to transfer the vertical load to the foundation. The elevator core is adopted with walls on 3 sides, thickness 25 cm, walls in the basement are also 25 cm thick. The structure is calculated as non-movable based on the movability test in relation to both orthogonal axes of the horizontal plane. For adopted dimensions of the pillars and walls, buckling test has been performed for the load case  $g+p$  according to the forms of the Regulations on technical standards for construction in seismic areas.

According to the Regulations, only half (50%) of the pillars and walls reinforcement should be spliced by overlapping, while the other half should be continuous or spliced by welding. Execute stirrups in the walls, which overlap along the shorter side, the so called torsion stirrups.

The floor slab is designed as a monolithic RC slab of the same thickness on all floors of residential and garage area,  $d=16$ cm.

The layout of all structural elements is shown in graphical items Vol V of the TD.

Vertical communication through the facility is achieved by executing staircases and elevators through all levels of the facility.

### **2.2.5.3 ROOF STRUCTURE**

The building has three completely separate roof structures:

1. Roof 1 -bore wooden roof made of glued laminated wood in height 10.96m covered with pile sheet and glass. Secondary roof carriers are wooden cornices at a distance of 104 cm, cross sections 12 / 29cm. The main carriers are in axes 4, 5, 7 and 8 at a distance of 5 m. They are based on pillars that are reinforced concrete in the lower part (in the axes V and F), and in the upper part are steel. The roof thickness is provided by steel roof hinges in the level of the roof and vertical planes.
2. Roof 2 - 4-conductive wooden roof made of glued laminated wood in height ridge 8.84m with two roof towers of 12.68m. The main roof racks are in the axes V, G, D, E and Z. Flowers are wooden sections 12 / 29cm at a distance of 74 cm. The main carriers are a static system of arc on two joints. The roof between the axes B and V, as well as between the axes Z and Z, closes sloping slopes over the wooden ridge to the reinforced concrete pillars.

3. roof 3-fold roof height 5.65 m covered with sheet steel with steel secondary supports that rely on the hair of the beam of reinforced concrete frames. Steel corneas are a static system of a continuous beam.

#### **2.2.5.4 INFORMATION ON BASIC STRUCTURAL ELEMENTS**

For all construction elements reinforced concrete MB 30(C 25/30) and reinforcement RA 400/500 and MAR 500/560 are used.

Adopted dimensions and reinforcement provide the necessary safety, usability and durability of the structure.

In a case that stated reinforcement is not available, the Contractor shall use B 500B and B 500A reinforcement for bars and meshes.

Evidence of the quality and use of these types of reinforcement and concrete are documented with accompanying quality certificates.

### **2.3 ALIGNMENT WORKS**

#### **2.3.1 Marking of building alignment**

Prior to commencement of works, Contractor is liable to make necessary alignment setting of the new building.

The Supervisor shall submit the benchmarks that specify the position and the level of the finished building. The Contractor shall maintain these markings and perform re-marking by itself, if necessary.

The survey works should be performed based on the layout from the Main Design. During performing of the works, surveying and measurements have to be done according to regulations of RS and temporary needs. If the design doesn't give details, those should be obtained from the competent Land Survey Authority, but such a fact shall not have impact on price. After completion of works, as-built facility should be surveyed, and data analyzed, and mapping, and Elaborate study which are to be submitted to the authorized cadastre.

#### **2.3.2 Marking of the trench excavation alignment**

Prior to commencement of excavation works, Contractor is liable to make necessary centreline alignment setting of the trench/excavation, including all required elements, direction changes, manholes, connections and other structures.

#### **2.3.3 Site clean up**

The site cleanup shall involve removal of all obstacles from the surfaces that shall be occupied by permanent and/or temporary structures. An area of the site to be cleaned up should be one as minimum required, and approved by the Supervisor. The method of execution of works for clearing the surfaces shall be decided by the Contractor himself who shall be responsible to observe all work safety regulations, prevent any damage of buildings or areas owned by others and avoid any disturbance of the works.

The site clearing up should also include grubbing up of shrubs and trees, demolition of fences and other similar barriers that may hinder the progress of works.

All material that may appear as the result of the works defined above, the Contractor shall remove from site free from any additional charges, and fully observing provisions prescribed for transportation of surplus materials as defined in this document.

### **2.3.4 Final cleaning and washing of construction site**

Cleaning and washing of construction site upon completion of all works, prior to provisional acceptance. A thorough cleaning of the entire plot around the buildings and in the building (basement, ground floor, first floor), including washing of all glass surfaces, cleaning and fine washing of all interior spaces and external surfaces, including collection of debris and removal to a permanent city landfill.

## **2.4 DEMOLITION WORKS**

### **2.4.1.1 Demolition of Existing facilities**

Demolished material that can be further used is owned by the Beneficiary. The waste is transported to the landfill approved by the Supervisor at the costs of the Contractor.

### **2.4.1.2 Cutting of existing asphalt pavement**

Cutting of the existing asphalt pavement and subsoil 20 cm wider on both, or every side, as required for a trench, or any other type of excavation, always provided that the Supervisor and the Contractor will establish jointly in writing that these works either have not been covered under other item, or that these works have not been executed yet. Excavated material will be stockpiled on site until reuse and/or haulage taken to a permanent city landfill.

## **2.5 EARTHWORKS**

### **2.5.1 Top soil removal**

Mechanical and manual excavation of topsoil, removal of grass and vegetation. All such material shall be temporally removed and deposited at site stock, approved by the Supervisor. Due to the quality of the topsoil and its intended purpose, no mixing of such material with other non-humus material shall be allowed during excavation, transport or at the Stockpiling Location. All humus material that appearing to be a surplus one, the Contractor shall remove from site free from any additional charges, and fully observing provisions prescribed for transportation of surplus materials as defined in this document.

### **2.5.2 Excavation**

Before excavation works, the Contractor shall undertake all necessary preparations and preliminary works.

Prior to the commencement of the works, the Contractor shall propose organization of the work that must be approved by the Supervisor. The Contractor is solely responsible for all works and proper technical solution including also the responsibility for safety measures, all the time during the progress of the works regardless of this approval by the Supervisor.

The excavation shall include both digging by mechanical equipment and by hand, shoring, or other safety measures applied to excavation areas, sorting (if possible) and adequate disposal of the excavated material, at least 1 meter aside of the excavation.

Wrong excavation shall not be accepted and excess excavation shall be backfilled with gravel and well compacted, all at Contractor's expense.

All support, strutting, elevated conditions of work (obstructions due to ground waters or surface installations, roots, etc) are included in the unit price.

If the excavation is performed in the area of existing infrastructure (electric, communication, hydro technical, gas pipeline, etc.) and their routes are not for any reasons marked on the site, then it shall be necessary to determine the position of these installations before the commencement of any works. The

location of such installations, if there is no any other way, shall be found by excavation of the pipeline (by cut grips). After determining the exact position of these installations, the Contractor shall make geodetic survey of installations and send the report to the competent organization for future maintenance of these installations. The Contractor must not start the excavation unless the Contractor is sure that the subject installation is "clean" as regards the existing installations. The Contractor shall be liable to compensate any damage incurred to these installations during excavation works.

The excavation must be made fully in accordance with dimensions from the Main Design. Should the Contractor fail to achieve required tolerances of excavation dimensions, they shall be adjusted, as directed and proposed by the Supervisor, within allowable tolerances at the expense of the Contractor. If excavation is within these tolerances, nothing else shall be added to payment or deducted from it, and the payment shall be effected according to the profile as designed. In case of over excavation, which shall be noted, any Supervisors instruction in that respect shall not constitute any ground for variation order and/or any additional payment.

The excavation works shall include securing and bracing of lateral excavation sides, as well as securing of the adjacent structures, which shall be made according to the land nature, that is, position of the adjacent structures, and all labour related to these activities shall be on Contractor's expense.

During execution of works, it is necessary to be careful to avoid undercuts or damage of excavation slopes. In any such case the Contractor shall be responsible to make additional repair, however, the Contractor is not entitled to any damage or payment for larger or unforeseen work. Such work involves cleaning of all inappropriate places in earth material, which require special protecting solutions, such as protection of incoherent areas, pockets, water sources, etc.

Land surveying control and measurements necessary for excavation works must be made accurately and fully in compliance with the design. The costs for performance of all necessary surveying works shall not be separately calculated and paid. The Contractor shall include all these costs in the unit price. If there are any survey beacons on the route for excavation, the Contractor shall return them at his own expense into their original state.

During excavation, the Supervisor shall, if necessary, make decision to change the inclination and slope depending on the properties of material, geologic conditions and other events that Contractor should take into consideration during work.

### **2.5.3 Types of Excavations in respect of Underground Water**

"Dry" excavation shall mean all excavations made above the groundwater table at the time of the excavation. In case of an eventual inflow equal, or less, than 3 l/sec per 50 m<sup>2</sup> of an excavated surface, the Contractor shall drain excavation pit by use of sufficient capacity pumps, without any extra payment.

"Excavation beyond groundwater table" shall mean all excavations made beyond and/or at the groundwater table at the time of the excavation, or excavation in case on inflow higher than 3 l/sec per 50 m<sup>2</sup> of the excavated surface. The Supervisor shall establish occurrence of an "excavation beyond groundwater table", and only then and during the period of time of such circumstances established by the Supervisor, the Supervisor shall accept works made under the item "Water Pumping from Excavation Pit". Notwithstanding the above instruction, based on data related to geo-technical and hydro-technical studies and analysis, the Contractor shall estimate scope of works under this item.

### **2.5.4 Types of Excavated Material**

Following the Civil Engineering Norms (GN.200), applicable in the Republic of Serbia, the excavated material is grouped in seven categories:

"Earth material" is a collective name for all types of excavations made by equipment or by hand, however, without blasting (except for excavations with the pick-hammer). Removal of any stone pieces smaller than 1 m<sup>3</sup>, which may be found in this material, shall not be paid separately. This material falls in the group of 2nd and/or 3rd category.

"Rocks" is a collective name for all types of excavations made by pneumatic equipment:

If excavation is made by equipment or by hand with systematic use of pneumatic tools, but without blasting, this material falls in the group of 4th and/or 5th category.

If excavation is made by equipment or by hand with systematic use of pneumatic tools, but with occasional blasting, this material falls in the group of 6th category.

If excavation is made with systematic blasting, this material falls in the group of 7th category.

### **2.5.5 Use of Excavated Material**

Generally, the Beneficiary is the owner of excavated material. The excavated material (if it meets technical requirements) shall be used for backfilling. Backfilling should be done in 20–30 cm layers of soil which has optimal level of moisture, without large chunks and organic material, and which is compacted to the level that will prevent later settlement.

All surplus material shall be deposited at the Permanent Stockpile Locations; the Contractor shall remove from site free from any additional charges all such material, fully observing provisions prescribed for transportation of surplus materials.

### **2.5.6 Removal of the excess soil**

The excess soil from excavation which is not used for backfilling and after obtaining approval of the Supervisor shall be loaded, transported unloaded, with spreading and planning of the soil according to the configuration of the surrounding terrain, to the landfill proposed by the contractor and approved by the Supervisor.

## **2.6 MECHANICAL BULK EXCAVATION**

This item refers to all excavations wider than 5 m at the ground level in all directions. This item is foreseen for all kind of massive foundations, or includes removal of material from widespread surfaces such as cuts, cut-and-fills; borrow areas, and bigger deviations.

The bulk excavation for the foundation and/or the cut in shall be in strict accordance with the Main Design and technical regulations, and shall be made according to the designed reference levels and gradients with respect to transversal profiles. Prior to excavation commencement, the outstanding markings of transversal profiles shall be checked and agreed upon in writing by the Supervisor and the Contractor.

Excavated material is to be deposit 1 m from the edges of the excavated area or loaded onto vehicles for transportation to areas of Permanent Site Stockpile Locations, subject to balancing of earth quantities and quality of the excavated material.

### **2.6.1 Manual excavation**

Manual excavation of soil, category III, for pavement, terrain planning, footings and floor layers.

The scope of works will include manual excavation, levelling and cleaning of the bottom and sides of excavations, with discarding of material (small particles and earth to one side and larger stones to another side), all required strutting and other means of supporting and protection of excavation, all required material for digging, including securing of traffic, crossings, etc. Average depth of excavation is 35 cm with acceptable tolerance of 3cm.

Excavated soil to be transported to the temporary stockpiling location within site using carts.



## **2.6.2 Mechanical and manual excavation for trenches and strip foundations**

The excavation of trenches means all excavations, which are narrower than 5 m in one direction, measured at the ground level. These are excavations intended for laying the pipes, cables, different channels, strip foundation, etc. It is assumed that excavation works shall be partially made by hand. In the trenches with inclination of excavation sides which is impossible for material to sustain, it shall be necessary to apply a suitable method of planting and strutting i.e. safely supporting of excavation sides.

The scope of works shall include excavation, levelling and cleaning of the bottom and sides of trenches with discarding of material (small particles and earth to one side and larger stones to another side of the trench), all required strutting and other means of supporting and protection of excavation, all required material for digging including insurance of traffic, crossings, etc.

Widening of trenches shall be made at the locations of manholes, hydrants, welding points of the piping, or where defined under the Main Design. For inclination and strutting of the widening, everything defined above shall apply.

## **2.6.3 Trench for utilities**

With respect to its nature, trench for utilities system shall be fully in accordance with the details from the Main Design with expansion for manholes, in respect of alignment, width and bottom levels. The trench shall be rectangular.

## **2.7 EXCAVATION FOR MANHOLES**

This item refers to excavations not wider than 5 m at the ground level in one direction. The excavation for manholes and/or foundation footings shall be in strict accordance with the Main Design and technical regulations. Excavation must be regular, with entirely vertical sides and completely horizontal foundation pit bottom, bearing in mind that excavation is carried out up to the foundation pit depth immediately prior to concreting, so that the bottom doesn't become wet due to rain, or dry due to sun. Over excavation shall not be allowed and the Contractor shall be responsible and liable to engage his own labour and material to bring foundation pit bottom up to designed reference level using plain (C 8/10) concrete.

Construction of footings must not begin until acceptance of foundation pits is registered in measurement log and such details are entered in measurement book, as a basis for excavation calculation. Upon performed foundation excavation, it is entered in measurement log as follows: foundation reference level, eventual groundwater reference level, material type and condition, way of bracing and land bearing capacity. Soil bearing capacity inspection is performed according to the existing regulations. If the bearing capacity is different than the envisaged one, the Contractor is liable to inform immediately the Supervisor on that.

## **2.8 TRENCH & FOUNDATION BEDDINGS**

### **2.8.1 Sand layer under and around pipes**

In cohesive and solid soil (stiff clay, marlstone, mild clay), in the rock or soil containing coarse gravel or stone, it is impossible to lay the pipes directly on natural base since such soil cannot be shaped suitably. In such a case, it shall be necessary to make sand bedding.

After completed excavation, which is accepted by the Supervisor, pipes shall be laid onto 10 cm+ 1/10 D (D-internal pipe diameter) compacted and previously shaped sand bedding. Maximum grain to be filled in the sub grade is 2-3 mm. The sand material shall be free from any organic or other ingredient.

After completed montage of pipes and other trench accessories, the trench shall be backfilled around and above pipes (except at pipe connections) with 10-30 cm sand, applied in 10-20 cm hand compacted layers. If motorized rammers are used, subject to the Supervisor's approval, the manufacturer's instructions must be strictly observed.

Pipe connection spots shall be backfilled with 10-20 cm hand compacted sand layers upon successfully performed pressure testing, subject to the Supervisor's approval.

## **2.9 BACKFILLING**

### **2.9.1 Backfilling with sandy gravel**

After pressure test and sand filling, the trench will be backfilled by hand using natural sandy gravel in maximum 20 cm layers, while full compaction and extraction of shoring will proceed simultaneously. Maximum grain size for backfilling will not exceed 30 mm. Backfilling will start when approved by the Supervisor. Compacting will be done until 95% of Proctor compaction is obtained. Trench sections crossing the streets will be backfilled with sand or gravel up to the formation level in the pavement.

ICS Number	Standard Number	Year	TITLE
93.080.30	SRPS U.E1.015	1991	Designing and construction of roads and urban communications – Refilling up trenches for distribution networks

### **2.9.2 Backfilling of pipelines with soil**

In case that excavated material provides adequate material for backfilling, i.e. the size of material for backfilling is max. 3 cm. than upon sand (loess) bedding is made and pipes are erected and prior to the pressure test, the pipeline shall be covered with excavated material up to the height of 30 cm. above the top point of the pipe.

The joints of pipes shall be left free, so as to enable control during the test under pressure. The Contractor is particularly warned not to start the backfilling of the trench before the pressure test is finished or the places where new designed pipeline intersects with existing one for which there are no data available. Such intersections need to be made in the presence of the Supervisor.

Irrespective, the method applied for initial backfilling, upon the pressure test is ended, bench marks and contra flexure points protected, and sand, or clay, or excavated material, as the case may be, are refilled and compacted in the area of pipeline joints, the backfilling of the trench may be proceeded (material must not contain stones larger than 5 cm).

Material shall be filled in layers 30 cm thick and compacted using motorized or, if this is not possible, hand rammers, paying special attention to the pipeline. Compacting shall be done until 95% of Proctor compaction is obtained.

If backfilling is not done according to the regulations, the Supervisor may request a new excavation and refilling of weak points.

### **2.9.3 Backfilling upon the finished other structure works**

After the completion of foundation concrete works or installation of equipment other than pipes, already excavated and stockpiled material shall be refilled into the trench, or around/within the foundation walls spread out, graded and fully compacted as defined in the design and these technical requirements up to the level 100-150 cm high, as foreseen under the Design.

Material shall be filled in layers of 15 to 20 cm each and compacted by means of motorized or hand rammers, taking care not to damage the pipe or pipe insulation or foundations (walls). Compacting shall be done until 95% of Proctor compaction is obtained.

The backfilling of trenches must not start before the equipment test is carried out, nor before the concrete reaches the required strength (7 days).

If excavated material is not good for refilling, then material from the borrow pit shall be used, as directed by the Supervisor.

## 2.10 LANDSCAPE WORKS

The works needed to reconstruct landscape by using excavated material, spreading, wetting if necessary, levelling, and tamping and control testing. The fill shall have the designed cross sectional dimensions; levels and grades tolerance permitted being up to 5 cm. The fill shall be made in horizontal layers not thicker than 30 cm, and compacted with rollers to the required value. Compactness shall be tested with a round plate, 30 cm dia. and the required modulus of compressibility.

## 2.11 STRUCTURE OF BUILDING - CONCRETE STRUCTURES

### 2.11.1 General

All concrete work shall be carried out fully in accordance with the Main Design, Static Analysis and applicable regulations and standards.

"Rulebook on technical measures and conditions for concrete and reinforced concrete" (PBAB) Serbian standards (SRPS) or international standards.

The Main Design defines concrete quality, separately for each Static Analysis item, including crushing strength after 28 days (C) and class of concrete, as well as number of test samples for each Static Analysis item, provided that the Contractor shall be obliged to observe the above stated fully.

Natural aggregate mixture shall be used for concrete C12/15 at the maximum; all other concrete quality shall be made from separated aggregate, which shall be comprised under the unit price. The concrete shall be mixed mechanically from aggregate, cement and water, subject to the Supervisor approval, following the prevailing regulations:

MATERIAL	ICS Number	Standard Number	Year	TITLE
Cement	91.100.10	SRPS EN 197-1	2010	Cement - Portland cement, Portland composite cement, blast furnace cement, pozzolanic cement, composite cement - Definition, classification and technical conditions
		SRPS B.C1.012	1996	Cement - Delivery, packing and storage density
		SRPS ENV 196-4	1995	Methods of testing cement - Quantitative determination of constituents
		SRPS ENV 197-1	1997	Cement - Composition, specifications and conformity criteria

				- Part 1: Common cements
Natural and crushed aggregate	91.100.15	SRPS B.B2.009	1986	Raw materials for production of aggregates for concrete – Technical requirements
		SRPS B.B2.010	1986	Aggregate for concrete – Technical requirements
		SRPS B.B3.100	1983	Crushed aggregates for concrete and asphalt
		SRPS B.B8.040	1982	Crushed aggregate for concrete and mortar - Examination of aggregate with organic impurities
		SRPS B.B8.042	1984	Natural and crushed aggregate - Chemical analysis of aggregates for concretes and mortars
	91.100.30	SRPS U.M1.057	1984	Concrete - Grading of aggregate for concrete
Water	91.100.30	SRPS U.M1.058	1985	Concrete - Water for making concrete - Technical requirements and testing methods
Admixtures for concrete	91.100.30	SRPS U.M1.034	1996	Concrete - Admixtures for concrete - Definitions and classification
		SRPS U.M1.035	1996	Concrete - Admixtures for concrete - Quality requirements and testing
		SRPS U.M1.037	1981	Concrete - Admixtures for concrete - Previous testing

The aggregate has to be clean, without organic impurities, or earth (acceptable up to 2% by weigh), otherwise the aggregate has to be washed.

The Contractor shall be under obligation to present evidence on quality of material used for concrete manufacturing (cement, aggregate, water).

The concrete quality and executed works have to be in accordance with prevailing regulations:

ICS Number	Standard Number	Year	TITLE
	SRPS ISO 2736-1	1997	Concrete tests - Test specimens - Part 1: Sampling of fresh concrete
	SRPS ISO 2736-2	1997	Concrete tests - Test specimens - Part 2: Making and curing of test

91.100.30			specimens for strength tests
	SRPS ISO 4012	2000	Concrete - Determination of compressive strength of test specimens
	SRPS ISO 4013	2000	Concrete - Determination of flexural strength of test specimens
	SRPS ISO 4109	1997	Fresh concrete - Determination of the consistency - Slump test
	SRPS ISO 4848	1999	Concrete – Determination of air content of freshly mixed concrete – Pressure method
	SRPS U.M1.051	1987	Concrete - Production control in the concrete plants
	SRPS U.M1.021	1997	Concrete - Classification by compressive strength
	SRPS U.M1.055	1984	Concrete - Method of test for resistance of concrete against freezing
	SRPS U.M1.015	1998	Concrete – Concrete, hardened – Determination of the depth of penetration of water under pressure
	SRPS U.M1.016	1992	Concrete - Method of test for resistance of concrete against freezing and thawing
	SRPS U.M1.045	1987	Transport and delivery of ready-mixed concrete
	SRPS U.E3.050	1981	Prefabricated concrete units - Technical requirements for manufacture and installation

The Contractor will be under the obligation to prepare design documentation for concrete fully in accordance with the article 232 of the Rules on concrete and reinforced concrete (PBAB 87) and to deliver for the Supervisor's approval.

The concrete works shall be executed by qualified work force only, respecting technical specifications and prevailing regulations, national and international standards for such type of works.

Concrete consistency is selected in such a way the with available installation equipment high quality compaction can be achieved, which means that installation should be as easy as possible without occurrence of segregation and with satisfactory finishing touches.

Prior to concreting formworks should be checked, as well as the struts regarding the stability and shape, while during the concreting constant control of concrete should be done. Concrete should not start before the Supervisor inspects the reinforcement and gives written approval for concreting.

Particular attention during concreting should be paid to reinforcement; it should not be dislocated, and it should remain in the position as installed, and it should be all covered with concrete.

Joints should be determined prior to concreting. Their position depends on the procedure, concrete mixer capacity, type of load in that part of structure, and if concreting of visible surfaces is done their position depends on requirements set for their layout.

Lean concrete bedding MB 20 (C16/20) will be placed under the concrete constructions in thickness according to the design

Concreting should be continued in the following way: If work process allow it, 6-12 hours after final concreting the Contractor will wash the contact surface of the joint with water under pressure of 3 - 4 bars or with jet of quartz sand with grain size of 0.5-5 mm under the pressure of 7 bars because concrete can reach 5 kg/cm<sup>2</sup> of strength under pressure. If there are no conditions for this type of procedure, it is necessary for contact surfaces to be hollow punched. Excess material and place of work should be cleaned and washed with water.

Prescribed number of samples shall be tested by the licensed (accredited) laboratory on the Contractors expense. The Supervisor shall be entitled to request additional sample testing, up to the maximal number of samples foreseen under the regulation, fee of any additional expense on his side, if the Supervisor should request additional sample testing, exceeding the maximal number of samples foreseen under the regulation, then in case of unsatisfactory test results expenses shall be on the Contractor, otherwise, in case of positive test results, the Contractor shall bear expenses of such additional testing.

Concreting shall not commence prior to the inspection and acceptance of the reinforcement by the Supervisor.

Only plain concrete casting shall be done manually in 5-15 cm layers, the reinforced concrete casting shall be done mechanically with vibration, provided that a vibration equipment shall be in accordance with the type of structure, subject to the Supervisor approval. Concrete should be compacted during the installation and immediately after it. Compaction should be done by mechanical vibrations and the Contractor should provide sufficient number of vibrators for internal vibration as well as the conditions for their dislocation. Vibrators should be applied to all concrete around the reinforcement, in the corners and angles of formwork, and they should be used long enough and be of such capacity to compact the concrete completely, but vibrations should not be extended in order to avoid segregation. Separated mortar should not occur on the surface. Vibrators should be inserted and taken out from the concrete carefully. They should not lean on reinforcement directly or they should not be directed towards the parts and layers of concrete which have hardened to the degree which does not make concrete plastic any more.

Before placement of new concrete onto the hardened concrete, formwork should be tightened again, the surface of hardened concrete should be made rough, thoroughly cleaned up of undesired material and cement paint and wetted with water. Immediately after concreting, concrete should be protected against:

- very quick drying,
- precipitation and running waters,
- high and low temperatures,
- vibrations that might disturb inner structure and
- mechanical damages.

Concrete classification following SRPS norm (SRPS U.M1.021)

ICS Number	Standard Number	Year	TITLE
91.100.30	SRPS U.M1.021	1997	<b>Concrete - Classification by compressive strength ( neq ISO 3893:1977)</b>

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The common regulation for concrete in the Republic of Serbia is “the Regulation for Concrete and Reinforced Concrete” (always referred to as: “BAB87”), meanwhile, applying newly introduced 1997 standard SRPS U.M1.021 (**Concrete - Classification by compressive strength** neq ISO 3893:1977) and “BAB87”, certain discrepancies appear. The newly introduced standard SRPS U.M1.021 refers to EUROCODE 2 and EN 206 and subsequently defines 28 days **compressive strength** [ N/mm<sup>2</sup> ] using, either a cylinder Ø 15 cm/30 cm test sample, or a 15 cm cube test sample, compared to the 20 cm cube test sample usual and prescribed for “BAB87”.

Please find below a table presenting and emphasizing such discrepancies:

“MB” following ”BAB 87”	Concrete Classes following EUROCODE 2 & EN 206	28 days Compressive Strength [ N/mm <sup>2</sup> ]	
<i>Cube 20 cm</i>	<i>C</i> <i>[Cylinder Ø15cm/30cm] /</i> <i>[Cube 15 cm]</i>	<i>Cylinder Ø15 cm/30 cm</i>	<i>Cube 15 cm</i>
MB 10	C 8/10	8	10
MB 15	C 12/15	12	15
MB 20	C 16/20	16	20
MB 25	C 20/25	20	25
MB 30	C 25/30	25	30
MB 35	C 30/37	30	37
MB 40	C 30/37	30	37
MB 45	C 35/45	35	45

### 2.11.2 Reinforced concrete foundations and slabs

Procurement of material and casting of a MB 30 (C 25/30) reinforced concrete strip foundation. The strip foundation shall be reinforced according to the Main Design, reinforcement details and the Static Analysis. The concrete shall be cast and cured as prescribed under the regulations and standards. The reinforcement shall be calculated and paid separately.

### 2.11.3 Reinforced concrete slabs

Procurement of material and casting of a reinforced, concrete slab. The slab- shall be reinforced according to the Main Design, reinforcement details and the Static Analysis; the concrete shall be casted and cured as prescribed under the regulations and standards. The reinforcement shall be calculated and paid separately.

### 2.11.4 Reinforced Concrete Staircase Slab with Stairs & Rests

Procurement of material and casting of a reinforced concrete massive inclined staircase slab, cast with C 25/30 concrete, reinforcement B500B in smooth shuttering, jointly with stairs and rests. The stairs dimension as per the Design; fully in accordance with the Static Analysis and reinforcement details; the concrete shall be cast and cured as prescribed under the regulations and standards. The price shall include shuttering, supports and auxiliary scaffoldings. The reinforcement shall be calculated and paid separately.



### 2.11.5 Reinforced concrete columns, girders & belt courses

Procurement of material and casting of reinforced concrete columns, from foundation slab till girder under the first floor slab and columns in the facade walls and corners. The columns shall be cast in required shuttering. The columns shall be reinforced according to the Main Design, reinforcement details and the Static Analysis.

The concrete MB 30 (C25/30) shall be cast and cured as prescribed under the regulations and standards. The price shall include shuttering, supports and auxiliary scaffoldings. The reinforcement shall be calculated and paid separately.

### 2.11.6 Reinforced Concrete Horizontal beams

Procurement of material and casting of MB 30 (C 25/30) reinforced concrete horizontal beams in required shuttering reinforced according to the Design, reinforcement details and the Static Analysis.

The concrete shall be cast and cured as prescribed under the regulations and standards. The price shall include shuttering, supports and auxiliary scaffoldings. The reinforcement shall be calculated and paid separately.

### 2.11.7 Reinforced Concrete Walls

Procurement of material and casting of MB 30 (C 25/30) (or MB 20 where appropriate) reinforced concrete walls in required shuttering reinforced according to the Design, reinforcement details and the Static Analysis.

The concrete shall be cast and cured as prescribed under the regulations and standards. The price shall include shuttering, supports and auxiliary scaffoldings. The reinforcement shall be calculated and paid separately.

## 2.12 REINFORCEMENT STEEL

ICS Number	Standard Number	Year	TITLE
91.080.40	SRPS EN ISO 15630-1	2008	Steel for the reinforcement and pre stressing of concrete - Test methods - Part 1: Reinforcing bars, wire rod and wire
	SRPS EN ISO 15630-2	2008	Steel for the reinforcement and pre stressing of concrete - Test methods - Part 2: Welded fabric

Supplying, cleaning, cutting, bending and installing smooth, ribbed reinforcement rods, or reinforcement welded fabric. Fully in accordance with Static Analysis and the Main Design Reinforcement Details.

Ribbed Reinforcing Bars B500A and B500B

Reinforcing Welded Mesh (MA400/500 and MA500/600)

Reinforcement works imply provision, cutting, connection, bending, cleaning, installation and fixing of steel reinforcement according to the design and specifications.

Prior to work commencement, the Contractor shall be familiar with detailed reinforcement plans, check the validity based on the static calculations, check the quantity and measures and if there are any objections he shall address the Design Engineer for all explanations and possible changes.

Reinforcement works will be done with reinforcement stated in the design or B500B, high tensile ribbed steel reinforcement or mesh reinforcement which will be clearly defined in the position. The quality of steel and its characteristics must meet all conditions and requirements set by Rulebook on technical measures and conditions for concrete and reinforced concrete as well as the Rulebook on technical regulations for the use of ribbed concrete steel for reinforced concrete.

The installed reinforcement must be firmly fixed and connected. Fixing of reinforcement in the designed position should be done with steel and concrete supports, architectural skeleton, but the use of steel supports on outer surfaces is not allowed. Interconnection and fixing of reinforcement will be done by binding wire and stapling – small welds.

The reinforcement must be cleaned of layers of rough rust and grease, properly folded, placed and interconnected with wires, according to the static calculation and reinforcement details. For reinforced concrete structures, use round steel bar, ribbed steel bar or prefabricated wire-mesh reinforcement, all in accordance with the provisions of the "Regulations on technical measures and requirements for concrete and reinforced concrete".

## 2.13 MASONRY

### 2.13.1 General

All masonry work shall be carried out fully in accordance with the Main Design, Static Analysis and applicable regulations and standards.

ICS Number	Standard Number	Year	TITLE
91.080. 30	SRPS ISO 9652-2	2005	Masonry - Part 2: Unreinforced masonry design by simple rules
	SRPS ISO 9652-5	2003	Masonry - Part 5: Vocabulary

All materials used for masonry works shall have specified quality and valid test certificates

MATERIAL	ICS Number	Standard Number	Year	TITLE
Clay Bricks And other Brick products	91.100.25	SRPS B.D1.011	1987	Massive clay bricks – Technical requirements
		SRPS B.D1.012	1988	Radial clay bricks – Technical requirements
		SRPS B.D1.014	1987	Facing massive clay bricks - Technical requirements
		SRPS B.D1.014/1	1995	Hollow clay facing bricks and blocks - Technical requirements - Amendments



		SRPS B.D1.015	1987	Hollow clay bricks and blocks - Technical requirements
		SRPS B.D1.015/1	2003	Hollow clay bricks and blocks - Technical requirements - Amendment 1
		SRPS B.D1.016	1987	Solid light-clay bricks – Technical requirements
		SRPS B.D1.017	1987	Perforated light-clay bricks and clay blocks - Technical requirements
Lime	91.100.10	SRPS B.C1.020	1981	Building lime
Cement	91.100.10	SRPS B.C1.010	1997	Hydraulic masonry binder - Technical requirements
		SRPS B.C1.011	2001	Cement - Portland cement, Portland composite cement, blast furnace cement, pozzolanic cement, composite cement - Definition, classification and technical conditions
		SRPS B.C1.012	1996	Cement - Delivery, packing and storage density
		SRPS ENV 197-1	1997	Cement - Composition, specifications and conformity criteria - Part 1: Common cements
Natural and crushed aggregate	91.100.15	SRPS B.B8.040	1982	Crushed aggregate for concrete and mortar - Examination of aggregate with organic impurities
		SRPS B.B8.042	1984	Natural and crushed aggregate - Chemical analysis of aggregates for concretes and mortars
		SRPS EN 13139	2007	Aggregates for mortar
Gypsum	91.100.10	SRPS B.C1.030	1966	Building gypsum
Water	91.100.30	SRPS U.M1.058	1985	Concrete - Water for making concrete - Technical requirements

				and testing methods
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All used binding materials and protecting agents must be of specified quality and posses test certificates

ICS Number	Standard Number	Year	TITLE
91.100.10	SRPS U.M8.002	1997	Mortars for masonry and plastering - Test methods

All masonry work must be carried out by qualified manpower, using the latest tools and machines for this kind of works

Brick laying shall be made by skilled and with qualified workman power, and according completely to current regulations following technical descriptions and shall be made precisely according to the Design, with regular joints in horizontal rows, without pieces, smaller then quarter of brick, half of hollow clay block, as the case may be.

Vertical and horizontal joints shall be completely filled by mortar, without hollows. Thickness of mortar in joints shall not be over then 10-12 mm. Joints at outer surface shall be left empty for about 15-20mm, to provide better adhesion of mortar during plastering. Any mortar leaking shall be removed immediately. Trimming of bricks and/or hollow clay blocks shall be made by machinery equipment.

The Contractor on his own expense shall provide for all required and necessary material related to manufacturing shattering, formworks, scaffoldings, as well as for timbering & bracing of trenches & foundation pits. The Contractor shall remain owner of all said material and equipment and shall be under the obligation to remove the same from the Site when required. Any instruction by the Supervisor intended to improve safety and/or quality of shattering, formworks, scaffoldings and timbering & bracing of trenches & foundation pits shall not be considered as an additional work under any circumstances.

ICS Number	Standard Number	Year	TITLE
79.040	SRPS D.B1.025	1982	Technical log - Wood scaffolding
91.080.20	SRPS U.C9.400	1984	Timber scaffolding and formwork - Technical requirements
	SRPS U.C9.500	1984	Timber protection in constructions - Technical requirements
91.200	SRPS EN 39	1995	Steel tubes for working scaffolds - Requirements and tests
	SRPS EN 74	1995	Coopers, loose spigots and base plates for use in working scaffolds and false work made of steel tubes - Requirements and test procedures

### 2.13.2 Hollow Clay Block wall d=25cm

Cladding of façade walls with d=25cm ceramic blocks in 1:2:6 or 1:3:9 cement-lime mortar. Clay blocks shall be moisturized before building in. The Contractor shall bear any and all responsibilities for stability of such wall. Window ledges and door and window lintels shall be treated as per details and shall be include into an unit price. While laying the blocks attention shall be paid to mortar outflow.

### 2.13.3 Hollow Clay Block Wall d=20 cm

Constructing inner partition walls d=20 cm made of hollow clay blocks in 1:2:6 cement-lime mortar, with simultaneous construction of horizontal reinforced concrete belt courses and door lintels. Clay blocks shall be moisturized before building in. Joints shall be cleaned 2 cm depth

### 2.13.4 Hollow Brick Wall d=12 cm

Constructing inner partition walls d=12 cm made of hollow clay bricks in 1:3 cement mortars. Clay bricks shall be moisturized before building in. Joints shall be cleaned 2 cm depth

### 2.13.5 Indoor plastering

For indoor plastering of clay product wall surfaces, and/or concrete surfaces (columns, girders, lintels, etc.) mortars will be produced from materials as defined under the related standards.

ICS Number	Standard Number	Year	TITLE
91.100.10	SRPS CEN/TR 15124 (EN)	2008	Design, preparation and application of internal gypsum plastering systems
	SRPS CEN/TR 15125 (EN)	2008	Design, preparation and application of internal cement and/or lime plastering systems
	SRPS EN 998-1	2008	Specification for mortar for masonry - Part 1: Rendering and plastering mortar
	SRPS EN 1015-12	2008	Methods of test for mortar for masonry - Part 12: Determination of adhesive strength of hardened rendering and plastering mortars on substrates

### Plastering of indoor wall surfaces

Plastering of internal walls made of bricks, clay blocks, as well as plastering of concrete columns, girders and lintels with two layers 1:2:6 cement-lime mortar. Plastering shall be preceded with cleaning of wall surfaces and spraying with cement grout. In case of concrete surfaces wire netting shall be affixed as sub-layer. The first layer mortar shall be made of grade-one sand and shall be laid on moisturized surface and shall have scraped surface finish providing adhesion for the second layer. The second layer shall be made of finished and most pure materials and shall be applied with constant moisturizing, with smoothed finish. Plastered surfaces shall be strait, without any bends, and with sharp edges. The mortar shall be constantly moisturized to prevent over drying and cracking.

## Plastering of ceilings

Plastering of ceilings with two layer 1:3 lime mortar. Plastering shall be preceded with cleaning of surfaces and spraying with cement grout. The first layer mortar shall be made of grade-one sand and shall be laid on moisturized surface and shall have scraped surface finish providing adhesion for the second layer. The second layer shall be made of finished and most pure materials and shall be applied with constant moisturizing, with smoothed finish. Plastered surfaces shall be strait, without any bends, and with sharp edges. The mortar shall be constantly moisturized to prevent over drying and cracking.

### 2.13.6 Flooring

ICS Number	Standard Number	Year	TITLE
91.100.25	SRPS EN 98	1992	Ceramic tiles - Determination of dimensions and surface quality
	SRPS EN 163	1994	Ceramic tiles - Sampling and basis for acceptance
91.180	SRPS U.F2.011	2000	Final work in building - Ceramic works - Technical requirements

Procurement and manufacture of d=4 cement 1:3 mortar screed having a minimal compressive strength 30 MPa and a minimal adhesive strength 1.5 MPa, will serve as base for flooring.

### 2.13.7 Facades

ICS Number	Standard Number	Year	TITLE
91.060.10	SRPS ISO 7361	2002	Performance standards in building - Presentation of performance levels of facades made of same-source components
91.180	SRPS U.F2.012	1978	Final work in building - Specifications for front side works

#### 2.13.7.1 Coating of Facade Walls

Coating of the facade walls will be done according to the Main Design,

Fabrication of the thermal facade made of stone wool, with properties: density KRT F-130 kg/m<sup>3</sup>, thickness 10 cm, with the necessary facade scaffold, as follows

- stone wool density KRT F-130kg/m<sup>3</sup> d=10cm, the two component adhesive for bonding and plastering
- Silicate mesh min 160gr/m<sup>2</sup>, the two component adhesive for bonding and plastering around openings,
- initial AL strip, and in all corners PVC strips - metal screw anchors, type, length min. 18 cm
- base in the same color as the facade
- final facade, type - silicate, decorative (scratched) plaster d=2mm

Installation of AL-initial strip d=10cm, then stone wool d=10cm is bonded to patella, and vacuum on the edges, exclusively using special adhesive for stone wool (14-16 kg per 1 m of stone wool). After 48h of adhesion, the stone wool is anchored with steel screw anchors (8 anchors per 1 m²). Over the attached stone wool, apply a layer of stone wool adhesive in the thickness of 2-3 mm, and after the adhesive has dried (min 6h), immerse the fibber glass mesh with overlap of 10 cm on a newly set adhesive. All horizontal and vertical edges around the opening and contour edges shall be processed using staff angles with plaster lath.

External plastering works shall be executed fully in accordance with instructions of the manufacturer of stone wool and orders of the supervisor.

## 2.14 TIMBER STRUCTURES

### 2.14.1 General

Timber properties and quality must follow regulations under the Code for designing and building of wooden constructions and prevailing standards

ICS Number	Standard Number	Year	TITLE
79.040	SRPS D.B1.025	1982	Technical log - Wood scaffolding
	SRPS EN 1611-1	2007	Sawn timber - Appearance grading of softwoods - Part 1: European spruces, firs, pines, Douglas fir and larches
91.080.20	SRPS U.C9.200	1984	Structural timber design – Solid timber construction an fibre building boards construction

	SRPS U.C9.200/1	1987	Structural timber design: solid timber construction and fibre building boards constructions - Amendments
	SRPS U.C9.300	1984	Structural timber design – Glued laminated members – Technical requirements
	SRPS U.C9.400	1984	Timber scaffolding and formwork - Technical requirements
	SRPS U.C9.500	1984	Timber protection in constructions - Technical requirements
	SRPS U.D0.001	1983	Materials for timber structures - Technical requirements for materials
	SRPS U.D0.001/1	1987	Materials for timber structures - Technical requirements for materials - Amendments

	SRPS U.C9.200	1984	Structural timber design – Solid timber construction an fibre building boards construction
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91.080.2 0	SRPS U.C9.200/1	1987	Structural timber design: solid timber construction and fibre building boards constructions - Amendments
	SRPS U.C9.300	1984	Structural timber design – Glued laminated members – Technical requirements
	SRPS U.C9.400	1984	Timber scaffolding and formwork - Technical requirements
	SRPS U.C9.500	1984	Timber protection in constructions - Technical requirements
	SRPS U.D0.001	1983	Materials for timber structures - Technical requirements for materials
	SRPS U.D0.001/1	1987	Materials for timber structures - Technical requirements for materials - Amendments

Contractor shall be under the obligation strictly to apply all necessary general procedures from the Safety Code, fire fighting procedures and all other safety related standards. The entire scope of such procedures shall be delivered to the, before commencing any work.

For manufacturing any constructive element, the Contractor shall follow details from technical specifications for works execution and from structural analysis for dimensions.

All carpentry works must be done according to the Main Design details. Timber must be health, dry, suite to current technical descriptions, with dimensions defined in the design and bonding defined in bonding analysis.

All laboratory tests must be done prior to any providing of material. Preliminary testing shall prove the timber quality. Testing costs shall be borne by the Contractor. Responsibility for stability of scaffoldings, supports, shuttering, formwork, bracing and timbering shall be Contractor's obligation, fully and solely as defined under current laws and regulations.

Roof construction and face elements, must be done from conifer wood, I class, nominal humidity up to 12%. Protective paints colour and shade according to accepted samples shall coat visible wooden parts. Roof elements, construction timber and elements for hanging of suspended ceilings, must be protected against rotten, insects, fungicide and fire, by adequate coatings.

Holdings, anchors, anchor plates and all other jointing and fixing elements, must be produced from stainless steel and protected against corrosion and decaying.

The Contractor shall be under the obligation regularly to clean and remove waste material, also to remove any residual waste after finishing the works.

#### **2.14.2 Shuttering & form works**

The Contractor shall submit the shuttering design, which is to be the part of the Concrete Design, to the Supervisor for approval.

The Contractor must use, where possible, readymade shuttering. The shuttering must be impermeable to prevent leaking of cement mortar. The gap between shuttering elements must not be more than 1mm or 2

mm. All anchors that hold the shuttering for the following phase must be placed sufficiently from the edge of the concrete not to cause concrete damage.

Shuttering surface must be clean from hardened concrete residuals and engine oil, or similar, must be applied to it for easier removal. All wooden surfaces of shuttering will be wetted by water to prevent the loss of moist from fresh concrete.

### 2.14.3 Roof timber structure

Procurement, manufacturing and montage of the roof wooden structure. Structure shall be made of the 2<sup>nd</sup> class fir timber, fully in accordance with prevailing regulations and standards. Dimensions of roof structure elements shall be following the Static Analysis. Details shall be made following the Main Design details. Each rafter shall be jointed both to ridge beam and purling, as well as to every crossed belt course. All timber material shall be protected from insects, fungus, rotten, as well as fire protected. The unit price covers entire wooden structure including rafters and all joint and mounting elements.

### 2.14.4 Sheeting and bracing

The Contractor shall be responsible for the design, installation, and maintenance during construction, and where appropriate, removal of all support works needed for trenches and other excavations. The Contractor shall submit to the Supervisor for approval, details of his proposal for excavation support which details shall include such Drawings, calculations or other explanatory matter as the Supervisor may require, but such approval shall not relieve the Contractor of his responsibilities under the Contract. No excavation work may proceed until the Supervisor's approval has been given to the Contractor's proposals.

The Contractor shall not remove temporary works supporting the excavations until in the opinion of the Supervisor the Permanent Work is sufficiently advanced to permit such removal which shall be executed under the personal supervision of a competent foreman. Where the removal of excavation support works is considered by the Supervisor to endanger existing structures thus making them liable to subsidence damage, the Contractor shall leave such support works in place, removing only the minimum necessary to allow the reinstatement of the surfaces.

Works for pit sheeting and bracing close to private or public properties, structures and utilities shall be carried out with low vibration and low concussion.

## 2.15 Roofing

ICS Number	Standard Number	Year	TITLE
91.060.20	SRPS EN 505 (en)	2008	Roofing products from metal sheet - Specification for fully supported roofing products of steel sheet
	SRPS EN 516 (en)	2008	Prefabricated accessories for roofing - Installations for roof access - Walkways, treads and steps
	SRPS EN 517 (en)	2008	Prefabricated accessories for roofing - Roof safety hooks

### 2.15.1 Supply of ceramic roof tiles

Supply of plain roof tiles. Tiles have to be of identical quality, colour and dimensions for all delivery batches. .

Deposit to a temporary location at the construction site, designated by the Supervisor.

### 2.15.2 Installation of ceramic roof tiles on ridges

Installation of new roof tiles on ridges. Tiles must be smooth, intact and of good quality.

Start installing the ridge tiles only after the ridge plank has been set in position, as the tiles are fixed to the plank with special connector.

### 2.15.3 Covering of the roof with ceramic roof tiles

Installation new plain roof tiles. Tiles must be smooth, intact and of good quality.

Start laying the tiles from the eave. The first row of tiles has to be fixed to the plank with galvanized screws for wood 4/60 mm, through the hole found on the upper part of each tile. The same has to be done at ridges. At eaves and ridges, two tiles have to be installed over the plank. Do not fix the tiles with nails.

## 2.16 WATERPROOFING

ICS Number	Standard Number	Year	TITLE
91.120.30	SRPS U.M3.220	1987	Non-strew, bitumen impregnated roofing felt - Quality requirements
	SRPS U.M3.231	1988	Bituminous strip with porous glass mat - Quality requirements
	SRPS U.M3.232	1987	Bituminous roofing felt - Quality Requirements
	SRPS U.M3.234	1988	Bituminous strip with glass fibre fabrics - Quality requirements
	SRPS U.M3.244	1990	Materials for damp-proof courses, for hot process
	SRPS U.M3.300	1989	Bitumen strip for welding - Quality requirements
	SRPS U.M8.080	1990	Bitumen strip for waterproofing - Method of testing

Before applying insulation, surfaces to be insulated must be carefully aligned, thoroughly cleaned and completely dry. For waterproofing, all coatings (cold or hot) must be applied in such a way that they cover the surfaces completely, without bubbles, applied according to standards and manufacturer's instructions, well connected, whether connecting is done by gluing or welding. In addition to walls and other vertical surfaces, waterproofing needs to be elevated by at least 20 cm in height, measured from the base of the wall.

### 2.16.1 Waterproofing of floors on ground

Making horizontal waterproofing for floors-on-ground against moisture and underground water. The insulation should be made by using penetrates in accordance with manufacturer's specifications and in number of layers all according to the Main Design.

### 2.16.2 Waterproofing of toilets and bathrooms

Making horizontal waterproofing of toilets including 15 cm rising up along walls and in shower basins, including 160 cm rising up along walls, applying three coats and two meshes (3+2) with prior coating with cold bitulite. The waterproofing shall be applied over entirely dry and clean surface.

Works shall be performed fully in accordance with Main Design and manufacturer's instruction.

## 2.17 THERMAL INSULATION

ICS Number	Standard Number	Year	TITLE
91.120.10	SRPS EN ISO 10077-1 (en)	2008	Thermal performance of windows, doors and shutters - Calculation of thermal transmittance - Part 1: General
	SRPS ISO 8144-1	1998	Thermal insulation – Mineral wool mats for ventilated roof spaces – Part 1: Specification for applications with restricted ventilation
	SRPS ISO 8144-2	1998	Thermal insulation – Mineral wool mats for ventilated roof spaces – Part 2: Specification for horizontal applications with unrestricted ventilation
	SRPS U.J5.600	1998	Heat in civil engineering – Requirements for design and manufacturing of buildings
	SRPS U.M9.015	1998	Fibrous building materials – Materials for thermal insulation – Technical requirements

2.17.1

### 2.17.2 Thermal insulation of facade works

Procurement and wall lining to be done in accordance to the details from the Main Design.

### 2.17.3 Thermal insulation of ceiling under roof

Procurement and lining of insulation over ceiling structure, all according to the Main Design.

## 2.18 WINDOWS & DOORS

If not stated otherwise erection method shall be dry, anchoring by bolts through pre-drilled holes in frames. Connection between wall and frames shall be filled in with polyurethane foam.

Colour of wooden doors shall be according to the design or chosen by the Designer.

ICS Number	Standard Number	Year	TITLE
91.060.50	SRPS EN 1026	2008	Windows and doors - Air permeability - Test method
	SRPS EN 1027	2008	Windows and doors - Water tightness - Test method
	SRPS EN 1121	2008	Doors - Behaviour between two different climates - Test method
	SRPS EN 12365-1 (en)	2009	Building hardware - Gasket and weather stripping for doors, windows, shutters and curtain walling - Part 1: Performance
	SRPS ENV 1627 (en)	2008	Windows, doors, shutters - Burglar resistance - Requirements and classification
	SRPS EN ISO 10077-1 en)	2008	Thermal performance of windows, doors and shutters - Calculation of thermal transmittance - Part 1: General
91.180	SRPS U.F4.020	1990	Finishing works in building - Building-in of building joinery - Technical requirements
	SRPS U.F2.025	1992	Finishing work in building - Glazier works - Technical requirements

All workshop drawings and material samples shall be subject of the Supervisors approval.

All measures given under any item of Technical Specification are related to opening dimension (i.e. masonry dimensions). All provided dimension shall be subject of verification before commencing production.

All exterior doors and windows as well as interior doors are made of multi-chamber aluminium profiles, power coated, and all according to the sample selected by the Beneficiary.

The price of joinery works include fabrication, corrosion protection, installation, final processing, fittings and glazing as well as all the necessary scaffolding, unless not otherwise specified in the respective item of the Breakdown of the Lump-sum price.

Joinery should be of high quality aluminium profiles, which does not require any particular maintenance.

Frame profile of the window is standard, with a coefficient of thermal conductivity K of less than 1.5, environmentally clean, self-extinguishing, lead-free,

Metal reinforcing of frame is of U profiles, thickness 2,5-3,0 mm, galvanized. Tilt-turn fittings are standard and should provide functionality of the window even after several years of use. We recommend reinforcing of the hinges bracket in the lower supporting zone at larger openings.

On the frame there must be an appropriate standard sealing rubber as well as standard water drain.

**15 January 2016**

The glass is float, 4mm thick, class I (not to deform the silhouette and the natural appearance of the object being observed through it). Aluminium batten between two glass must be perforated on both sides and filled with coal dust. Width of aluminium batten between two profiles of thermal glass of 4mm on the window wing should be 12mm (4+12+4).

Metal joints of the frame to the building structure must be minimum two on the sides and one or two in the top area of openings, depending on the width of the opening. Mounting shall be done using screws of appropriate strength; length of 100 mm. Additional sealing shall be carried out by applying polyurethane foam of appropriate quality.

Welds on the joints (both on the frame profile and on the window sash profile) should be as less visible as possible also due to aesthetic reasons.

Embed dripping edges on the outside of the building, in the lower part the opening, which would significantly protect the building from certain atmospheric influences.

Internal joinery shall be made of plastic-coated aluminium profiles without thermal break.

Use appropriate certificates to confirm the quality of fittings and chemical neutrality of profiles (soundproofing, fire resistance, resistance to water, air leakage, heat leakage ...).

### **2.18.1 Windows**

Procurement and installing of the windows as per Main Design. The entire construction shall be made of multi-chamber aluminium profiles, with adequate steel connecting structure. Glazed with low- emission 4+16+4 mm glass and filled with argon gas. Connection between wall and the window frame has to be filled in with permanent elastic putty, or with polyurethane foam. While installing special attention shall be paid to exact vertical positioning, in order to provide proper open/shut functioning. The window finally processed and protected with PVC foil. Drawing details shall prevail in interpretation of requirements.

### **2.18.2 Outer windows and door**

Procurement and installing of a single multi-chamber aluminium profiles, with double glass low emission glass 4+12+4 or 4+16+4, as specified in the Design. In the profiles there cannot be any remnants of cadmium or lead, and the space between the glasses has to be filled with argon. The technology and program of installing the blind frames has to be in accordance to other phases of the works. The armature on windows in the rooms, living rooms is for opening wing around the lower horizontal axis «pivoted horizontally». When in need of washing, the wing could be taken off and open for 180°. This is enabled only with a certain special key. The outer doors are with locks and a cylinder and three keys. The visual part of the armature is made of eloxy aluminium and coloured.

All windows and doors have to have attests of quality and tightness, which is confirmed by the finishing tests of the object to tightness in accordance to requests for technical acceptance of the object. The glasses on doors are safety glasses 4mm thick. Drawing details shall prevail in interpretation of requirements.

## **2.19 BLACKSMITH WORKS**

All metalwork fabrication to be carried out in workshop or on site using qualified labor. Price of each item includes all supports, hacking, anchors and repairs of sections that may be damaged during works.

### **2.19.1 Railings and grids**

#### **Indoor Stair Railings**

Procurement, production and installation of indoor stair railings made in accordance with the Design. All elements shall be corrosion protected by sand-blasting and primary and final epoxy coating.

### **2.19.2 Other blacksmith works**

#### **Steel Profile Grid for Cleaning Boots**

Frame for grid for cleaning boots is made of steel L 35/35/5mm profiles anchored into the floor. Within the frame, the grid shall be inserted, which shall be made of steel L20/20/3mm profile as the base, filled in with steel flat 20/3mm profile at 2 cm distance. Protection of all elements by primer and final epoxy coating, colour black RAL 9004.

### **2.19.3 Installation of steel snow stoppers**

Installation of steel snow stoppers with type appropriate for selected tiles. All elements must be corrosion protected by sanding and primary and final metal coating before the installation, plasticized, brown colour. Install snow stoppers on each rafter.

## **2.20 TIN-SMITH WORKS**

Metal sheeting to be cut to measure in workshop in accordance to details or as per Supervisor's instructions. Final tying and fitting must be done on site. Tying must be done to allow for expansion, contraction and other movement. Prior to laying of metal sheets over base fit one layer of tar-paper.

All metal sheeting works must be done in accordance with regulations. Works can be taken over when fully completed, sheeted sections cleaned of debris. Measured by descriptions given in specification of works, regardless of construction norms, and price must not include for overlapping, bending, tying or other wastage

ICS Number	Standard Number	Year	TITLE
91.060.20	SRPS U.N9.053	1989	Roof drainage, and drainage of open parts of building by various metal plates elements - Technical requirements

### **2.20.1 Down Pipes**

Procuring material, manufacture and assembly of d=0.6 mm galvanized steel sheet Ø120 mm rainwater down pipes. Each section of down pipes shall be inserted into the other one at least for 50 mm and joined as instructed by the manufacturer. Pipe support brackets are to be placed at the distance of 200 cm.

### **2.20.2 Horizontal Gutters**

Procuring material, manufacture and assembly horizontal gutters. The Horizontal gutter shall be made of d=0.6 mm galvanized plasticized steel sheet, all according to the main design. Entire gutter galvanized steel sheet shall be coated with primer and with final finish metal paint.

### **2.20.3 Roof Ridge Trimming**

Procuring material and manufacture trimming of the roof ridge. The trimming shall be made by trapeze 40/200 mm corrugated 0.6 mm galvanized and plasticized steel sheet. Connection to roofing shall be made by standard screws with build in washer and plasticized head, colour as roof cover. Trimming shall be made following the Design. Under the trimming, layer of asphalted cardboard shall be placed.

15 January 2016

#### **2.20.4 Window Ledge Trimming**

Procuring material and manufacture of window ledge trimming. The trimming shall be made by 0.6 mm galvanized steel sheet. Entire trimming shall be coated with primer and with final finish metal paint. The trimming shall be made before plastering, so that edges shall be covered with mortar. The front side of the trimming shall be overlapped for 3 cm. Trimming shall be made following the Design.

#### **2.20.5 Dilatation Trimming**

Procuring material and manufacture of dilatation trimming. The trimming shall be made by galvanized steel sheet, total width 50 cm and d=0.6 mm. Trimming shall be made following the Design.

### **2.21 TILING**

#### **2.21.1 GENERAL DESCRIPTION**

General description refers to tiling of all types of walls and floors, inside and/or outside of the facility. Works are carried out in compliance with technical requirements for execution of tile works – SRPS U.F2.011:1999. Ceramic tiles have to meet SRPS EN 14411:2005 regarding quality and dimensions:

- Parallel, straight, sharp and undamaged edges
- May not contain soluble salts and/or other ingredient that can cause damage
- Visible surface free of bubbles and notches
- Even colour
- Water absorption shall be within limits of standards applicable to respective type of tiles

Glues shall meet SRPS standards. They shall be applied in a layer of prescribed thickness, in accordance with manufacturer's instruction.

Only glues declared by manufacturer as appropriate for that type of works and certified by authorized Institute may be used for ceramic tiles. Manufacturer shall provide detailed instructions for installation and necessary pre-washing and gluing to certain type of walls.

When carried out inside the facility, tiling shall be executed only after the premises have been rendered, doors and windows frames installed and tested, and installations conducted. All edges, angles and wall plains have to be completely vertical.

Floor tiling shall be carried out horizontally, without waves, bumps, with flat surfaces or under required gradient, with equal and appropriately wide joints. Permitted departures for floors with ceramic tiles are  $\pm 3\text{mm}$  measured by 4,0m long rod. In order to protect the executed works, any form of traffic or walking is strictly forbidden within three days following completion of tiling.

Sealing material for joints shall meet its purpose and must be strictly used as per manufacturer's instruction. Filling of joints may be started with only after the surface has completely hardened. After filling, tiles shall be cleaned from material residue. In order to provide for necessary width of joints, PVC crosses placed before filling must be removed. When the joints are completely dry, tiles shall be cleaned with dry cloth.

Before the works begin, it is necessary to check whether the surfaces, which are to be tiled, are cleaned from dust and debris, flat, dry and prepared for works.

Class, purpose, and quality of tiles are determined by the technical documentation. Color and type of placement are determined by the Beneficiary.

### **2.22 FLOORING**



### 2.22.1 GENERAL DESCRIPTION

All floor coverings shall meet quality requirements; surfaces have to be horizontal or rounded, depending on the type of floor covering or floor description.

### 2.23 PAINTING OF INTERIOR SURFACES

#### 2.23.1 Painting of walls and ceilings with lime-based paint including skimming

Painting of plastered walls and ceilings, using white lime-based paint, to achieve matte antique look, with high vapour permeability to prevent moisture problems, class I, <0.13 Sd (m) EN ISO

7783-2. Ph 12,5, certified in compliance with directive 2004/42/CE-IIA(a), max. VOC value: 30g/l (2010). All surfaces need to be scraped and washed from paint and plaster, then skimmed. Sand, preimpregnate, plastic putty minor damage and emulsion putty. Sand, impregnate and paint for the first time, and then putty minor damage. Apply two coats of lime-based paint. Colour and tone according to Supervisor's and Conservation Supervisor's directions.

#### 2.23.2 Painting of walls and ceilings with lime-based paint

Painting of roughly plastered walls and ceilings, using white lime-based paint, without skimming, to achieve matte antique look, with high vapour permeability to prevent moisture problems, class I, <0.13 Sd (m) EN ISO 7783-2. Ph 12,5, certified in compliance with directive 2004/42/CE-IIA(a), max. VOC value: 30g/l (2010).. All surfaces need to be scraped and washed from paint and plaster. Sand, pre-impregnate, plastic putty minor damage and emulsion putty. Sand, impregnate and paint for the first time, and then putty minor damage. Apply three coats of lime-based paint. Colour and tone according to Supervisor's and Conservation Supervisor's directions.

#### 2.23.3 Painting of gypsum plasterboard ceilings with lime-based paint

Painting of suspended gypsum plasterboard ceilings, using white lime-based paint, without skimming, to achieve matte antique look, with high vapour permeability to prevent moisture problems, class I, <0.13 Sd (m) EN ISO 7783-2. Ph 12,5, certified in compliance with directive 2004/42/CE-IIA(a), max. VOC value: 30g/l (2010).. All surfaces need to be cleaned and dusted. Screw holes and joints have to be taped and skimmed. Apply three coats of lime-based paint. Colour and tone according to Supervisor's and Conservation Supervisor's directions.

### 2.24 CEILING

#### 2.24.1 Suspended ceilings with water-resistant gypsum plaster boards

ICS Number	Standard Number	Year	TITLE
91.060.30	SRPS B.C1.035	1981	Gypsum plasterboards; types, requirements, testing
	SRPS B.C1.040	1975	Cardboard.clad gypsum panels - Instruction for building in

Supply of materials, transport and making of suspended ceiling, including galvanized steel substructure and water-resistant gypsum plasterboards of d = 12.5 mm. Double substructure of galvanized steel profiles CD 60/27 mm suspended on bearing ceiling above and covered with gypsum plaster boards according to the design and manufacturers specifications. Includes preparation of joints for painting (banding and skimming).

## **2.25 Repairation of asphalt pavement**

Repairation of asphalt pavement including concrete and other layers under asphalt in places of water supply, storm and sanitary sewerage pipeline trenches and connections to the city network.

## **3 HYDRO-TECHNICAL INSTALLATIONS**

### **3.1 TECHNICAL DESCRIPTION**

These technical requirements are to be read and interpreted in conjunction with Design documentation. In a case of any doubts, the Supervisor shall issue instruction regarding interpretation of the documentation and fulfilment of the contractual requirements.

#### **3.1.1 PIPELINE**

The building will be connected to the existing water supply network (independent pipeline for hospital ACC Ø80mm). In water supply manhole, distribution for sanitary water with water meter Ø50mm and for hydrant grid with water meter Ø80mm has been carried out.

Inlet of water supply system to the building was conducted with TPE pipes resistant to pressure of 16bar and routed in a protective sewers. The network within the building is of polyethylene (PEX) pipes that conform to the standard.

Hydrant network is entirely of steel galvanized pipes.

All pipes that are placed in the soil are protected using fine river sand layer  $10 + D + 10\text{cm}$ . Verticals of water pipes in the building are protected with adequate protection against mechanical damage and other adverse impacts, meaning the main distributions, and fittings are chiselled into the walls, and laid on floors before execution of the cement screed. Such placed pipes are protected with thermal insulating material. The pipes which are buried in walls are protected with felt tape.

Water supply network will be tested on test pressure of 10 bar before backfilling of pipes in the ground, i.e. before closing chiselled pipes in the walls and installing thermal insulation around them.

#### **3.1.2 SEWAGE**

Wastewater disposal will be carried out through new sewage system which is attached to the existing one, i.e. existing manhole Ro1 (located next to the existing ambulance service), and the existing network ø150mm within the hospital complex. Inside the building, vertical sewage system, there is noiseless polyethylene (PEX) sewage of ø100 to 125mm, while the floor distribution to Ro1 manhole is of ø 150mm.

#### **3.1.3 RAIN DRAINAGE SYSTEM**

Atmospheric water from the facility will be taken from roof planes and conducted by verticals ø100mm - Ø125mm, and from floor distribution ø160mm to RS1 on the plateau (i.e. existing manhole) '.

All rain and fecal sewage system will be done of PVC sewage pipes and fittings. The sewerage network in the facility is planned to be placed visibly with all the necessary anchoring, and then covered – Protected using appropriate panelling.

After mounting the pipes waterproofing testing has to be done in accordance with relevant international or national standards.

The pipes which are buried in the ground must be protected with a layer of fine river sand thickness  $10 + D + 10\text{cm}$ .

Manhole steps must be made of casted iron.

Depths of sewage channels were determined based on the conditions on site and in the building.

Longitudinal inclination of sewage channels is 2%

All modifications and changes can be done only with the approval of the Supervisor.

### **3.1.4 PLUMBING UTENSILS AND EQUIPMENT**

Sanitary utensils and equipment are first class, from the manufacturer, type and colour determined by the Employer.

All the mounting materials necessary for execution of water supply and sewage installations as well as sanitary supplies and equipment must be first class and verified by the Supervisor on the site in order to meet the required quality and type.

All penetrations through floor slabs and other concrete structures must be secured before placing concrete. Presence of the Supervisor and the Contractor for conducting plumbing and sewage systems works is obligatory.

## **3.2 TECHNICAL REQUIREMENTS**

### **3.2.1 PRELIMINARY MEASURES**

The Design on installations must be approved by Utility Enterprise for water supply and sewage before the start of works. The Contractor is obliged, before starting works, to compare the Design on installation to the actual situation on the site and together with the Supervisor to discuss any concerns. Before making any possible amendments, the Contractor shall timely notify the Supervisor and ask for approval for proposed modifications.

### **3.2.2 INSTALLATION OF WATER PIPELINES**

The Contractor is obliged to check all the elevation levels in the design and compare them to the actual elevations at the site. In executing the sewerage network, the one should first conduct connection to the street channel, then network through foundation and at the end vertical pipelines.

All horizontal pipelines of water supply are set with inclination towards the lowest tap point. If these are more, it must be taken into account.

Direction change of water pipes is to be performed using arches rather than knees.

Bending of galvanized pipes can't be done.

Through the walls, pipes should be conducted perpendicular to the wall surface.

### **3.2.3 GROUND PIPES**

All pipes in the ground are laid in a layer of sand covering the pipe with all sides in the thickness of at least 5cm. In filled soil, at the bottom of the trench, set up a sufficiently thick layer of sand and compact it well. Humus, building materials waste, slag and stones may not be used for backfilling trenches.

Placing pipes in the trenches could begin as soon as the Supervisor has found that the trench was excavated properly and according to the design. Backfilling can't start before the Supervisor has examined the pipeline, i.e. before installation has been tested.

### **3.2.4 PIPES IN STRUCTURES**

Firmly building in of pipes in walls and other structures is not permitted. An opening for the passage of pipes through structure must be large enough, and the space between the pipes and structures filled with a plastics material in order to prevent damage to the pipes. Water pipes when going through structural walls will be protected by a protective pipe with a diameter 40 mm larger than the external diameter of the water pipe, and the space between will be filled with hemp in bitumen or permanently elastic putty. Sewage pipes when passing through walls must not be firmly installed, and the space will be filled with moist clay, ie hemp and bitumen and asphalt or other permanently elastic putty, if there is a risk of breaking of water into the building. Possible unforeseen gouging in walls and other structures can be made only upon prior permission of the Supervisor.

#### **3.2.4.1 PIPES PROTECTION**

Water pipes must not pass through the walls of chimneys and ventilation ducts, through the sewer manhole, beneath the floor of the toilet or WC and anywhere else where they can be exposed to pollution, freezing, heating and corrosion.

At the intersection points, pipes must be protected. At the intersection with conductors, water pipe must be higher and inter-space filled with clay at least 20cm thick. If the distance is less, water pipe will be conducted through the protective pipe as when pipes passing through the wall. At locations where they are exposed to freezing, pipes are to be thermally insulated. Insulation is to be carried out carefully and pipelines must not be closed before inspection of the same by the Supervisor. The same procedure is for sound insulation.

In operation damaged insulation has to be carefully repaired.

If works are temporary suspended, pipes have to be temporarily sealed in order not to be contaminated, material filled or damaged.

#### **3.2.4.2 JOINTS AND FITTINGS**

Pipe joints between the pipes and pipe fittings have to be carried out carefully. When connecting, the internal diameter of the pipe must not be narrowed nor deformed by bending pipe.

Sealing joints of water and sewage pipes and pipe elbows is done according to the manufacturer's technology. Joints of galvanized pipes are sealed with hemp and putty which must not contain red lead or other toxic substances. Sealing the plastic pipe is made by gluing or by rubber rings.

Pipe joints in walls, ceilings and other structures must be avoided.

Fittings of the various materials must confirm with appropriate standards:

- PEHD - EN12201
- Steel galvanized pipes - EN 10219-
- PVC - EN 1401

Or otherwise stated in the Main Design.

#### **3.2.4.3 PIPE FIXING (FASTENING)**

Pipelines are to be fixed to the walls and ceilings by clamps i.e. hangers at distance depending on the diameter and type of pipes. Plastic pipes in warm rooms should be on a solid base along the entire length.

#### **3.2.4.4 PIPES**

##### **PVC and PP pipes**

All PVC and PP pipes shall be manufactured by a quality assured manufacturer in accordance with the ISO 9000 system. Un-plasticized PVC pipes and fittings for gravity drainage and sewerage shall comply with the relevant provisions of CEN Standard EN 1401, PP pipes shall comply with CEN Standard EN 1852. Un-plasticized PVC pipes and fittings for pressure pipes shall comply with the relevant provisions of CEN-standard EN 1452, or referring SRPS Standards.

All connections to PVC and PP pipes must be performed by using single 45 branch; no saddle must be used.

Only pipes with a ring stiffness greater than 8 kN/m<sup>2</sup> may be used. Reference is made to ISO 9969.

### **High density polyethylene (HDPE) pipes**

All HDPE pipes and fittings shall be manufactured by a quality assured manufacturer in accordance with the ISO 9000 system. HDPE pipes shall be manufactured from PE 100 material, as classified by the European Technical Committee Report CEN/TC 155. In accordance with ISO 12162 the PE 100 material shall have a minimum required strength (MRS) value of 10 MPa. The pipes and fittings shall be coloured blue (potable water), yellow (gas) or black (leachate and wastewater) and be suitable for below-ground use.

Gravity pipes shall be engineered light weight pipes with (structured wall pipe type) with ring stiffness larger than SN 8 kN/m<sup>2</sup>. The pipes shall be manufactured so that the cavity between the inner and outer pipe can be water filled.

Pressure pipes shall be in pressure class PN10 minimum.

PE pipes and fittings shall comply with the relevant provisions of CEN-standard EN12201 (water and wastewater) and EN1555 (gas).

Generally, all buried pipes shall be jointed using either butt or electro fusion welding techniques. Small diameter pipes (diameter < 63 mm), pipes within structures and pipes connecting to metal fittings shall be jointed using mechanical jointing techniques, such as compression, flanged joints or push-fit joints. Jointing of large pipes of the light weight type shall be made by extruder welding.

All welding shall be performed by certified welders holding licences not older than 12 months, and issued by a recognised institution approved by the manufacturer and the Supervisor.

### **Galvanized steel pipes**

The works include supply and installation of galvanized steel pipes in accordance with EN 10219-2, including fittings and joining material (stand oil and hemp). Hydrant piping system must sustain working pressure of 10 bars (NP10). Pipes must be covered with two layers of bituminous coating, included in the unit price.

#### **3.2.4.5 SANITARY EQUIPMENT**

Fittings and other equipment must be inspected in the workshop prior to installation. Placing fittings has to be carried out accurately, taking into account nice and the easy handling and the aesthetic appearance.

Outlet equipment and other fittings being handled with must be fastened as requested by the manufacturer.

#### **3.2.4.6 INSTALLATION ELEMENTS**

Installation of elements must be carried out properly, clean and precise, taking into account usability and aesthetic appearance of the unit.

Plumbing elements are fixed to the walls with plastic or metal spines. Console placed items must withstand a force of 1 kN at the most unfavorable point.

### **3.2.4.7 TESTING OF INSTALLATIONS**

The finished but not yet insulated and backfilled installation network must be tested for impermeability and well-functioning before hand-over. Water supply pipe system - if the regulations do not provide otherwise, is placed under a test pressure twice larger than the operating one, but at least 12 bars for a period of 30 minutes. Sewage network is tested by filling with water in whole or in parts, with previous temporary blockage of drains and openings all according to appropriate international or SRPS standard.

Testing is conducted in the presence of Contractor, Supervisor and the Beneficiary, where the relevant record is compiled. Testing is done at the expense of the Contractor. Only after successful completion of the testing, wrapping, heat-insulating and other insulation of lines can be done, as well as closing the grooves and channels and backfilling trenches.

### **3.2.4.8 CONTRACTOR'S OBLIGATIONS**

The Contractor is required to provide at his own expense and to take all the necessary analyzes i.e. consents on safety of sanitary water from the Hygiene Institute upon testing the system and before commissioning.

The Contractor remains bound to eliminate at his own expense all shortcomings which may arise within the agreed deadline.

The Supervisor may accept only installed quantities of material. All material not accepted by the Supervisor as irregular or faulty, must be immediately removed from the site.

The Contractor is required to execute complete installation in bona fide cooperation with other contractors on the facility.

### **3.2.4.9 HYDRANT CABINET**

The works include supply, transport and installation of standing type (or wall mounted) fire hydrant cabinet, dimensions 1080 x 564 x 252 mm. The cabinet is protected against corrosion by coating with two layers of anticorrosive primer and final painting in red colour. Standard equipment in the fire hydrant cabinet include:

- one piece of hose Ø 52 mm, length 15 m;
- one nozzle Ø 52 mm and a clip;
- one spanner for FF hydrant;
- one spanner ABC;
- one spanner C.

However, specific equipment required to be obtained is listed in the Main Design and subject of approval of the Supervisor.

The cabinet must be placed near the hydrant, on steel supports fixed on two concrete anchors, in accordance with fire protection regulations, design and Supervisor's instructions.

### **3.2.4.10 BOOSTER PUMPING STATION**

The works include supply and installation of a Booster pumping station, two pumps, H=15 m, with automatics control cabinet. Installation must be according to the applicable technical regulations and recommendations of the manufacturer. The work must strictly comply with design specifications and drawings, approved by the Supervisor.

## **4 ELECTRICAL INSTALLATIONS**

### **4.1 TECHNICAL DESCRIPTION**

#### **4.1.1 Technical description of works**

The existing substation on the hospital grounds supplies MDC (main distribution cabinet) via CCB placed on the wall next to the basement entrance. MDC is placed at the entrance to the basement on the left side. MDC supplies DBs on the floors. Energy schemes are given in the drawing in the attachment, as well as the schedule of the room on the floors.

The electrical installations have to be in accordance with the applicable technical regulations and standards for this type of structures.

The electrical installations have to fulfil following requirements:

##### **4.1.1.1 Electricity supply of the facility**

Electricity supply of the facility to be performed in accordance with the Technical requirements for connection to the network 09/57u/2015 dated 05.10.2015, issued by PC EPS "ElektroSrbija". For cables to enter into the MDC the target should be set at 100 mm. The power supply of the facility has to be performed through cable type PPOO/O-A 4x510 mm<sup>2</sup> from the existing substation 1250 kVA, and from a special LV feeder. Power supply of all DBs has to be performed by cable type N2HX from MDC. For back-up power supply designed diesel power unit will be used. Complete installation of the facility is intended for power supply through diesel power unit as an alternative power source.

##### **4.1.1.2 Distribution cabinets and boards**

Electricity consumption measuring is planned to be executed via the semi-indirect measuring group with a built-in receiver for the change of tariffs, through measuring power substations 150/5A. Main distribution cabinet should be made in two separate field parts. In one part, a measuring group, power substations, CT switch, linear encoder and other necessary materials should be placed, and in the second part the fuses of the feeder cables of floor distribution boards and surge diverters. Door panes should be installed for meter reading.

All distribution boards must be fitted with single-pole As-Built schemes protected by plastic foil and stored on the inside of the cabinet door, and all built-in elements must wear permanent markings for identification of the circuits to which they belong. Also, a warning label should be placed on the outside of the door.

The installation of residual current protective device RCPD 40/0,5 A is provided for as an additional measure of protection against excessive contact voltage.

##### **4.1.1.3 Electrical installation for general consumption and heating**

For the purposes of general consumption, according to the purpose of the facility, the required number of single-phase and three-phase grounded sockets and connections is scheduled, as given in electrical installation layouts. In offices, doctors' rooms, as well as in nurses' rooms, three to four single-phase sockets with protective contacts should be planned for the connection of portable electric devices, and in other rooms a necessary number of socket outlets should be placed according to purpose.

Electrical installation is executed with cables type N2HX 3 (5) x 2.5 mm, partly concealed under mortar, and partly in PCT shelves. In damp and wet rooms insulated conductors type PP 00-Y should be laid. All the distribution should be executed in plastic junction boxes. Sockets are installed at the height of 0.4 m from FFL, except in cases where other connector mounting height is given in the electrical installation layout:

- |                              |                      |
|------------------------------|----------------------|
| - Sockets above the desk     | 1.1 m from the floor |
| - Sockets for operation room | 0.8 m from the floor |
| - Sockets                    | 0.4 m from the floor |
| - Air conditioning device    | 2.2 m from the floor |
| - Switches                   | 1.3 m from the floor |

- Boiler outlet 1.7 m from the floor

#### **4.1.1.4 Electrical lighting installation**

In every room of the house adequate general lighting is designed, according to the purpose of the rooms, mounting conditions and the Employer's requirements. The design envisages that the lighting consists of ceiling fixtures, spherical lamps and fluorescent lamps with bright diffusers which will be purchased and installed according to the choice of the Employer, all according to the type given in the electrical installation layout.

Lighting in all areas is switched on by regular, serial and two-way switches, except the lighting in the hallway of the basement and ground floor, which is switched on from the doorman's lodge. Installation is performed with N2HX 3x1.5 mm<sup>2</sup> cable type, which is partly laid into flexible PVC pipes Ø.16 mm through the floor construction, and partly in PCT shelves.

#### **4.1.1.5 Earthing**

Earthing of the facilities consists of a strip of Fe-Zn 25x4 mm which will be laid into reinforced concrete foundation. The strip should be welded by electric procedure to the surrounding reinforcement. All metal parts of the building should be connected to earthing rod.

The strip goes from the earthing rod and connects MPEB and MDCs. Potential equalization will be performed in sanitary facilities with the installation of PS-49 boxes to whose busbar they will be connected through the conductor of a cross section of 4mm<sup>2</sup>, via suitable clips, metal mass of water supply, sewage and heating. The busbar in PS-49 box is connected with protective busbars in distribution cabinets through a conductor of a cross section of 6 mm<sup>2</sup>. The water meter is bridged by a copper braid, cross section 16mm<sup>2</sup>. RACK and PTT cabinets are also connected to PEB (potential equalization busbar).

Lightning rod is a clamp with the device for early start set 3m above the highest point on the roof connected to two outlets with base earthing.

The outlet on the roof is a Fe-Zn 20x3 mm strip on roof supports SRPS N.B4.920. Roof supports should be installed at the distance of 1 m. All metal parts of metal structure, gutters, roof covering, etc, should be connected by a strip. The outlets must establish the shortest connection of the clamp to the grounding. Outlets should be installed in concrete pillars before concrete works. On every outlet a measuring connection must be installed at the height of 1.7 m from the ground.

### **4.2 TECHNICAL REQUIREMENTS FOR THE EXECUTION OF ELECTRIC POWER INSTALLATIONS**

These technical requirements are an integral part of the design, and as such they are required for the Contractors.

The entire installation must be performed according to the design, single-pole diagrams, technical description and the given requirements, in accordance with the following technical regulations and standards:

- Rulebook on technical norms for low voltage electrical installations /Off. Gazette SFRY no. 53/88
- Rulebook on Yugoslav standards for electrical installations in buildings / Off. Gazette SFRY no. 68/88
- Rulebook on technical norms for the protection of LV networks and associated substations / Off. Gazette SFRY no. 13/78
- Rulebook on technical regulations for lightning rods SRPS IEC 1024 / Off. Gazette FRY no. 11/96
- Regulations of YPTTU
- Degrees of protection of electrical equipment - SRPS N.A5.070



- Electrical installations in buildings - SRPS N.B2. 730, 741, 742, 743,751,752,754
- Labelling of isolated lines and cables - SRPS N.CO.006
- Daylight and electrical lighting of the rooms in buildings SRPS N.C9.100

The material which is installed must be of a good quality, must comply with SRBS standards and must be installed by skilled workforce. The material that does not meet the requirements for incorporation into concrete must not be used to.

During the execution of works, the Contractor must be careful not to damage the already completed works and the existing installations and has to coordinate activities with other Contractors.

Drilling or chiselling of reinforced concrete structures can be carried out only with the written approval of the construction Supervisor.

When installing the cables or conductors in tubes the Contractor must make sure that all the conductors belonging to one circuit are placed in one tube.

Metal protective linings of pipes and cables must not be used as feedback conductors or as conductors for protective earthing.

Pipes laid in the walls or the floor must not be covered with material that would make them corrode.

Fuses and switches are installed only for phase conductors.

Threaded part in lamp holders must not be connected to the phase conductor.

In wet rooms only waterproof equipment must be installed.

The joining of different materials can be done only through lead pads 2 mm thick.

In parallel lying of the lines of different installations the sequence is as follows:

- at the top of the wall – telecommunication lines,
- 10 cm below them – signalling lines,
- 10 cm below them – energy lines.

At crossing points, which are executed at a right angle, the distance between these lines must be at least 10 cm. If this is not possible, an insulating insert 3 cm thick is placed.

Parallel placing of lines, flues and other heating elements must be avoided, and where this is not possible, a distance of 5 cm should be provided, and at their intersection the distance of 3 cm, while the lines should be protected by thermal insulation.

All installation switches should be placed on the door opening side, and for damp rooms – outside, by the front door, at the height of 1.2 m.

The height of socket outlets in damp rooms is at least 1.5 meters, and at other places - 40 cm above the finished floor level.

Switches for lighting, distribution boards and plug boxes should be set according to the notes in the drawings and technical descriptions.

Branching and continuation of the conductors must be executed only in distribution boxes of sufficient dimensions for accommodation of the conductors' connections.

All conductors for this installation must be made of copper. Type of conductor, insulation cross-section and insulation type are indicated in the drawings.

For easy connection of the lines in places of branching and continuing a free part of the conductor 15 cm long should be left.

Electric meter cabinets should be set so that they are not lower than 60 cm or higher than 220 cm. Closed distribution cabinets are installed at a height of 170 cm from the floor, and open ones at 220 cm, taking the center line of the cabinet as a measuring point.

On distribution cabinets the parts under voltage on the back side must be positioned at least 10 mm away from the wall or metal parts. All the elements in the DC must be placed clearly and marked, and a single-pole diagram placed on the door.

Upon the completion of the works electrical installation must be checked and tested according to technical regulations pursuant to the Regulations on Technical Standards for Low Voltage Electrical Installations / Off. Gazette SFRY 53/88, Article 192-198 / and the Record and expert findings regarding finished works must be submitted, and also protocols for testing the protection against dangerous contact voltage and insulation resistance of electrical installations, issued by authorized institutions.

Commissioning of the installations in continuous operation can be executed only after the performance of the technical inspection and the obtaining of work permits.

#### **4.3 TECHNICAL REQUIREMENTS FOR THE EXECUTION OF LIGHTNING ROD INSTALLATION**

The entire installation of the lightning rod should be executed according to Technical regulations regarding lightning rods ("Off. Gazette of SFRY" no. 11/96), Technical regulations for the execution of electrical installations in buildings and the following conditions:

The installation, which will be performed at the facility, must be made from a prescribed material, resistant to mechanical and chemical impacts, and therefore only materials processed by hot-dip galvanizing must be used.

The lines on the roof and in the ground must be carried out from as long and as whole pieces as possible, with as few interconnections as possible.

The spacing of lines' fixing must be carried out from as long and as whole pieces as possible, with as few interconnections as possible.

All lines must be placed so that they are protected from mechanical damage.

In order to prevent overshoot and excessive electrodynamic forces, arches must not have radius smaller than 200 mm, and towards the straight line it must not be less than 900.

Joints - measuring connections are implanted at each outlet line at the height of 1.75 m from the ground. / This is not the case when lightning rods run through concrete columns /.

All metal parts in the roof must be connected to the lightning arrester by proper clamps / horizontal gutters, sheet metal flashings, chimneys /, and also vertical gutters must be connected to the earthing rods in the facility thus making utility lightning rod descents /.

All joints must form one solid, strong galvanic and mechanical connection, and all of the component parts of the joints must be made of the same material.

Total measured grounding resistance of the earthing rod must not exceed  $10\Omega$ .

Takeover of the installation can be done only after the completion of all the works and verification of lightning rod installation by an authorized organization.

#### 4.4 TECHNICAL REGULATIONS AND STANDARDS

During the execution of works and designing, the following norms and standards have to be used.

Rule book on technical norms for low voltage electrical installations ("Off. Gazette of SFRY" No. 53/88 and "Off. Gazette of SFRY" no. 28/95)

1. - SRPS N.B2.702 - ELECTRICAL INSTALLATIONS IN BUILDINGS
  - a. VOLTAGE RANGES
2. - SRPS N.A3.805 - ELECTRICAL GRAPHIC SYMBOLS
3. - SRPS N.B2.730 - ELECTRICAL INSTALLATIONS IN BUILDINGS
  - a. GENERAL CHARACTERISTICS AND CLASSIFICATION
4. - SRPS N.B2-741 - ELECTRICAL INSTALLATIONS IN BUILDINGS
  - a. SAFETY REQUIREMENTS
  - b. PROTECTION AGAINST THERMAL EFFECTS
5. - SRPS N.B2.743 - ELECTRICAL INSTALLATIONS IN BUILDINGS
6. - SRPS N.B2.743/1 SAFETY REQUIREMENTS
  - a. PROTECTION AGAINST EXCESSIVE ELECTRICITY
7. - SRPS N.B2.751 - ELECTRICAL INSTALLATIONS IN BUILDINGS
  - a. SELECTION AND INSTALLATION OF ELECTRICAL
    - i. EQUIPMENT DEPENDING ON
    - ii. EXTERNAL INFLUENCES
8. - SRPS N.B2.752 - ELECTRICAL INSTALLATIONS IN BUILDINGS
9. - SRPS N.B2.752/1 ELECTRICAL DISTRIBUTION
  - a. PERMANENT PERMISSION FOR THE USE OF ELECTRICITY
10. - SRPS N. B2.754 - ELECTRICAL INSTALLATIONS IN BUILDINGS
  - a. EARTHING AND PROTECTIVE CONDUCTORS
11. - SRPS N. B2.761 - ELECTRICAL INSTALLATIONS IN BUILDINGS
  - a. METHOD FOR MEASURING ELECTRICAL
  - b. RESISTANCE OF WALLS AND FLOORS
12. - SRPS N. B2.763 - ELECTRICAL INSTALLATIONS IN BUILDINGS
  - a. VERIFICATION OF CONDITIONS FOR PROTECTION
  - b. VERIFICATION OF CONDITIONS FOR PROTECTION BY AUTOMATIC SUPPLY DISCONNECTION
  - c. MEASUREMENT OF FAULT LOOP IMPEDANCE
13. - SRPS N. B2.764 - ELECTRICAL INSTALLATIONS IN BUILDINGS
  - a. VERIFICATION OF CONDITIONS FOR PROTECTION
  - b. VERIFICATION OF CONDITIONS FOR PROTECTION BY AUTOMATIC SUPPLY DISCONNECTION
  - c. VERIFICATION OF THE FUNCTIONING OF RESIDUAL CURRENT PROTECTIVE DEVICE
14. - SRPS N. B2.771 - ELECTRICAL INSTALLATIONS IN BUILDINGS
  - a. ROOMS WITH A BATHTUB AND A SHOWER
  - b. PARTICULAR TECHNICAL CONDITIONS
15. - SRPS N. B2.774 - LOW VOLTAGE ELECTRICAL INSTALLATIONS
  - a. CONSTRUCTION SITE INSTALLATIONS
  - b. ELECTRICAL INSTALLATIONS IN AGRICULTURE AND HORTICULTURE
  - c. PARTICULAR TECHNICAL CONDITIONS
16. - SRPS N. B2.775 - LOW VOLTAGE ELECTRICAL INSTALLATIONS
  - a. CONSTRUCTION SITE INSTALLATIONS

- d. ELECTRICAL INSTALLATIONS IN AGRICULTURE AND HORTICULTURE
- c. PARTICULAR TECHNICAL CONDITIONS
- 17. - SRPS N. B2.781 - LOW VOLTAGE ELECTRICAL INSTALLATIONS
  - a. SELECTION OF PROTECTIVE MEASURES AGAINST ELECTRIC SHOCK DEPENDING ON EXTERNAL INFLUENCES
- 18. - SRPS N. B4.800 - LIGHTNING ROD INSTALLATIONS
  - a. GENERAL CONDITIONS
- 19. - SRPS N. B4.801 - LIGHTNING ROD INSTALLATIONS
  - a. CHOICE OF PROTECTION LEVEL
- 20. - SRPS N. B4.803 - LIGHTNING ROD INSTALLATIONS
  - a. DETERMINATION OF PROTECTION LEVEL
  - b. FRY LIGHTNING MAP
- 21. - SRPS N. B4.803 - LIGHTNING ROD INSTALLATIONS
  - a. PROCEDURES FOR THE DESIGN, EXECUTION, INSPECTION AND VERIFICATION
- 22. - SRPS IEC 1024-1 - LIGHTNING ROD INSTALLATIONS
- 23. - SRPS IEC 1024-1-1 - DETERMINATION OF PROTECTION LEVEL

## **5 TELECOMMUNICATION AND SIGNAL INSTALLATIONS**

### **5.1 TECHNICAL DESCRIPTION OF TELECOMMUNICATION AND SIGNAL INSTALLATION**

#### **5.1.1 Technical description of the facility**

Electrical installation is in accordance with applicable technical regulations and standards for this type of facility. Method of laying cables is selected according to the architectural and construction solutions and applicable regulations, namely:

- a) In perforated cable trays, placed in the area between the ceiling and the suspended (gypsum cardboard) ceiling;
- b) Through finned pipe installation in suspended ceiling and along the wall under the mortar.

Cables are envisaged with LS0H characteristics (*Low Smoke Zero Halogen*).  
Characteristics of the electrical installations are as follows:

##### **5.1.1.1 Telephone installation**

Telephone installation is led in by an underground telephone cable from the nearest telephone exchange in the post office to the telephone connection cabinet (ITO). For the purposes of the telephone system distribution in this facility, distribution using cable U/UTP cat6 4x2xAWG23 is foreseen, placed inside PVC pipes Ø 16 mm to each telephone socket. ITO cabinet is placed near the main entrance, respecting the recommended distance of installations/connections of high and low voltage power. From this cabinet, the RACK cabinet is being supplied with power, in which the telephone switchboard is located with cable J-Y(St)Y 5x2x0,6 mm, from which all the telephone sockets are supplied.

Connecting of conductors is performed exclusively through slugs (power strips).  
A conductor for potential equalization P/F-Y 16 mm<sup>2</sup> is led from the equipotential bonding busbar to the PTT cabinet.

In rooms with two telephone sockets, two RJ45 sockets are installed, whereby one is used for the telephone, and the other one for computer (internet) connection.

### **5.1.1.2 Computer network**

Internal distribution consists of radial distribution, executed with cable type UTP 4x2xAWG23 cat.6 in PVC pipes with a diameter of 16mm, from the RACK cabinet to the sockets in the facility, as indicated on the drawings.

RACK cabinet is placed on the ground floor, in room No. 7, respecting the recommended distance between installation/connections of high and low voltage power.

A conductor for potential equalization P/F-Y 16 mm<sup>2</sup> is led from the equipotential bonding busbar to the PTT cabinet.

In rooms with two telephone sockets, two RJ45 sockets are installed, whereby one is used for the telephone, and the other one for computer (internet) connection.

### **5.1.1.3 TV installation**

Internal distribution consists of radial distribution, executed with cable type RG-6 in PVC pipes with a diameter of 16mm, from the point of concentration in the RACK cabinet directly to the TV sockets in the rooms, as indicated on the drawings.

The cable TV connection is foreseen in the RACK cabinet, which is located on the ground floor. TV connectors are installed at a height of 0:40 above the floor in installation boxes, together with computer and telephone connectors.

## **5.2 TECHNICAL TERMS AND CONDITIONS FOR EXECUTION OF TELECOMMUNICATION AND SIGNAL INSTALLATIONS**

### **5.2.1 GENERAL PART**

1. These technical terms and conditions are an integral part of the design.
2. During the execution of works, comply in all with the existing SRBS regulations, collection of electro-technical regulations and the Regulations on work health and safety, as well as any other requirements defined in this design.
3. For any changes to the design or deviation from the project due to application of other types of materials, an approval must be obtained from the Supervisor.
4. Before the commencement of works, the Contractor is obliged to review the design thoroughly and to submit in a timely manner all objections, if any, to the Supervisor.
5. During the execution of works, the Contractor is obliged to enter all deviations that have occurred in the project and show them in "as built drawings".
6. The material to be installed must be of first class quality.
7. Certificates must be provided for all equipment and materials which are planned in the design.
8. Prior to the commencement of the construction works on the TT/telecom cabling conduit pathways and laying the TT cable, it is necessary to notify the authorized organization of "Telekom Srbija" for the purpose of expert supervision.
9. During the execution of construction works, the Contractor is obliged to keep a log with all the information that such a log requires.
9. Installing the TT cable to the network TT cable is done exclusively by "Telekom Srbija". Upon completion of works, the Contractor is obliged to submit to the Investor the as-built drawings.
10. During the execution of these installations special attention should be paid in order not to damage other installations.

### **5.2.2 INTERNAL INSTALLATIONS**

1. Distribution cabinets shall be installed in separate rooms or areas intended for electrical installations.
2. Nameplates with installation type mark shall be placed on each distribution cabinet.

3. Each distribution cabinet shall be connected separately to the strip or Cu rail with common earth ground.
4. Any branching or separation of installation lines shall be conducted only in junction boxes with covers.
5. Cables and lines must be placed so that the following may not occur:
  - Torsion bending and nodes
  - Pressing the cable that would deform the cross-section (cable must be freely laid or secured only with appropriate cable clamps, i.e. laid under plaster or inside appropriate PVC pipes)
  - Damage caused by the means of transportation; if cables and lines are installed above the transportation means, additional safety measures must be taken against falling of cables.
6. Cables and lines must be laid so that their entire length is accessible at all times for control and possible interventions.
7. In case of more parallel installed cables, the distance between them must be equal to at least the diameter of the adjacent thicker cable. Cable must not be attached to the elements of equipment which are exposed to tremors or are moved frequently.
8. The cables which pass through penetrations in floors, walls, etc. must be treated with fire resistant materials in order to prevent penetration of fire and smoke.
9. The signal cables must be at least 10 cm away from the power cables and lines, and telecommunication cables must be at least 10 cm away from the signal cables, i.e. 20 cm away from the power cables and lines.
10. Junction boxes are installed in hallways, and not in the rooms, which enables easier and faster maintenance.
11. In the event of joining or connecting of individual conductors and cables, joints must be permanently and safely attached. For connection of conductors only such joint may be used, which enables no penetration of harmful influences. Safe and tight joining may be executed by using screws, wrapping or soft soldering.
12. Connecting or joining point of cable or line conductor must have the same conductivity and insulation as the cable or line. Conductor should not be damaged at the connecting or joining point and its cross-section should not be reduced.
13. Connecting or joining points must be executed so that the spacing between the conductors, as well as between conductors and other parts without voltage, is sufficient and permanently secured.
14. Comply with the installation plans and technical description during the installation of equipment.

## **5.3 FIRE ALARM SYSTEM**

### **5.3.1 TECHNICAL DESCRIPTION**

#### **5.3.1.1 INTRODUCTION**

Fire protection system complies with relevant provisions of law, regulations, rules, standards and recommendations and especially to:

- The Law on Fire Protection ("Off. Gazette RS", no. 111/2009 and no.20/2015)
- The Law on Planning and Construction, Off. Gazette R. Serbia no. 72/2009
- Regulations on technical standards for fixed installations for fire alarm („Off. Gazette SRJ,, no. 87/93)

#### **5.3.1.2 DESCRIPTION OF STABLE FIRE ALARM INSTALLATIONS**

Stable installation of fire alarm must be designed and constructed in such a manner that proper selection, number and arrangement of fire detectors allow for signalling of fire at the earliest possible stage, with a sufficient safety and security to prevent false alert.

Selection of fire detectors depends on the expected size of fire which can occur in case of fire occurrence, the height of space, the impact of surrounding operating conditions and possible sources of interference.

If in the stage of fire emergence shouldering fire expansion with smoke and little heat and radiation of flame can be expected, smoke detectors must be used.




If in the phase of fire breaking rapid expansion of fire with very high heat release and intensive radiation of flame can be expected, smoke and heat detectors and flame detectors or combinations thereof may be implemented.

Smoke detectors are applied in areas likely to cause damage by smoke, regardless of whether it comes to the preservation of human life or of valuable devices sensitive to smoke.

Correlation between different automatic fire detectors and height of the room must conform to the requirements in Fig.1.

Fig.1

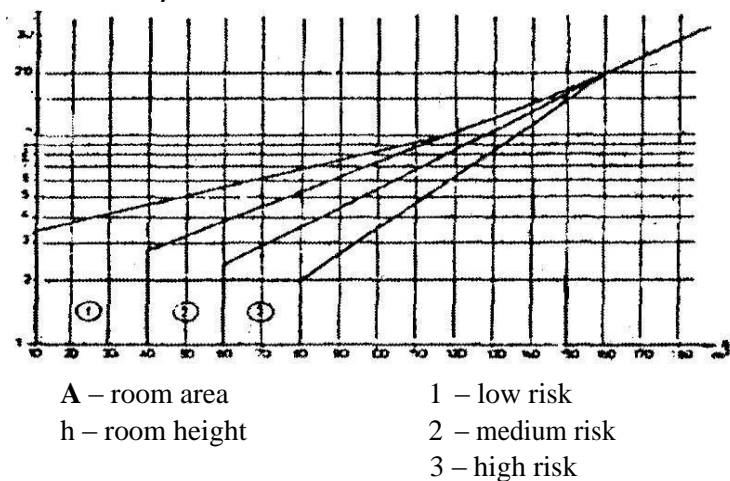
visina prostora, m	dimni javljač	termički javljači			javljač požara
		klasa 1	klasa 2	klasa 3	
20-30					
7,5-20					
6-7,5					
4,5-6					
do 4,5					

LEGENDA  prikladan  vrlo prikladan  neprikladan

The dependence of the smoke detectors in which technical surveillance measures are applied and the height of the area must conform to the requirements in Fig.2.

Fig.2

(FLAME + IONISATION DETECTOR)



Smoke detectors and flame detectors can be placed in a location where the temperature does not exceed +50° C.

The temperature of reacting of thermal detectors must be between 10 and 35 ° C above the highest temperature which can occur naturally or by driving operation around detectors.

In rooms with temperatures below 0°C the smoke detectors are not set. For temperatures below 0° C thermal fire sensors are recommended.

Smoke detectors can be placed in the area in which the air velocity is not greater than 5 m/s, unless if allowed use of detectors for higher speeds as well.

Vibrations must not affect the proper operation of fire detectors. Before mounting the detectors vibrations should be measured and determine potential impacts.

Permitted relative air humidity is up to 95%, but creation of fog and dew in smoke detectors must be prevented. In the implementation of technical measures of control in rooms where there is possibility of water spraying, detectors of adequate protection shall be used.

If in the drive stations there are side effects of smoke, dust or similar aerosols, false alarm of smoke detectors should be prevented by applying filters and covers. Use of thermal detectors is more reliable and safer.

If due to the height of space or other reasons use of flame detectors is inevitable, unwanted effects of light should be prevented by using special curtains or blankets placed on detectors. Taking into account all of the above for this facility we chose optical smoke and thermal smoke detectors.

This project provides the analogue addressable system with one loop for automatic fire alarm, which consists of:

- Addressable switchboard for the fire detection and fire signalling;
- Automatic addressable detectors;
- Addressable manual detectors;
- Alarm sirens;
- Addressable modules;
- Cable installations.

Addressable system means that each detector has its own individual address, so that in case of fire we have accurate information which detector and in which room was activated.

### **Addressable switchboard**

Addressable switchboard is a device for monitoring and control, which is connected to fire alarms and performs light and sound alarm and signalling on fire occurrence to the parallel signaling devices in Fire Services.



*Fig. 1 Addressable switchboard*

Signaling switchboard represents microprocessor device for fire detection at an early stage.

It monitors the entire detection line, the state of detectors, alarm condition and the correctness of the cable connection.

It consists of a low modulus for automatic and manual detectors, the central processing unit, and control module, a module for connection to a computer, 3 programmable relays, 5 programmable inputs, LCD display, and memory up to 1000 events.



Line module in the switchboard allows connecting a maximum of 128 addresses in the detective line.

Switchboard is powered by 230V AC, 50 Hz from the main switchboards of joint consumption (RTZ).

Signaling switchboard includes:

- alarm indicator (red);
- signalizing zone indicator (red);
- ERROR indicator (yellow or white);
- ON status indicator (green);
- OFF status indicator of part of fire alarm system (yellow);
- power indicator from standby power (green);
- device for execution of functional control.

Signaling switchboard is mounted on the wall in the reception desk on the ground floor at the height of 1.5 meters from the floor where provided the presence of trained staff and thus achieved the maximum control for automatic fire device performance.

It is assumed that the facility will be under 24-hour watch, by trained workers and for these reasons voice alarm apparatus is not anticipated. Near signalizing switchboard must be located:

2. plan of alarming;
3. control of books;
4. instructions for use and maintenance of signalizing switchboard.

### **Automatic addressable detectors**

Automatic fire detector is part of the stable installation of fire alarm, which continuously or at predetermined intervals follows suitable physical or chemical changes allowing thus fire detection in a controlled area.

Considering the use of the building, possible fire, speed of expansion of fire and the conditions prevailing in the premises, for automatic detection of fire occurrence the optical smoke and heat detectors are provided.



*Fig. 2 Appearance of addressable optical detector*



*Fig. 3 Appearance addressable thermal detector*

Optical smoke detector has a very stable optical measuring chamber, through which the scattered infrared light registers and measures the concentration of smoke particles in the air.

Optical and thermal detectors are mounted on the ceiling and are equipped with LED bulb that signals the same is active.

Optical detectors are installed in all rooms except in boiler room and kitchen where thermal detectors are installed, expecting false alarms because of smoke and water vapour.

Optical detectors are activated with the appearance of smoke and heat detectors with an increase of temperature over the permitted one.

Automatic fire alarms cover all rooms except toilets and wardrobes.

When choosing the type of detectors the actual and potential impacts have been taken into account:

- Disrupting effects;
- The size and shape of the room;
- The height and shape of the room;
- The flow of air;
- Fluctuations in temperature.

### **Addressable manual detectors**

Addressable manual detector is a manual signalling detector (alarm), which is switched on by a man after fire detection.



*Fig. 4 Appearance of addressable manual detector*

Manual detector is used for manual remote alarm of fire signalling to the central device for signalling fire, without controlling time and thus has a role in fire protection for directly alerting. Manual fire alarms are installed in the basement, ground floor, gallery and all floors at a height of 1.5 meters from the floor where it is easily visible to activate.

Activating the manual alarm is made by breaking the glass, which represents safe alarm.

With each manual alarm written plate must be placed, having precisely indicated the purpose and method of switching on.

### **Alarm sirens**

Alarm siren is a device for alerting (alarming) which in case of fire provides sound and light signals.



*Fig.5 Appearance of conventional siren with strobe light Fig.6 Appearance of conventional alarm siren*

Informing staff about the appearance of fire is carried out by means of sound and light alarm signals transmitted by alarm sirens set in the building.

Sirens with strobe lamp (sound and light signalling) and without strobe lamps are envisaged, which produce sufficient sound level, and their schedule is given in the drawing. Alarm siren is mounted at a height of 2.4 meters from the floor.

### **Cable installations**

Installation is carried out under the Regulation on technical norms for low voltage electrical installations (Official Gazette of the FRY " No.28/1995) and in accordance with SRPS N.B2.751/1986 - Electrical installations in buildings, source and setup electrical equipment, depending on outside influence, according to item 2.4 - Electrical equipment must be performed from a material that blocks spreading of flame and smoke and toxic gases.

The installation of a stable system must meet the following requirements:

- section of cables must be selected to match power consumption of the device used and the requirements with regard to the maximum permissible electric resistance of lines.
- wire thickness in the cable must not be less than 0,6 mm.
- in the use of multi-core cables 10% of reserves is to be left of the number of lines and terminals (joints) in control cabinets.
- not allowed to lay the circuits with power up to 50 V with voltage circuits higher than 50 V together in one tube, cabinet, cable, separate channel or vertical (descending point).
- distribution boxes and cabinets of fixed installations must be marked in red.
- number of connections (connection) should be as small as possible, and each connection is made by soldering or other highly secure mechanical method.
- against electrical effects that interfere with work (electrical interference, lightning, switching on and off of intense consumer, electrical sparks and electromagnetic waves) should be taken appropriate protective measures, such as laying the cables in grounded metal pipes and/or the use of special filters and other protective measures.
- insulation resistance between the line and the line and ground shall be at least 500 kilohms (kΩ).
- for measuring insulation resistance must not be used instruments of voltages higher than 50 V, unless all parts of fixed installations are separated from the line and cable.
- electrical installations and equipment of fixed installations must comply with the area in which are installed (eg. waterproof for tropical conditions, for installation in explosion-endangered areas).
- stable installation of fire alarm systems shall be so designed and constructed that they do not cause radio and/or television interference.

Installation is to be carried out under the mortar and partly in suspended ceilings where the cable is connected with clamps in class E90. Installation for connecting automatic detectors, handheld detectors and addressable modules is provided for the cable type J-H(St)H 2x2x0,8 mm recessed in halogen-free corrugated pipes Ø18 mm, and the siren cable NHXHX 3x1.5 mm<sup>2</sup> FE180/E90. Power of signaling switchboard is 230VAC/50Hz and is done with a cable N2HX 3x1.5 mm<sup>2</sup> from RTPR with separate 16 A fuse marked in red.

Backup power is anticipated with two rechargeable batteries of 12 VDC capacity of 16Ah (72 hours operation in steady state and 30 minutes in alarm state).

Housing of signaling switchboard should be connected to the main potential equalization system (in GRO) multi-cord cable P/F-Y 16 mm<sup>2</sup>.

Scheme of installations is given in the drawing in the appendix, as well as the arrangement of individual elements.

### **The obligatory documentation for stable system for fire alarm**

Certificates on conformity of stable elements of fire alarm system must comply with:

- Law on Fire Protection ("Official Gazette RS", no. 111/2009 and no.20/2015)
- Law on Planning and Construction, Official Gazette R Srbije br. 72/2009
- Law on Occupational Safety and Health, Official Gazette R. Serbia no. 101/2005
- The Law on technical requirements for products and conformity assessment ("Official Gazette RS", br.36/2009)
- Regulation on technical norms for protection of facilities from atmospheric discharge (Official Gazette FRY no. 11/96)
- Regulation on technical norms for hydrant network for fire extinguishing (Official Gazette SFRY no. 30/91)
- Rulebook on technical standards for fixed installations for fire alarm (Official Gazette SFRY" no. 87/93)
- Regulation on technical norms for low voltage electrical installations (Official Gazette FRY no. 28/95 and Official Gazette SFRY no. 53 and 54/88)
- Regulations on the content of elaboration of technical documentation for building construction ("Official Gazette RS", no.15/2008)
- Regulations on technical standards for systems of ventilation or air conditioning (Official Gazette SFRY no. 30/89)
- Regulations on technical standards for access roads, turning platforms and plateaus for fire trucks near buildings with increased fire risk (Official Gazette FRY no. 8/95)
- Regulation on technical requirements for protection of garages for passenger cars of fire and explosion (Official Gazette SME no. 31/05)
- Regulation on electrical equipment designed for use within certain voltage limits (Official Gazette RS, no.13/2010)
- Regulations on safety of lifts (Official Gazette RS, no.101/2010)
- Symbols for designs SRPS U.J1.220. SRPSZ.C0.001 - Protection against fire and explosion.
- SRPS N.B2.730/1984 - Electrical installations of buildings, General characteristics and classification
- SRPS N.B2.751/1986 - Electrical installations of buildings, Source and erection of electrical equipment regarding external influences
- Available investment and technical documentation of investors.

## **6 MECHANICAL INSTALLATIONS**

### **6.1 TECHNICAL DESCRIPTION**

#### **GENERAL NOTES**

The facility is new construction that is being built according to modern methods and with the use of modern materials.

The construction design envisages thermal insulation of building elements according to the standards of thermal protection of buildings.

Premises are situated, as well as rooms of supporting technical services and rooms for housing and maintenance of transport and other means necessary for the operation of the marketplace.