

## TECHNICAL SPECIFICATIONS

## **A. ARCHITECTURE**

### **GENERAL TECHNICAL CONDITIONS FOR WORKS**

#### **1) CONSTRUCTION WORKS**

##### **GROUND WORKS**

Before the beginning of works it is necessary to survey the terrain and to define the relative height elevation  $\pm 00$  in the presence of the supervising engineer, to peg off the building (object) and to check if the routes of the existing installation lines at the construction site and near it collide with the excavation or with the working space of the necessary machinery.

Before the beginning of ground works, the terrain should be cleaned of brushwood and weed or the trees with the diameter of up to 10 cm (if it disturbs the placing of the object or the organisation of the construction site). These works, and also the works on measuring the terrain and marking the building are calculated within the unit prices.

The duty of the contractor is to determine the true composition of the soil, or its category, and to inform the designer if it deviates from the Geotechnical elaborate and/or the project of structure.

The planning of the bottom of a wide excavation and the excavation for the foundation should be performed with the accuracy of  $\pm 3$  cm, what is included in the unit price.

The acceptance of the excavation should be performed in the presence of the supervising engineer. The excavation to a determined depth should be completed before the realization of foundations begins, so that the bed surface of the foundation does not get softened by soaking. The bottom of the excavation, or the foundation, must be placed on a bearable soil regardless of the designed depth of the foundation. Additional excavations eventually needed should be paid in accordance with real quantities.

If the contractor finds any subjects, objects or installations during the excavation of the ground, it is necessary to cease the works on such a place and to inform the investor and the supervising engineer about that.

The excavation of foundation pits should be calculated in accordance with the floors, from 0 to 2 m, 2 to 4 m etc. The excavated material should be disposed at a sufficient distance from the edge of the excavation, to prevent it from falling in.

Supporting, un-supporting and protection of the excavation from precipitation waters by covering it with PVC foils and by making a surface drainage with canals and silt pumps are included in the unit prices.

The material necessary for supporting has to be prepared at the construction site before the beginning of the excavation.

If the excavated pits are damaged, slided down or stopped by negligence or because of insufficient supporting, the contractor should bring them into proper state without any special compensation.

If the contractor has dug below the foundation plane stipulated by the design, it must fill the holes made in such way with CSC 10 concrete to the designed elevation, without any compensation.

The filling of a dug over with gravel is forbidden.

The amounts of ground excavation, transporting and filling are calculated on the basis of the fused condition of the soil.

If it is not stated differently in a paragraph of bill of quantities, the transporting of ground includes the transporting to the city rubbish-heap or depot.

##### **CONCRETE AND REINFORCED CONCRETE WORKS (BAS EN 206-1:2002)**

All the concrete and reinforced concrete works must be performed solidly and professionally, in accordance with the Book of regulations on technical measures for concrete and reinforced concrete and other regulations.

Materials for concrete:

- the cement for making structures of visible concrete should come from the same manufacturer, and the aggregate should be of the same composition during the entire construction process, so that the colour does not change. The cement stored at the construction site for more than 3 months must not be used for making the concrete unless the testing determined that it corresponds to stipulated conditions in terms of quality;
- the aggregate for concrete must be natural gravel and sand or an aggregate made by crushing stone. Basic characteristics that an aggregate for concrete must satisfy are the following:
  - maximal dimension of a grain of an aggregate (D) is limited with  $1/3$  of the dimension of the elements to be concreted, or not bigger than the smallest space between the armature sticks in a horizontal row. For the preparation of concrete, only an aggregate for which has been confirmed by an attest to have the properties in accordance with the Book of regulations on CRC may be used;
  - granulometric composition must ensure favourable ability to be built in and compactness of the concrete. On the construction site, the contractor is obliged to test an amount of very fine particles of the aggregate, and also its granulometric composition;

- drinking water is considered to be favourable for making concrete. For reinforced concrete structures, sea water must not be used for concreting, because of the armature corrosion;
- before laying down, the armature must be cleaned of rust and impurities. Before the concreting, the placed armature should be checked by the construction site foreman and the supervising engineer, and also by the structural engineer, by the decision of the supervising engineer. The built-in armature is calculated for smooth and ribbed armature: separately up to the diameter of 12 mm and over 14 mm in kg, and for nets by kg and by type of net.

The concrete for making structures must be mixed mechanically to ensure its homogeneousness.

If the temperature of air is over 20°C, the concrete should be built in within 30 minutes or the time until the beginning of binding should be prolonged by additions. Concrete should be transported in a way and under the conditions that prevent segregation.

Ground-wet concrete should be tamped and plastic concrete vibrated (wainscoted and needled vibrator). The cessation of concreting at specific concrete and reinforced concrete structures may be performed only at those places stipulated by design elaborate. In the case that a forced cessation of concreting occurs, the contractor is obliged to take the measures for such a cessation not to have negative effects on the static properties of the structure. During the transporting, installation and in the initial period of binding after installation, fresh concrete must be protected from all atmospheric influences (sun, frost, wind and other inconveniences, and also from unpredicted loads and shocks).

Water must not be subsequently added to fresh concrete. Concrete must be cured at least 7 days from the day of installation, or until the built-in concrete achieves at least 70% of stipulated strength. If the temperature of the surrounding air at installation is lower than 5°C, the concrete must not be built-in, unless special protective measures are taken. Final surface should be left rough, unless the item description states differently.

The additions to concrete improve particular features:

- accelerate binding and hardening,
- slow down binding and hardening,
- resistance to freezing during binding (at low temperatures)
- impermeability, etc.

The strength of concrete is determined by the project of structure. Every position of reinforced concrete elements is defined in statistic calculation, armature plan and bill of quantities, and it had its own compressive strength of concrete (CSC). Besides that, a design may present specific requirements for other characteristics of concrete (wear resistance, impermeability, frost resistance etc.).

The smallest amount of cement for making reinforced concrete is 250 kg/m<sup>3</sup> of built-in concrete, if the concrete is exposed to atmospheric influences the minimal amount of cement is 300 kg/m<sup>3</sup> of built-in concrete. The amount of water should be sufficient for the concrete to get well-compact in relation with the conditions of building in. Because of that, it is necessary to control the water-cement factor all the time by measuring and checking the consistency of concrete. Pressure hardness of concrete is tested on cubes with a side of 20 cm that have been kept in water or at least in 95 - percent relative humidity, at the temperature of 20°C ± 3°C. Characteristic pressure hardness is the value under which not more than 10% of all pressure hardness values of the tested concrete (10-percent fractile). The compressive strength of concrete is nominal pressure hardness, in MPa that is based on the characteristic hardness at the concrete being 28 days old. During the building-up of an RC construction it is necessary to take samples of concrete to be delivered in an authorised laboratory for attesting. The samples of concrete taken in a concrete factory are not relevant because of the possibility to decrease the hardness by subsequent addition of water for the needs of transporting.

Mounting and semi-mounting reinforced concrete elements

Minimal compressive strength of concrete for mounting elements is 20. The quality of concrete joints must be of at least the same quality as that of the concrete elements to be joined. Mounting elements must be stored and transported in a way which prevents extreme tension or damage. All partly cracked elements must be removed. During the mounting, the elements must be joined and supported.

For semi-mounting ceilings (omnia slabs, fert small beams and fillings, pre-stressed small beams and fillings.....), supporting of slabs or small beams in accordance with the manufacturer's instructions should be provided. Armature, pressure slab concrete and ribs for rigidity should be made in accordance with the statistic calculation.

Framework and wainscot must have such a safety and rigidity that they can receive burdening and influences that occur during the performing of works without harmful deformations. They must be made in a way that ensures compete safety of workers and means of work, and also the safety of passers-by, traffic, neighbouring objects and the environment.

Before the concreting, the wood wainscot must be well cleaned, soaked, and the smooth one oiled. It is also necessary to check the dimensions and the quality of making. The wainscot may be removed only after the built-in concrete gets adequate hardness, at the instruction of the supervising engineer. The removal of wainscots should be performed

carefully so that the structure is not damaged, especially thin reinforced concrete elements (lintels with a tooth, bangers, fences etc.).

The calculation of the amount of concrete is voluminous ( $m^3$ ), of wainscot in surface ( $m^2$ ), and of armature per weight (kg). The cross sections of a structure are divided in small (up to  $0,12 m^3$  of concrete per  $m^2$  or  $m^3$  of a structure), medium (up to  $0,3 m^3/m^2$  or  $m^3$  of a structure) and big (bigger than  $0,3$  of concrete on a  $m^3$  of concrete per  $m^2$  or  $m^3$  of a structure).

The beams are also calculated over the column per length.

Lintels are calculated in the length of the opening, including the leaned part.

Reinforced concrete slabs are calculated from bed to bed, in a light span. Concrete bases are calculated in  $m^3$ .

On the calculation of walls, all openings are subtracted, regardless of size, except the openings for the passage of pipes.

### **BRICKLAYER WORKS (GN 300 Norms and Standards for Works in Civil Engineering – High Rise Construction)**

Bricklayer works must be performed solidly and professionally, in accordance with current regulations and the rules of good craft.

During the making of walls of buildings, the constructor must stick to the following measures:

- bricklaying must be done with regular bricklayer bindings, and the overlap must be at least one quarter of the length of a wall element.
- the thickness of beds must not be bigger than 15 mm, and the width of bumpers must be neither smaller than 10 mm nor bigger than 15 mm, if the bricklaying is done in winter, the walls should be protected from frost.
- The walls the making of which has not been completed before winter frosts must be protected in an adequate way,
- Every subsequent drilling or making of grooves in the walls of a building that has not been stipulated by the design may be performed only if a previous static calculation has determined that the carrying capacity of the wall after the drilling or grooving is not smaller than the stipulated carrying capacity.
- lateral and longitudinal walls must be interconnected with bricklayer binding at joint, that is, for partition walls, teeth must be released in a massive wall at every second row for  $\frac{1}{2}$  of a brick.
- the walls by the vertical belt course should also be made in teathed manner.
- external joints should be left blank from 1,5 to 2 cm for binding the mortar at plastering of walls.
- during the bricklaying, bricks should be moistened with water, and at bricklaying with cement mortar bricks must lay in water right before bricklaying.
- the walls of chimney and ventilation canals should be smoothed.
- During the bricklaying, the openings in accordance with the bricklayer measures should be left in time, care should be taken of installation of particular construction elements, leaving grooves for sewage system and for central heating if they are drawn in (it is not to be paid separately, it comes within the unit price).

Closing (plastering of slits, grooves etc.) beyond the laid installation is also not to be charged separately.

Walling in (closing) of grooves in the walls left for sewage system and heating installations after performing the installations, with brick or in another way, is not to be paid separately, unless the bill of quantities sets it separately.

The calculation of carrying walls, columns and chimneys is voluminous ( $m^3$ ), and of partition walls and mortar is on the basis of surface ( $m^2$ ).

### **HYDROINSULATION WORKS (GN 561 Norms and Standards for Works in Civil Engineering – High Rise Construction)**

The works include the hydro insulation of basements and foundations, and the hydro insulation in bathrooms on the floors of a building. Other hydro and thermal insulations are included in covering, tinsmith and other craft works.

All the hydro insulation works must be performed solidly and professionally, in accordance with current regulations and the rules of good craft.

Bitumen based hydro insulation is performed as coatings and as coatings with insulation tapes (pasteboards).

Insulation pasteboard and other types of insulation tapes and slabs should be cut even and right angled. Torn and patched pieces are excluded from installation. All overlaps must be at least 10 cm wide and glued with bitumen – cold bitumen mass or hot bitumen insulation mass. At laying down two or more layers of insulation tapes or slabs, the overlaps must not lay one at another but have to be moved.

At the hydro insulation of walls, the pasteboard must have a 10 cm wide over-spread at every side of the wall that should be connected with the horizontal insulation of floors.

The surfaces on which insulation is laid down should be completely flat, dry, cleaned of dust and impurity and smooth enough, so that the insulation adheres well. The insulation should adhere to the surface even, without wrinkles and bubbles.

Special attention must be paid to fire protection at work with hot bitumen coatings and welded pasteboards because of great flammability of bitumen. In the case of fire, it should be extinguished with sand or foam. Extinguishing with water is dangerous because of hot bitumen splashing.

Hydro insulation based on penetrating coatings (siliceous basis) is applied right after the binding of concrete, that is, after the removal of wainscot. Humidity and acidity of a concrete base should be checked by the contractor and the composition of the coating should be accorded with the quality of the base.

Impure bases (soil, oil, etc) should be cleaned mechanically and with water, and also with means stipulated and allowed by the coating manufacturer. The number and way of applying the coating in accordance with the manufacturer's instructions.

The joint of horizontal and vertical insulation should be performed with swelling putties, after both coatings have been made.

Bitumen hydro insulation and hydration with penetrating coatings are calculated per  $\text{m}^2$  of surface, except for installation of swelling putties that is calculated per  $\text{m}^1$ .

## **CARPENTRY WORKS**

All carpentry works must be performed solidly and professionally, in accordance with current regulations and the rules of good craft.

Carpentry works include wooden structures of roofs and ceiling, made of standard lumber, that is, planks and beams.

Wooden structures made of glued girders, spatial wooden constructions and other structures made of latticed girders are described in a special paragraph, separately from the work with lumber.

The material for making carpentry structures is 2<sup>nd</sup> class softwood (spruce, pine, fir), and, in extreme situations, if such thing is stipulated in a paragraph of the bill of quantities, some hardwood (oak).

Carpentry structures should be made of dry lumber (up to 30% of technical moist). The dimensions of cross-sections are determined with structure project and should correspond to standard cross-sections of lumber, i.e. for beams from dimensions 10 x 10 cm with an increase of 2 cm to maximal dimensions of 24 cm; for structures made of planks maximal height of the cross-section is 26 cm.

Joints of structural elements should be made in accordance with the design and the rules of good craft for every type of described structure (carpentry joints, nailed joints, node sheet metals).

Carpentry works are calculated per  $\text{m}^2$  of ground-plan surface of a structure and compulsory on the basis of description and drawing, except at structures with latticed girders where it is calculated per  $\text{m}^1$  of a girder, i.e. in accordance with the sum of vertical projections of girders at the total surface of roof truss.

The duty of the contractor is to use the drawing and description to calculate the necessary amounts of lumber, work and transporting that all enter within the unit price. The lumber is delivered unprotected unless a description of a paragraph stipulates anti-insect coating or deep penetration of lumber. The lumber is delivered being machine-cut, except if a special paragraph demands it to be planed, too.

Wainscots made of planks, rigid slabs and chipboards, and also the wainscots of pediment eaves and similar should be made of lumber with stipulated moisture and joined with non-corrosive, galvanic-protected external means.

Floor wainscots of rigid slabs, shipboards or planks should be glued on beams, i.e. planks, if such thing is demanded in the design of structure.

## **METAL STRUCTURES**

Steel structure should be made in workshop, on the basis of architectural design, static calculation and working drawing, of rolled steel profiles, seam and seamless (drawn) pipes, cold-formed profiles and slab-like sheet metals.

Quality marks of standard structure steels are Fe 360, Fe 430, Fe 510 (the marks correspond to flow expressed in  $\text{N/mm}^2$ ).

The elements of a steel structure must be protected from corrosion.

Before applying the protection, all steel elements are sanded.

Corrosion protection can be performed by:

- organic coatings (fundamental and final),
- metal coatings (zincing, galvanizing, metalizing),
- non-organic coatings (enameling, phosphating, bromination),
- cathode protection (structure is under a small voltage and serves as a cathode).

Special steels (alloys of steel and noble metals – copper, nickel and chrome) are 4 – 6 time more resistant to corrosion than normal steels, and can be used without protection in non-aggressive atmospheric conditions (their names are Inox, Rostfrei, Stainless Steel).

The joints in metal structures are performed in workshops or at mounting, as stipulated with the design.

Workshop binders are different types of welds with stipulated thickness of a weld, quality of making, way of welding and way of welding quality control.

Mounting joints are performed with bolts.

The bolts in a steel structure are marked on the basis of the class of hardness from M-12 to M-30.

Pre-stressed bolts are made of special steel and are used for joints of dynamically burdened structures. By tightening the nut of a bolt a great force occurs in the body of the bolt together with lateral pressure force on sheet metals in the joint, that prevents deformations, and because of that it is necessary to control the tightening of bolts with so called torque wrench. The static calculation stipulates the carrying capacity of bolts, number of bolts and their arrangement and mounting order.

The stability of a structure during the mounting is achieved by additional pressed and tightened elements (supports and tighteners with necessary lifting cables and binding clamps.

On the basis of the weight of the structure, the carrying capacity of a crane and the way of mounting are stipulated, what is specified by the steel structure design for the order of mounting.

Mounting extensions structure bearings on sub-structure heads and steps of steel columns are stipulated by working drawings.

The order of mounting stipulates global stability of the structure at all stages of mounting.

Before the beginning of mounting works, the contractor should present to the supervising body the following documentation:

- the plan of organization and arrangement of a construction site,
- the list of equipment for the contractor of mounting works,
- the steel structure mounting design, that must contain the proof of stability of an element at particular stages of mounting, provided that it guarantees carrying capacity at burdening and invariance in form of the mounted piece of structure at all stages of mounting,
- the plan of control in all stages of mounting (geodetic control),
- at structures mounted by welding
  - a) name and professional degree with passed vocational exam of the person responsible for mounting by welding
  - b) the technology, welding plan with weld control plan (the same as stated for works in making a steel structure).
  - c) the design of framework
  - d) time plan of mounting works performance.

Before the beginning of mounting works, the contractor of works should examine the delivered steel structure at the construction site and determine if any damage occurred in transporting, and fix the parts that are slightly damaged, and at bigger damages strengthen or remove the parts.

For the parts of steel structure and anchor to be built-in in concrete, after mounting a geodetic control of the position accuracy should be done. The results of measuring, deviations within the tolerance limits of measures and shapes in accordance with the regulations should be recorded in written form, together with receiving of built-in parts. The record is undersigned by the contractor of works and the supervising organ.

At steel structures that are placed on bearings, the contractor of works should adjust the steel structure in the position stipulated by design, and call the supervising organ to examine the structure, provided that the organ has an insight into the result of measuring and control. By making a record in the construction journal (mounting journal), the supervising organ determines that the adjusting of the steel structure or the part of the steel structure completes and allows the installation of micro-concrete (CSC 30) under the bearings of columns and around the anchor.

Fire protection is executed with stipulated protective coatings (Pyrostop), sprayed protections of plaster of Paris or cement with expanding vermiculite, perlite or mineral wool, and protective linings of plaster slabs, brick and concrete linings.

In accordance with the regulations, the degree of fire protection of a steel structure is determined, expressed in minutes of resistance of the structure to standard fire (the degree of protection is stipulated by the fire protection design within the main design - 30, 60, 90, 120 min).

## **2) CRAFT WORKS**

### **TINSMITH WORKS**

All tinsmith works must be performed solidly and professionally, in accordance with current regulations and the rules of good craft.

Tinsmith works include all kinds of covering and bordering with tin, and also the making and mounting of grooves, vertical drainpipes and ventilation pipes.

They are divided on the basis of sheet metal types:

- galvanized sheet metal 0,50 – 1 mm,
- zincd sheet metal 0,50 – 2 mm,

- zincotit (zinc titanium) 0,50 – 0,8 mm,
- zinc tin 0,50 – 1 mm,
- copper sheet metal 0,50 – 2 mm,
- lead sheet metal 0,50 – 3 mm,
- aluminium sheet metal 0,50 – 3 mm, anodized or coated
- polyethylene type elements for grooves and vertical drainpipes

Before the beginning of works, the contractor is obliged to check all structure elements on or to which the sheet metal parts attached and to deliver in written form to the ordering party all the remarks concerning possible faults, especially in case of: inadequate choice of designed material and badly solved way of binding the sheet metal parts for construction works.

The parts of different material must not touch each other because that may lead to corrosion. The steel elements for attaching zinced or galvanized sheet metal must be galvanized unless the description of work stipulates some other protection (placing of pads made of lead or plastics which are resistant to acids or alkalis).

For copper sheet metal, the firming of copper or copper steel should be applied. For the firming (hooks, rivets, riders, nails, bolts etc.), there should be applied:

- for steel sheet metal – steel fasteners,
- for galvanized, zincotit, zinc tin and lead sheet metal – well galvanized fasteners,
- for copper sheet metal – copper fasteners,
- for alu sheet metal – alu or galvanized steel fasteners,

Composition and fastenings must be performed in a way that enables the elements to dilate freely at thermal changes, still remaining impermeable. They must be safe of damages that may be caused by wind etc.

Under the sheet metal that is placed on concrete, wood or plaster of Paris, a layer of bitumen pasteboard should be placed, the delivery and placing of which are included in the unit price.

Covering works with sheet metal

Standing joints made all over the inclination must be double, i.e. with two bends, at least 25 mm high. The joints parallel with eaves must be double bended and laid down.

At flat galvanized sheet metals (roof pitch below 15°) 25 mm wide overlaps must be soldered.

At copper sheet metals soldering is not allowed.

In covering a roof with galvanized sheet metal in bands, the sheet metal must be bent at right angle. Lateral joints must be made as laid-down ones with a minimal width of 20 mm.

Corrugated sheet for covering may be made of zinced, galvanized or alu sheet metal with minimal thickness of 0.7 mm. The overlap must be at least 150 mm.

Bugger roof valleys must be covered as roofs.

At lengths longer than 4 m, 100 mm wide overlaps must be made.

Penetrations in metal covering (fastening of chimneys, dome pipes etc.) must be made with special care at galvanized sheet metal by means soldering, and at copper one by means of double laid-down edge tied impermeably with covering. The calculation is per surface or length, with stating of developed width, and per piece for chimney caps, compound borders etc.

## COVERING WORKS AND INSULATION OF FLAT ROOFS

Covering and insulation works include all works needed to create hydro insulation on slope and so called plane roof surfaces (except sheet metal coverings that are included in tinsmith works).

In these works, necessary preliminary works have also been described (e.g. lathing, formation of a ventilation layer under roof tiles, installation of thermal insulation layer at integrated flat roofs etc.).

Before the beginning of works, the contractor is obliged to examine the bases and warn on eventual faults.

Covering works – sloped roofs

Works are performed with brick (canals, plain tile, pressured tile, Mediterranean), concrete, asbestos-cement, metal, stone wooden, and elements of bitumen shingle. The colour of covering elements is defined by designer.

All covering elements must be used at pitches allowed by the manufacturer, and built-in in accordance with the manufacturer's instructions, current regulations and the rules of good craft.

If that is described in the bill of quantities, within the unit price the contractor of these works should make the needed base of final covering, i.e. lathing, wainscot and additional hydro insulation with pasteboard or glue freely laid down.

Insulation works – flat roofs

All the insulation works must be performed solidly and professionally, in accordance with current regulations and the rules of good craft.

Insulating works include hydro insulation of flat roof surfaces and their thermal insulation if there is an integrated flat roof.

Hydro insulation on the basis of bitumen is made as coatings and as coatings with insulation tapes (pasteboards).

The hydro insulation that consists only of coating should be made in accordance with the manufacturer's instructions, with respect to all physical, chemical and climate conditions.

Insulation pasteboard and other types of insulation tapes and slabs should be cut even and right angled. Torn and patched pieces are excluded from installation. All overlaps must be at least 10 cm wide and glued with bitumen – cold bitumen mass or hot bitumen insulation mass.

At laying down two or more layers of insulation tapes or slabs, the overlaps must not lay one at another but have to be moved.

At the hydro insulation of walls, the pasteboard must have a 10 cm wide over-spread at every side of the wall that should be connected with the horizontal insulation of floors.

The surfaces on which insulation is laid down should be completely flat, dry, cleaned of dust and impurity and smooth enough, so that the insulation adheres well.

The insulation should adhere to the surface even, without wrinkles and bubbles.

Special attention must be paid to fire protection at work with hot bitumen coatings and welded pasteboards because of great flammability of bitumen. In the case of fire, it should be extinguished with sand or foam. Extinguishing with water is dangerous because of hot bitumen splashing.

At flat roofs which are constructed in such a way that the hydro insulation is placed above the thermal insulation, there are two possible cases:

- a) hydro insulation is laid down on hard thermal insulation placed above the layer for fall (toward the water-catching neck),
- b) hydro insulation is placed on the layer for fall that stands above the thermal insulation. Steam barrier and steam-relief layer should be spot-glued and irradiation, either by pipes or at edges near annexes must be enabled.

At roofs which are structured in such a way that thermal insulation is above the hydro insulation, the overheating or freezing of thermal insulation is to be prevented.

Steam barrier and steam-relief layer should be laid down the same as at integrated roofs. That is the best construction of a flat roof, but its durability depends on the quality of thermal insulation layer that must be resistant to freezing and overheating and must not be hygroscopic not to lose thermal features.

Bitumen hydro insulation is calculated per m<sup>2</sup> of surface, water-catching necks are calculated per piece, and final profile per m<sup>1</sup>.

Concrete for fall and eventual placing of thermal insulation under it are described and calculated in final bricklaying works.

## JOINERY WORKS

Joinery works must be performed solidly and professionally, in accordance with current regulations and the rules of good craft.

Exterior joinery is made of 2<sup>nd</sup> class softwood (pine, larch fir spruce), and in extreme circumstances of oak wood and exotics, and interior is also made of chipboard, hardboard etc.

Exterior joinery consists of windows, doors, walls, slats, blinds and boxes for blinds and is made as single, double (joining window, with spaced casements), full (doors), single glazed or glazed with iso-glass. Interior joinery consists of doors and internal walls. It can be full (smooth or logged), and glazed. Handrails and fences may also be a part of joinery and are mostly made of massive or laminated wood.

Window/doors are single or multi sash elements within a frame.

Wall is a multipart surface tied to a complex frame construction.

Types of doors according to the way of opening:

- rotational
- parade
- circular
- lifting sliding
- suspended sliding
- telescopic
- folding doors with edge suspension
- folding doors with suspension in the middle
- lifting
- lifting lamellar
- corrugated.

Types of windows according to the way of opening:

- rotational (around the edge vertical axis),
- tilt (around the lower horizontal axis),



- shutter (around the upper horizontal axis),
- upturning (around the horizontal axis in the middle),
- screw (around the vertical axis in the middle),
- sliding
- vertically shear.

The windows or panes that are not to be opened are marked as fixed.

Protection of joinery: by colouring (impregnation, puttying, grinding, colour, enamel varnish) or by coatings (2 x azure, 1 x protective coating).

Hardware of windows and exterior joinery:

- socket loops
- French loops
- cylindrical loops
- rotational hardware
- hardware for lifting balcony doors
- hardware for lifting slide walls
- hardware for hangings side walls
- semi-olives (locks with a tab)
- olives
- latches
- ventuses
- socket locks
- catches, rosettes, shields
- cylinder locks

Hardware of interior doors:

- socket loops,
- French loops,
- cylindrical loops,
- hinge loops,
- piano loops,
- floor pumps,
- bomer loops,
- suspending guides,
- socket locks,
- catches, rosettes, shields,
- cylinder lock.

Exterior joinery is built-in with wet or dry procedure (installation on blind frames, or expanding foam). In the case of wet installation, the joinery must be protected (with PE foil).

Making and obtaining of blind frames, and also the making, obtaining and mounting of doorposts and window frames, same as adding of sashes is described and calculated in final bricklaying works. In wet procedure, the joint of exterior joinery and wall is packed with plaster of Paris and building on access, and in dry procedure with bituminised sponge (bitrax) and permanently elastic putties. At standard purposes of objects, it is not necessary to pack the interior joinery at the joint with wall.

In dry installation, exterior joinery can be finally processed in workshop. In wet procedures, it is necessary to impregnate the joinery before installation. Bricklayer measure is the inter-space of structural elements. Modular measure is the space between modular planes which is smaller than the bricklayer measure. Joinery measure is a real exterior measure of a joinery element that should be smaller than the modular measure. Light joinery measure is used at doors and it marks clean space between the doorposts, i.e. between the floor and the lintel.

The difference between the bricklayer and modular measure in classical wet building should be 2 cm, and at mounting one it can be 0,5. The difference between modular and joinery measure should be from 0,3 to 2 cm.

The materials for making joinery (pine, fir, spruce) must not have the following errors:

- spiral growth above 3 mm at the length of 1 m (3%),
- crushes of heart because of drying and frost.

The allowed errors of wood are:

- healthy small bumps of up to 20 mm, two at every starting meter or not more than up to 1/3 of thickness.
- small not-coalesced patched bumps of up to 20 mm, 2 per a running meter,
- small coalesced and not-coalesced bumps of up to 6 mm at softwood and 10 mm at hardwood, unlimited,
- small resin holes of up to 5 mm of width and 50 mm of length per 1 m at one side,

- small longitudinal cracks that must not run obliquely through the element and must not be longer than 50 mm,
- blueness of up to 25% of surface,
- spiral growth of up to 2%.

Rotational doors or a window sash are left if they are shackled from the left side, i.e. if they open in the direction of negative rotation (clockwise).

Joinery elements are made on the basis of schemes and details, and in agreement with the designer and supervising organ, and marked with the number of a cost estimate paragraph. The contractor is obliged to make a working drawing for every position that is to be delivered to the designer to be certified, and all that must be completed before the beginning of making.

The calculation is per piece.

## **LOCKSMITHS WORKS**

Locksmith works must be performed solidly and professionally, in accordance with current regulations and the rules of good craft.

Construction locksmith is made of standard drawn steel pipes and L profiles, and also of steel profiles formed in accordance with factory details and steel sheet metals  $d = 0,7 - 4$  mm.

Construction locksmith can also be made of drawn aluminium profiles formed in accordance with factory details that enable the making of windows with or without interrupted thermal bridge, and of aluminium sheet metals.  $d = 0,7 - 3$  mm.

Construction locksmith is rarely made of brass and stainless steel (inox).

Exterior locksmith consists of windows, doors, walls, slats, blinds, shutters and boxes for blinds and shutters. It is made as a single one with interrupted thermal bridge (aluminium structure only) or without interrupted thermal bridge (aluminium and steel). It is glazed with single or thermal insulation glass.

Interior locksmith consists of doors and internal walls, and also of fences, handrails, bars, covers for revision panes, consoles for flags etc. Window/doors are single or multi sash elements within a frame, that can have one vertical and one horizontal bar.

Wall is a multipart surface tied to a complex frame construction.

Suspended facades are integral technological solution of facade protection that are suspended in front of the carrying structure and are described in B XIV.

Types of doors according to the way of opening:

- rotational
- parade
- circular
- lifting sliding
- suspended sliding
- telescopic
- folding doors with edge suspension
- folding doors with suspension in the middle
- lifting
- lifting lamellar
- corrugated.

Types of windows according to the way of opening:

- rotational (around the edge vertical axis),
- tilt (around the lower horizontal axis),
- shutter (around the upper horizontal axis),
- upturning (around the horizontal axis in the middle),
- screw (around the vertical axis in the middle),
- sliding
- vertically shear.

The windows or panes that are not to be opened are marked as fixed.

Protection of steel locksmith: by zincing and thermal varnishing (in factory), by anticorrosive basal colours (workshop or construction site).

Protection of aluminium locksmith: by anodizing, by thermal varnishing in factory or by plastic coating, also in the factory.

Protection of brass: by polishing and varnishing.

The protection of stainless steel is not necessary.

Hardware of windows and exterior locksmith:

- cylindrical loops
- rotational hardware
- hardware for lifting balcony doors
- hardware for lifting slide walls
- hardware for hangings side walls
- semi-olives (locks with a tab)
- olives
- latches
- ventuses
- socket locks
- catches, rosettes, shields
- cylinder locks

Hardware of interior doors:

- cylindrical loops,
- floor pumps,
- bomer loops,
- suspending guides,
- socket locks,
- catches, rosettes, shields,
- cylinder lock.

Exterior steel locksmith can be installed with wet procedure, and the others cannot, because of the aggressiveness of cement and lime.

In wet procedure, the joint of exterior locksmith and wall is packed with additional bordering after the making of plaster of Paris and with permanently elastic putties, and in dry procedure with bitumenised sponge (bitrax) and permanently elastic putties.

In dry procedure, the locksmith is installed on a blind frame that is principally made of galvanized steel profiles at aluminium, brass and inox locksmith.

At standard purposes of objects, it is not necessary to pack the interior locksmith at the joint with wall.

Exterior aluminium locksmith is protectively processed in factory (anodized or thermally varnished) and it should be protected with PE foil by the end of all works on a building.

Bricklayer measure is the inter-space of structural elements.

Modular measure is the space between modular planes which is smaller than the bricklayer measure.

Locksmith measure is a real exterior measure of a joinery element that should be smaller than the modular measure.

Light locksmith measure is used at doors and it marks clean space between the doorposts, i.e. between the floor and the lintel.

The difference between the bricklayer and modular measure in wet building should be 1- 2 cm, and at mounting one it can even be 0. The difference between modular and locksmith measure should be from 0,3 to 1 cm.

Rotational doors or a window sash are left if they are shackled from the left side, i.e. if they open in the direction of negative rotation (clockwise).

Locksmith elements are made on the basis of schemes and details, and in agreement with the designer and supervising organ, and marked with the number of a cost estimate paragraph. The contractor is obliged to make a working drawing for every position that is to be delivered to the designer to be certified, and all that must be completed before the beginning of making.

The calculation per piece, and small elements made of standard metal profiles also per weight.

## **FINAL BRICKLAYING WORKS**

Final bricklaying works must be performed solidly and professionally, in accordance with current regulations and the rules of good craft.

They include the making of dividing walls, cement glazes, floating floors, interior and exterior mortar and pebble-dash, installation of doors and windows and installation of mounting chimneys and ventilation canals, i.e. all bricklaying works to be done after the formation of primary structure of a building.

During the making of building walls, the contractor must stick to the following measures:

- bricklaying must be done with regular bricklayer bindings, and the overlap must be at least one quarter of the length of a wall element.
- the thickness of beds must not be bigger than 15 mm, and the width of bumpers must be neither smaller than 10 mm nor bigger than 15 mm,
- if the bricklaying is done in winter, the walls should be protected from frost.

- The walls must be connected with bricklayer binding joint, i.e. for dividing walls teeth should be let or the connecting should be done by anchoring with metal joint bars.
- during the bricklaying, bricks should be moistened with water, and at bricklaying with cement mortar bricks must lay in water right before bricklaying.
- During the bricklaying, the openings in accordance with the bricklayer measures should be left in time, care should be taken of installation of particular construction elements, leaving grooves for sewage system and for central heating if they are drawn in (it is not to be paid separately, it comes within the unit price).
- Closing (plastering of slits, grooves etc.) beyond the laid installation is also not to be charged separately.

Plastering with mortar should be done only when the walls are dried and the building is subsided. It must not be done when there is a danger of freezing or extremely high temperatures of 30° or more.

Before the plastering with mortar, the walls must be clean and joints hollowed out, so that the mortar can attach well. Before the plastering, it is good to moisten the walls, especially at cement mortar.

If there is saltpetre appearing on the walls, it should be cleaned with brush and washed with hydrochloric acid diluted in water (ratio 1:10) at the cost of the contractor, and a substance to prevent the appearing of saltpetre should be added to mortar.

The first stage of plastering with mortar is always the throwing of rough spurt (sharp sand, cement, water) to be done with trowel. Rough mortar should be thrown on rough spurt, to define the plane of plastered surface. Fine mortar is used only for smoothing the surfaces. It should be made in such a way that the surfaces are completely flat and smooth, and angles, edges, joints of wall and ceiling are made sharply, unless the bill of quantities stipulates differently.

For installing the horizontal grid the knitting of galvanized wire 0,7 to 1 mm, with the field density of 10 mm should be used. It can be square or multi-angular, and at glazes and floating floors, an armature grid up to strength Q 203 may be used.

In processing a facade with noble mortar, it should be scribbled or sprayed (hirofa). The mortar must be quality, factory-made in chosen colour and quality.

At making facade mortars, it should be done in accordance with the manufacturer's instructions.

At traditional mortars (smooth, sprayed, scratched) the making is in the following stages:

1. cleaning of base,
2. rough spurt,
3. final layer (fine mortar + sanding, fine scratching)

The other name for scratched mortar is scribbled and for sprayed is hirofa.

The calculation is per m<sup>2</sup>, m<sup>1</sup> and piece.

## **GYPSUM PLASTERING WORKS – DRY CONSTRUCTION**

Gypsum plastering works must be performed solidly and professionally, in accordance with current regulations and the rules of good craft.

They include the making of lightweight mounting and mounting-demounting ceilings, of dividing walls and floating floors from construction slabs with plaster as the main component.

Gypsum plaster slabs are produced as smooth or perforated, with thickness from 1,5 to 4 cm and dimensions from 40 x 4 cm to 60 x 60 cm and placed on metal substructure.

Gypsum cardboard slabs consist of plaster with thickness of 9, 12,5 and 15 mm, which is at both sides protected/reinforced with cardboard.

They are made as:

- standard (GK) – for dry spaces
- moist proof (GKI) – for moist spaces
- fireproof (GKF) - for linings of fireplaces and for forming firewalls.

They are produced in dimensions of 122 X 244 to 366 cm, and they can be formed in compact full smooth surfaces by placing at metal galvanized structure and adequate processing of joints (with special putties and glues).

Acoustic perforated slabs are also produced, and they are mounted and processed (edges) as the smooth ones.

Pointing up of joints and chiselling is included in the price of gypsum plastering works and, at the end of works, the gypsum cardboard slabs are completely ready for colouring without any need for painting preparation of a wall.

It is necessary to process the joint with mortar with special elastic putties to prevent cracking.

The calculation is on the basic of surface and volume if it is about the joint with mortar or any other different material.

## **GLAZING WORKS**

The contractor should use a material the properties of which (type, colour, quality) must be identical to the specimen chosen by the designer among the specimens suggested per the contractor.

The material stipulated for making is stipulated in the paragraphs of the bill of quantities.

Window glass (3 – 4 mm) and tempered glass (6 – 10 mm) must be of uniform thickness, machine-made, completely transparent, without waves or bubbles, showing the image without deformations.

Ornamented glass must be of uniform thickness (5 – 6 mm) and suit to the specimen chosen by the designer.

Reinforced glass (6 – 7 mm) should have a uniformly distributed grid, uniform thickness, and it must not have waves or bubbles.

Thermal insulation glass consists of two pieces of glass with thickness  $d = 4$  mm and a gap of 12 mm, unless something different is stated.

Laminated glass ( $4 + 4 = 8$  mm, to  $5 + 5 + 5 + 5 = 20$  mm) must have a visible mark about the number of layers, total thickness and the attest on impact resistance.

Joiners and glaziers will make an agreement on grooves for glass for every single item, depending on the thickness of glass. It should be wide enough for the glass to be inserted into putty.

All the glazing is performed with the help of wooden, steel or aluminium putty lathes, given by the joiner or locksmith together with necessary bolts, and packing is done with plastic putty, which is at joinery in the colour of wood.

Before the beginning of works, the contractor must determine the quality and check the measures of openings for joinery and locksmith works that are glazed.

The constructor must perform the same checking before the installation of tempered glass doors. If the contractor discovers irregularities on the openings of joinery and locksmith products, and also on the openings where tempered glass doors should be installed, the ordering party must be immediately informed about that in written form so that the irregularities can be removed in time, thus enabling the contractor of glazing works to work smoothly.

Glazing of joinery or locksmith is, by the rule, done by a glazier being the subcontractor of the deliverer of joinery or locksmith.

Glazing is done in accordance to the agreement with joiner or locksmith, either in their workshops or after the installation of joinery and locksmith.

The persons responsible for glazing are the glazier and the contractor of joinery or locksmith together, on the basis of mutual agreements concluded before the beginning of works, while the deliverer is responsible to the investor (the ordering party for joinery/locksmith).

The installation of domes and fibre-glass tapes is done in accordance with the manufacturer's instructions, and in the coordination with the roof contractor.

Calculating is per surface or per piece.

## **STONEMASONRY AND STONE-LAYING WORKS**

The material to be used must be identical to the specimen chosen by the designer in terms of colour, type and processing (peaked, scratched, polished, stocked, sanded, grinded, burnt).

Stone slabs the holes and cavities at which are closed with putty and mortar will not be accepted and must not be installed, unless that has been previously contracted (travertine).

After laying down, the floors must be protected with gypsum screen, what should be contained in the unit price, and the protection is to be removed after the end of construction.

The binding material is cement mortar 1:2 on the wall panel and 1:3 on the floor panel. For the strengthening of stone slabs of vertical coating metal binders (carriers/anchors) that have to be statically calculated to carry the entire weight of slabs and is made of stainless steel. The holes in walls for the installation of carriers are machine-made, and must be cleaned and washed out before installation.

All the remains (mortar, lime, gypsum, putty, stone dust or other material) must not be thrown in sewage system.

The chosen stone is attested to:

- moist absorption,
- specific voluminous weight,
- porosity and degree of density,
- frost stability,
- wearing.

It is also necessary to check all relevant lengths, widths and heights and point out eventual deviations from the project, or problems before coating, to the supervising engineer.

The price should include all basic and assistive material, wastage of material, transporting to the construction site and at the construction site, costs of making, costs of assistive constructions (frameworks etc.), cost of the protection of the work done and the removal of impurities made during the work.

## **CERAMIC WORKS**

All works must be done in accordance with drawings, descriptions from the bill of quantities, existing technical procedures and directives by the designer and the supervising engineer.

The price for every particular type of work should include all basic and assistive material, lightweight frames, wastage of material, transporting to the construction site and at the construction site, costs of making and the removal of impurities made during the work, together with the transportation of all redundant materials and waste (packaging).

The contractor should use a material the properties of which (type, colour, quality) must be identical to the specimen chosen by the designer among the specimens suggested per the contractor.

As binding material for laying tiles on the floor, wet cement mortar 1:2 or construction glue should be used.

At installation in cement mortar, the tiles are placed on a rough construction base, concrete or a brick wall. The glue needs a cement glaze on the floor, concrete wall in smooth wainscot or rough mortar on the wall.

Joint bars should be jointed as it is stipulated in a particular item.

Before the beginning of works, the contractor is obliged to determine the quality of basis on which the ceramic works are done, and if it is not good, the ordering party must be informed about that, so that the basis can be fixed and prepared for performing ceramic works.

Before the laying of tiles, the wall should be well-cleaned, so that a strong binding with the wall can be established, to prevent tiles from dropping off later.

All space between the tiles and the wall should be completely filled and coated with binding material.

If some tiles have smaller or bigger dimensions, they must not be used.

Special attention must be paid to the joints of surfaces that are to be tiled, at the joints of tiling with other surfaces of processing and borders near openings, to be completely flat and clean.

Final tiling should be immediately cleaned from impurity and binder, and each paragraph includes the final cleaning of surface and pointing up of joints.

Floor planes must be completely flat and horizontal, except in rooms with floor drains, where minimal falls toward the drains are made.

Near floor gratings, siphons and other edges all floor tiles must be cut to needed measure and bordered correctly.

The floors at open surfaces should be made with dilatations, so that the difference among them is not bigger than 3 m in any direction.

The organisation of work must be performed by the contractor in such a way that it is in accordance with the operative plan, and that it does not lead to delays in contractor's work or to disturbing of work process of other contractors.

The calculation is per tiling surface, and per length for edges and borders.

## **HOUSE-PAINTING AND VARNISHING WORKS**

All the material to be used, together with assistive material, work and assistive work must in everything correspond to standards, regulations and technical conditions and the rules of good trade.

During the performance of works, the attention should be paid to atmospheric conditions.

Exterior works must not be done in the case of precipitations, fog, air supersaturated with moist, strong wind and the temperature below +5°C.

Coatings and colouring must be light resistant and water-washing resistant, and at exterior surfaces resistant to atmospherics. All house-painting works must be done in accordance with the selected specimens.

Before the beginning of works, the contractor is obliged to examine the bases and to determine if they are adequate for stipulated processing. If there are any faults on the base that can reflect on the quality of works, the contractor is obliged to warn the ordering party, because subsequent referring to bad bases will not be accepted.

The contractor may start with the work only when all the waste and other things that might disturb the work are removed from the room.

For all types of house-painting and varnishing works the bases must be clean of dust or other dirt such as: resins, oils, fats, soot, tar, bitumen, cement, mortar etc. It is allowed to warmish or paint only on a dry and prepared base.

Interior walls of rooms are at first evened, chiselled with special linings that must attach to the base well and make a very strong basis for colouring with dispersive colours after drying.

Exterior painting works must not be performed in bad weather that might damage the quality of works (coldness, precipitations, fog, strong wind etc.).

It is forbidden to throw the remains of colour, lime, gypsum, putty and other material in sewage system.

Painting of interior walls is performed in the following order:

0. washing and scraping of old colour,
1. impregnation – penetrating coating of base for the purpose of consolidation,
2. puttying and closing of single holes,
3. chiselling – covering of the entire surface with painting putty,
4. grinding and dusting,
5. double or triple painting – application of colour with brushes, rollers or spraying.

The quality of puttying and painting is controlled at night or in a darkened room with a reflector leaned to the surface of the wall or ceiling.

At painting of exterior walls, the stage of puttying (2) should be avoided, and the stage of chiselling (3) should not be stipulated at all.

Types of colours:

- dispersive,
- semi-dispersive,
- acrylic,
- wall tempera
- ground colours or chalk, determined in a particular paragraph of the bill of quantities.

Exterior joinery is protected with azure coatings, the first time in the factory/workshop by immersion, the second time at the construction site after installation and the third time at the construction site when all painting works with azure coatings are finished.

The first coating (immersion) is done without hardware and glazing, and the second and the third with packs and glazing. At that stage, the visible hardware and glass should be protected with duct tape.

Colouring of interior joinery is performed in the following stages:

- burning or mechanical removal of the existing colour,
- impregnation (in the workshop),
- puttying,
- grinding,
- varnishing with oil,
- additional puttying and grinding,
- enamel varnishing.

Colouring of joinery with azure colours:

- impregnation (in the workshop),
- puttying,
- grinding,
- azure coatings,
- grinding,
- final coating with varnish-azure

Principally, the colouring of joinery is done only on interior joinery, and in extreme circumstances on exterior joinery if it has already been coloured. The sashes of doors can be painted in the workshop by means of a compressor.

It is possible to colour the joinery that has French or cylinder loops, or some other hardware stipulated for colouring, but not a rotational hardware.

Locksmith is coloured in the following stages:

1. cleaning (mechanical – sanding or by acids),
2. foundation layer – red lead – alkyd or epoxy or acryl
3. final layer – enamel – alkyd or polyurethane or acryl  
(durability: to 10 y.  
to 20 y.  
to 20 y.)

Only interior locksmith can be puttied with car putty after the foundation layer has been placed.

The calculation:

The surfaces of walls are calculated without subtracting the openings smaller than 3 m<sup>2</sup>, and the openings bigger than 3 m<sup>2</sup> are subtracted, but the jambs are calculated separately – m<sup>1</sup> for m<sup>2</sup>.

In the calculation varnishing works on joinery/locksmith, full surfaces of openings and borders are calculated, without subtracting the surface of glass.

In traditional joinery, the surface is increased for profiles, depending on the complexity, with the factor from 1,7 to 3,2.

## FLOOR-LAYERING WORKS

Floor-layering works must be performed solidly and professionally, in accordance with current regulations and the rules of good craft.

The floor-layering works include the works with PVC and rubber slabs and tapes, that are glued with non-organic glues to dry and solid base made of cement glaze, gypsum screed or chipboard.

Before the layering, the contractor must heat up the slabs to lean on the base. At work with neoprene glues, the ventilation of room and mask protection must be provided.

Installation of linoleum should be done in accordance with the manufacturer's instructions, principally with spot-gluing on the linoleum tape and continuous gluing in the place where the tapes joint. Before the gluing, the tapes on joints should be tailored together by cutting both tapes at the same time on the place of the joint.

The installation of industrial carpets is done with spot-gluing or with gluing over the entire surface in accordance with the way of using the carpet and the manufacturer's instructions.

For linoleums and carpets, the contractor is obliged to use glue which is not poisonous and is not of neoprene origin.

The installation of parquet should be done by gluing on the entire surface, triple grinding and varnishing with parquet varnish in three layers, with fine grinding between the first and second layer. Finished panel parquets that are factory-nutted and varnished in layers should be layered on a foamy base layer – a foil with minimal thickness of 3,0 mm. The unit price for all products includes the (making), delivery, tailoring and installation of angular battens, unless something different is stated in the bill of quantities.

The contractor is obliged to protect the installed floors from damaging and contamination by the official takeover of works.

## **B. ELECTRICAL INSTALLATION**

### **GENERAL TECHNICAL CONDITIONS FOR WORKS**

#### **GENERAL**

- The technical conditions are part of the main electrical installation design and as such are mandatory for the contractor.
- Installations must be laid out in accordance with drafts, the technical description of the project design, regulations in effect and standards that are applied. Anything that is not precisely stated in the project design must be carried out according to current regulations and standards.
- Regarding any changes or deviations from the project design, written consent must be received from the supervising authority and the investor.
- Prior to beginning works, the contractor is required to review and check the project design on the spot and consult the designer regarding any deviations or lack of clarity.
- Any materials that are used must be in accordance with current standards and be of 1<sup>st</sup> class quality.
- After the delivery of the material and equipment to the construction site, the supervising authority will, as called upon by the contractor, examine the materials and equipment brought in and enter their condition in the construction log.
- If the contractor were to use material or equipment that was subsequently determined as inappropriate, then on the request of the supervising authority such material or equipment will be removed from the building and new material or equipment will be used and charged to the contractor.
- Works must be carried out properly, while for anything that, either during works or through subsequent use, shows itself to be improperly done will be fixed or replaced by the contractor at their own expense.
- Prior to laying cable, exact measurements must be taken regarding length and routes detailed for floors, walls and the ceiling and termination points must be marked and the terminal box and places that go through walls and only then can establishing cable routes begin.
- At places where the cables go through walls, appropriate protective sleeves must be placed to protect the cables.
- Cables are laid out along the routes as shown on the drafts horizontally and vertically. Slanted placement is not permitted.
- When unrolling the cable from the cable-drum, care must be taken that the cable does not twist so as not to damage the insulation.
- Zero conductors and protective conductors must not be connected to the fuses and must be a different colour than the phase conductors.
- For easier connection of conductors in the boxes, switches, lights and sockets, the cables must have an extra 10-15 cm in length left in such places.
- Any continuation or branching out of conductors and cables may only be carried out in the terminal boxes.
- Prior to placing switches, sockets and other apparatuses, they must be checked whether they are in proper working order.
- All equipment in the terminal boxes must be set up in a way that is easily visible and accessible and marked appropriately.
- Reinforced concrete and steel structures can be torn down, burrowed and drilled only with the written consent of the construction supervising authority.
- When laying out electrical installations, works already completed and building parts cannot be damaged.
- When laying cable parallel to each other, the distance between the cables must be at least 1x the thickness of the cable.



- After the completion of works, the contractor must check the installations for short circuits, must check the state of insulation protection, measure insulation resistance and issue an appropriate certificate on the working order.
- When checking installations, the resistance of the phase conductor and the grounding conductor must be at least 220 kΩ, while the resistance between the phase conductors must be at least 380 kΩ.

#### **INSTALLATION LAYOUT**

- Installations will be laid out with cables as stated in the drafts and schematics of the project design.
- Cables will be laid out one part in the suspended ceilings using cable clamps (3kom/m), one part in the walls and one part in the floor installation channels.
- Branching out the cables will be done exclusively using terminal boxes, while the cable between two termination points must be in one piece (no cable extensions allowed)
- Each electrical cable must have one blue wire and one yellow-green wire. The blue wire is used only as a grounding line, while the yellow-green wire is used as a protective line.
- Regarding the termination points on the terminal box, cable wires must be designated using appropriate designation (identical to the designation of the connecting clamps)
- After the completion of works, the contractor is required to provide a guarantee on works and materials used. The guarantee will not be shorter than 1 (one) year.

After the completion of works, the contractor is required to draft documentation on the works carried out.

### **C. WATER SUPPLY AND SEWAGE SYSTEM**

#### **GENERAL TECHNICAL CONDITIONS FOR WORKS**

##### **PREMEASURES**

The contractor shall conform to the approved project documentation in all construction works. Prior to construction work the project documentation shall be compared with actual field conditions and all questions that may arise shall be discussed with the authorized supervising personnel. Prior to any change the contractor shall notify the supervision personnel, and they shall inform the communal institutions for water supply and sewer drainage systems.

##### **PIPELINES**

The contractor shall conform to the technical preconditions when laying out the pipelines. All levels within the project shall be checked and concurred with actual field situation. The connection to the local sewer main shall be made prior to any sewer system installation works. Upon connection completion the installation of foundation pipelines can be conducted. Installation of sewer vertical drains inside the building, with all its drain branches, is to be completed last.

Water supply system horizontal pipelines shall slope towards the lowest outflow/exhaust point. If these are more than one, it should be taken into consideration. The change of direction shall be made with bends. Galvanized pipes bending shall not be performed at any situation. Through walls the pipes shall be conducted vertically.

##### **BELOW GROUND PIPES**

All below ground pipes are to be laid in a gravel layer. The gravel layer shall be 5cm thick and spread all around the pipe. If a pipe is laid in an embankment a thick and compact gravel layer shall be placed at the bottom of the trench. Muck and unsuitable materials, such as construction material remains, slag and rocks, shall not be used for trench backfilling. Prior to pipe bedding the authorized supervision personnel shall inspect the trench. If the trench is in accordance with the trenching detail and all other technical requirements the pipe bedding can begin. Upon pipe bedding completion, and prior to trench backfilling an authorized supervision personnel shall visually inspect the pipeline and perform and witness pipeline testing. The trench shall be backfilled in accordance with the trenching detail and all other technical requirements.

##### **IN-STRUCTURE PIPES**

Pipes built into the building's structure and walls are not permitted. Pipe passage openings in the structure shall be large enough, and the remaining free space between pipe and structure shall be filled with plastic material, in order to prevent any damage to the pipes. Water supply pipes, at their passage through the structure shall be fitted with the protective pipe. The diameter of the protective pipe shall be at least 40mm larger than the outer diameter of the water supply pipe. The space in between the two pipes shall be filled with suitable plastic mass, in order to prevent possible water leakage to the structure. Wall and ceiling channels for eventual pipe passage can be made only with supervision personnel permission.

## **PIPE PROTECTION**

Water supply pipes shall not pass through chimney walls and ventilation ducts, shafts, below toilet or urinal floor and everywhere where it can be exposed to contamination and corrosion. At crossing with other conduits the water supply pipe must be protected, and the intermediate space filled with at least 40cm thick clay layer. If the distance between the pipes is smaller than 40cm, then the water supply pipes shall be conducted through the protective pipe such as the ones used for in-structure passages. The pipe insulation shall be conducted with the outmost care and the conduits shall not be backfilled before inspection. The same conditions apply for the sound insulation. Eventual damage to the pipe insulation shall be repaired carefully. At shutoff the pipes shall be properly plugged in order not to get contaminated, filled or damaged.

## **JOINTS**

Pipe joints (pipe-to-pipe, pipe-to-fittings and pipe-to-fixtures) shall be completed with the outmost care. Joints must not shorten the inner diameter of the pipe. Cast iron pipes shall be joined and fitted by following the manufacturer's instructions (rubber gaskets, couplings, ...). Pipe joints in walls, ceilings and other structural elements should be avoided.

## **PIPE FIXING**

Pipelines shall be fixed to walls and ceilings by using brackets and hinges at distance of no more than 2m, and PVC pipes at no more than 1m distance. They should be supported at all length.

## **FITTINGS**

Fittings shall be inspected for use prior to their instalment. The fixtures instalment shall be done with precision, taking care of easy handling and aesthetic requests.

## **FIXTURES**

Fixtures instalment shall be neat and precise, taking care of easy handling and aesthetic requests. Sanitary fixtures shall be wall mounted using steel anchors and matching screws with nuts. Console elements should withhold the 400kp load at the weakest point. The fixing height for each of the fixtures is, unless otherwise specified in the project documentation, as follows:

Lavatory, front edge	80cm
Lavatory shelf	125cm
Mirror, height at the middle	155cm
Towel holder	70cm
Wall mounted hot and cold water mixer	105cm
Kitchens sink	85cm
Water closet (high-mounted), bottom	200cm
Urinal, front edge	65cm
Toilet paper box	90cm

## **INSTALLATION TESTING**

Completed, but not insulated and backfilled installations must be tested for water-tightness and leakages and for good functioning.

The pressure of 10bar shall be developed, by the contractor, within the water supply pipeline to be tested and shall be held for a minimum time period of 30 minutes during which the pressure should not fall below 10bar. Sewer drainage pipelines shall be tested by water jetting, with prior temporary plugging of outlets and openings. The tests shall be performed with contractor, authorized supervisor and communal representative present, and the test report shall be made.

The testing shall be performed at contractor's cost. The contractor shall, at his own expense, adjust or replace any component of the pipeline which fails the prescribed tests. The pipeline shall then be tested as described above until it successfully conforms to said tests. Upon testing completion, the pipes can be felted, thermally and otherwise insulated, and channels, gutters and trenches closed and backfilled.

## **CONTRACTOR'S DUTIES**

The contractor is obliged to remove, repair and fix all the malfunctions, errors or damages that may arise within a year from the installation approval, if the malfunctions, damages or errors are a result of low-quality materials or bad execution. Authorized supervisor can only approve and accept installed quantities. All of the material that was found bad

or unacceptable by the authorized supervisor must be removed immediately from the construction site. The contractor is obliged to complete the entire installation within the agreed deadline and in accordance with other contractors at the construction site

## **D. MECHANICAL INSTALLATION**

### **GENERAL TECHNICAL CONDITIONS FOR WORKS**

#### **GENERAL**

- The technical conditions are part of the main mechanical installation design and as such are mandatory for the contractor.
- Installations must be laid out in accordance with drafts, the technical description of the project design, regulations in effect and standards that are applied. Anything that is not precisely stated in the project design must be carried out according to current regulations and standards.
- Regarding any changes or deviations from the project design, written consent must be received from the supervising authority and the investor.

## **E. OTHER WORKS**

### **GENERAL TECHNICAL CONDITIONS FOR WORKS**

Electrical installations required for the construction site

The contractor is required to set up electrical installations as needed on the construction site.

The termination point for such purposes is determined in agreement with the relevant user service.

Displacing current thermo-technical installations

- For places where the thermo-technical installations (piping, radiators, A/C units and other) do not meet with the new requirements or do not correspond with the new layout of premises, such installations must be removed.
- Works must be carried out in accordance with current regulations for such works.
- Any piping that is installed must have a quality certificate issued by an authorized organization or by the manufacturer of the piping.
- The ends of the pipes must be protected during transport and storage. Pipes of all stipulated dimensions up to DN 300 must be seamless according to JUS.C.B5.221, with wall thickness within tolerable boundaries.
- Horizontal piping must be laid out with falls following fluid movement
- Welding is carried out while following the book of rules on hygiene/technical regulations for welding piping (API or other).
- Any changes in the direction of the piping network must be made using arches that are manufactured by specialized manufacturers of such items.
- Any non-insulated piping, equipment or bearing structures will be painted with anticorrosive layering that is resistant to temperatures of up to 100°C. Any piping or equipment that will be insulated must be painted in two layers of paint that is resistant to temperatures of up to 250°C.
- All of the piping installation equipment used for the production and layout of electrical installations with temperatures higher than 50°C must be insulated with regulation insulation material. When mounting, the insulation (steam-resistant insulation) must be resistant to humidity and temperatures of up to 100°C.

Prior to placing the equipment and piping lines in operation, they must be checked to the extent required in order to ensure conformity with current technical regulations.