

DOME CONSTRUCTION INSTRUCTIONS



This instruction is a coherent work plan based on the knowledge of engineers-constructors of UAB Sferos and specialists with many years of construction experience, following which mistakes and misunderstandings can be avoided. In order to make it easier to assimilate and understand the information described below, we advise you to view the main-informational videos, on our YouTube channel: JSC Spheres. Before starting construction, it is necessary to study **the entire** instruction below.

- The set of dome parts is transported in separate parts, without stacking on the transportation pallets, loading and unloading is carried out manually, since when using the lifting technique, polystyrene foam elements can be damaged.

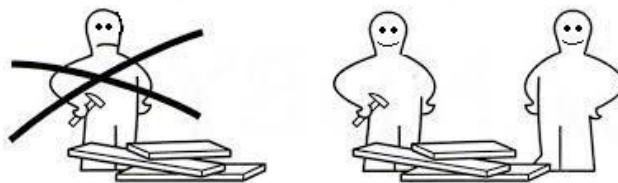


- If the set of dome parts will not be used immediately, it is necessary to protect the set from possible damage by third parties, direct sunlight, precipitation and other factors that can reduce the value and quality of the set.





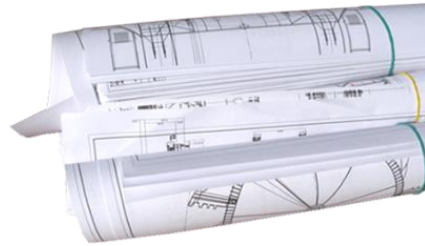
- All construction works are recommended to be performed by a team consisting of at least two people.



- Land preparation works (ground is excavated - fertile layer), relief is leveled, gravel is delivered - crushed stone. Compaction is done using a vibrating plate or a vibrating foot. The compaction layers must not be larger than 10 cm. If necessary, the gravel should be watered periodically, as dry gravel may not compact well. Depending on the terrain, the soil on which the dome is being built, and the depth of groundwater, a flat base, a site, is prepared for the construction of the dome.



- If the purpose of the dome being built is "Residential house", all layers must be made according to the project (drainage, gravel-crushed pillow, foundations). If the dome being built will be named "Ancillary building", then the concrete foundation is not mandatory and construction can be started directly on the compacted gravel site, but with reference to construction normative acts and rules.



- It is advisable to install all communications (water and electricity ports, sewage pipelines) on the construction site before the start of construction..



- You can find out more about the installation of a flat foundation in the YouTube video: "Installation and installation of the foundations and floors of a domed house".
- When building without a foundation: after preparing a smooth base, the center of the future dome is chosen. A wooden stake is driven into that place. A wooden point (stick) is nailed or screwed to the stake, the length of which must correspond to the radius of the planned dome. I.e. if the diameter of the dome will be 8 meters, then there must be exactly 4 meters from the center (the driven stake) to the end of the stick. In the future, we'll call this a "swirl." The remaining formwork of the dome is built on a similar principle (after assessing the thickness of the walls of the future dome and the remaining formwork).



- The set of dome parts consists of parts that have names - numbers (0,1,2,3, etc.). Elements of permanent formwork are usually marked "00". The first ring of parts is assembled from parts that are marked "0" (although it can also be "1", it depends on the conditions of the

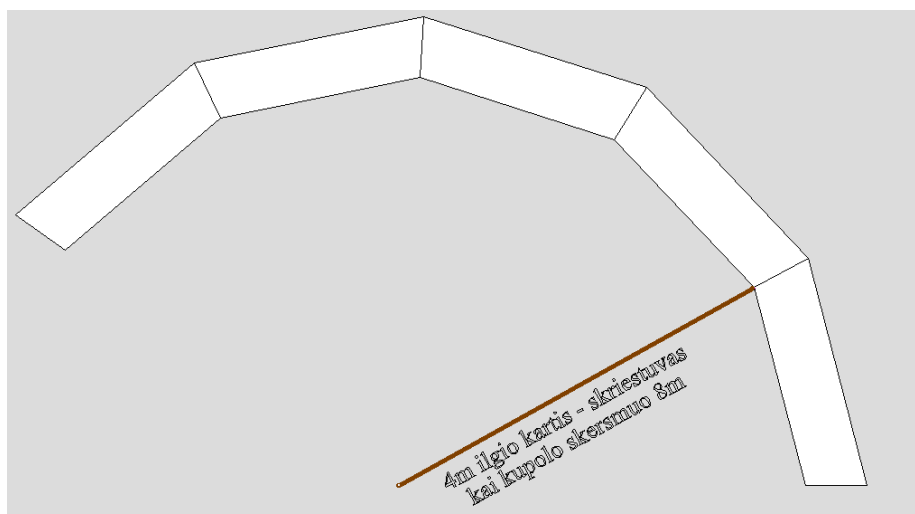
specific order). Elements that are marked "0" are usually smooth, without bending (a vertical dome ring is formed).



- Before starting to put the elements of the dome in place, it is necessary to prepare them. Each set of dome parts has special plates ("spacers") that need to be glued to each part to maintain an even gap between the dome elements for filling the glue. For the first ring, two plates are used on each part (one in the upper part, one in the lower part), and the elements of the following rings must have only one plate (on top). Always stick the plates on one side only. The plates are ready for gluing, after peeling off the protective paper, they can be glued immediately.



- For the construction of the first ring, you need to use a "hover", each part is placed at an equal distance from the center of the planned dome.



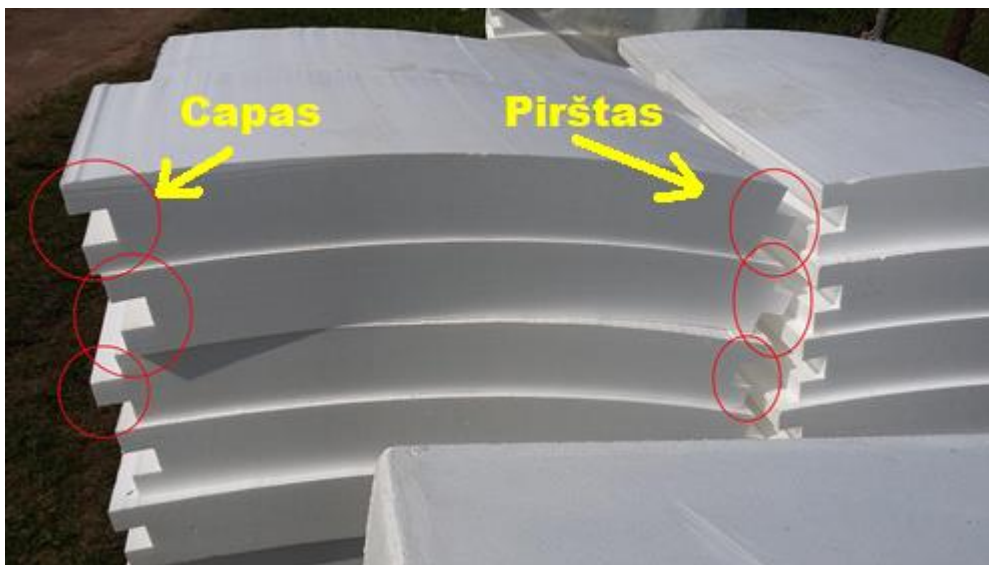
- After forming the first ring, it must be tied with belts (slings or ropes). It is only necessary to tighten so that the assembled parts do not move in relation to each other and that they are not deformed - broken.
- During the entire formation of the dome, a technological gap must remain between the details (vertically), which will later be filled with glue intended for gluing polystyrene (mounting foam is not suitable).



- The higher the dome ring is assembled, the more its parts "slop" (the top tilts down), as a result, when assembling the ring, it is necessary to raise the already inserted parts a little (roll their tops using wooden rods - sticks) to make it easier and more correct to insert a new part countries.



- When the first ring of details is already assembled and when it is already reinforced with belts or ropes, when the distance from the center is the same everywhere, it is possible to start spraying polystyrene foam glue, in high-pressure bottles. And when the glue expands and hardens, you can lay the next ring of details. Which is also recommended to be secured with straps or ropes (this should be enough for the following rings of dome parts to hold on their own).
- Note: The size of each piece may be slightly different (i.e. dimensions are not ideal). For example the "toe" in one joint may be loose in the cap, while in another joint the "toe" may be placed quite rigidly in the cap. It does not depend on the accuracy of the equipment used by UAB "Sferos", but on the properties of the polystyrene foam itself, when the manufacturer presses the workpiece, each time a slightly different density and elasticity of the material is obtained.



- For the further formation of the dome, it is advisable to cut a small hole to allow access to the inside of the dome being built. It is advisable to make a temporary opening in the place where the opening for the door will be cut.



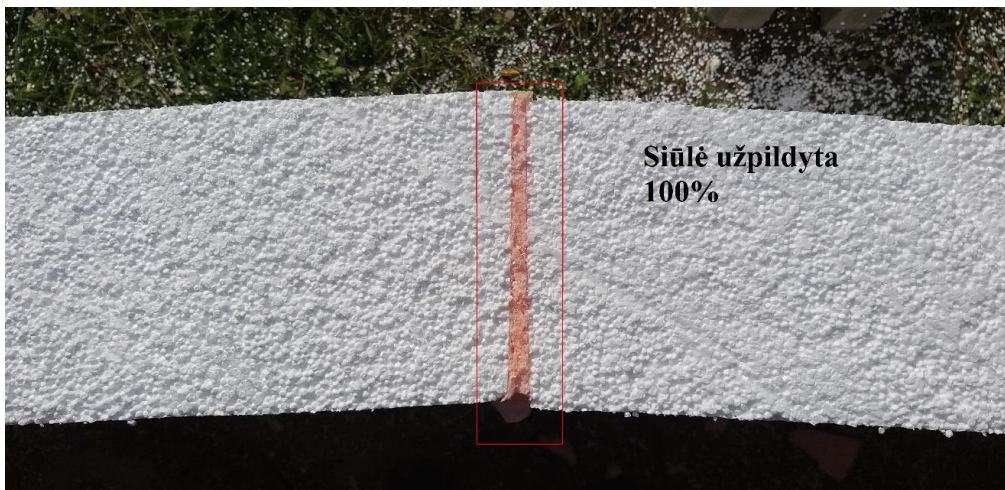
- **VERY IMPORTANT: ALL PARTS FOR EACH RING MUST BE USED WHEN DOMEING. I.E. IF THE RING HAS 33 PARTS, ALL OF THEM SHOULD BE USED. IT IS ALSO NOT POSSIBLE TO NARROW THE**

DETAILS BECAUSE YOU WILL NOT BE ABLE TO FINISH THE DOME FORMING WORKS PROPERLY

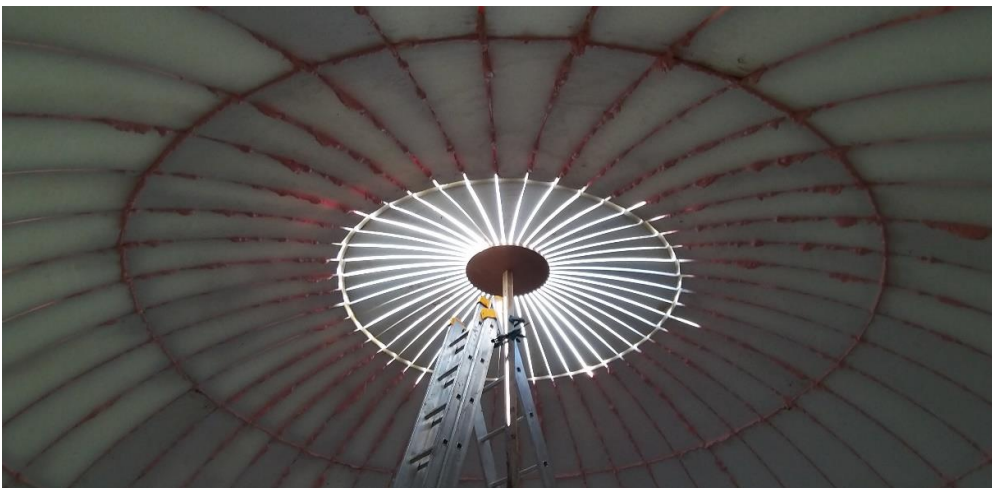
- When the first ring of the dome is arranged neatly and the parts are flush (relative to each other), you can start gluing. For gluing, it is necessary to use a glue gun (it is not necessary to use professional and expensive tools).
- Bonding specifics. When gluing the dome, one of the most important nuances is that the technological gap, which we mentioned earlier, must be filled 100%. This can be done only in one case, when the gap is gradually filled. Gluing the dome may require from 50 to 144 (or even more) bottles of glue (depending on the glue manufacturer and the diameter of the dome and the thickness of the walls).



- Gap filling. When all the conditions for the correct assembly of the dome ring are fulfilled, we start blowing the glue into the inside of the wall, the very center (we can do this both from the inside and from the outside). It is very important that the glue should be poured in only enough to fill a 5-8 cm layer. Otherwise, the adhesive may swell too much, resulting in voids that do not provide strength. And when the layer of glue from the first blow has stopped expanding and has hardened, you can blow again 5-8 cm. If there is a suspicion that the glue may expand too much and slip out, there is no need to be afraid of that, but when using materials rationally, it is better not to blow a lot of glue at once, it is better to fill the same gap 5-8 times, blowing the glue a little at a time. For careful foaming of the glue, it is advisable to use a straw placed on the glue gun, which comes in the package together with the new glue gun. The straw is usually thinner than the nozzle of the glue gun, so the assembled dome parts will not move when the glue is blown



- When the work of forming the dome comes to an end, it may seem that the dome is too weak to climb on top of it, it is necessary to wait for the glue to completely set.



- If the dome is built on a foundation, it is recommended to glue the lower parts of the dome to the base. This should only be done after the dome is fully formed and glued. Most often, the lower parts have horizontal grooves, which are not visible in the assembled structure. To fill the mentioned grooves with glue, you need to drill a hole in the polystyrene part, through which the glue gun will be inserted and the glue will be blown.

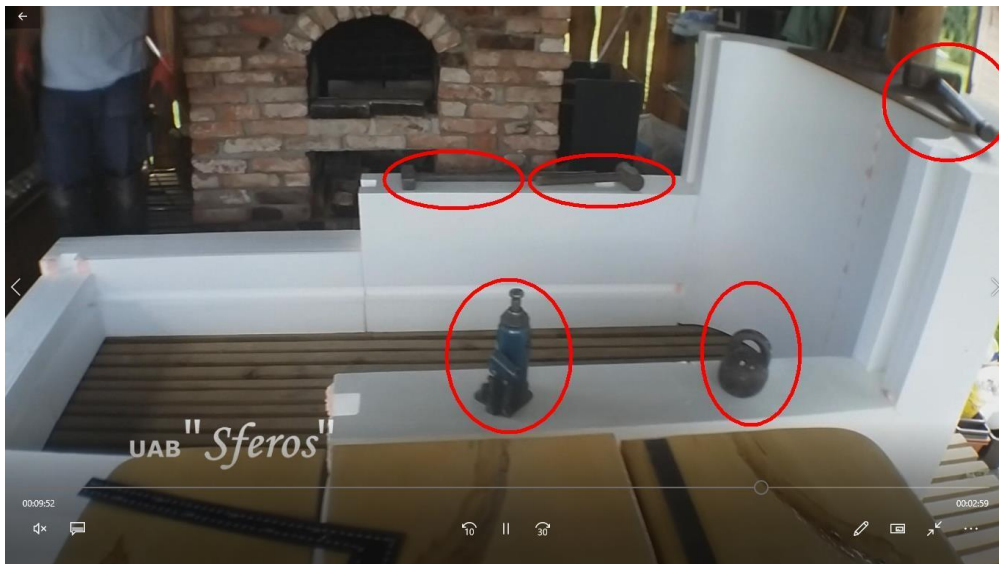




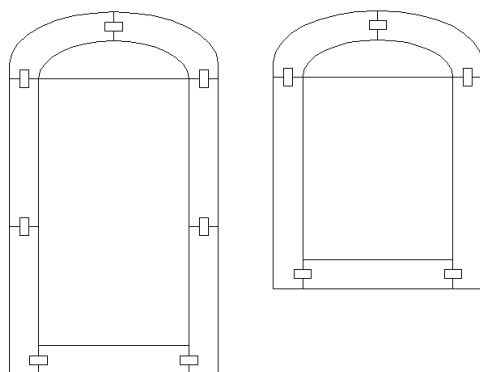
- All hardened and protruding glue must be cut with a sharp knife (it is most convenient to use a breakable stationery knife with the blade fully extended - spread out).



- Forming and gluing of window and door arches. Assembling the arch is easy, it is important to do it on a flat surface, using weights to press and lock the parts while they are glued. It is necessary to maintain the right angles of the entire structure - equal diagonals.



- Below is the most commonly used layout diagram of elements of door and window arches:



- A level should be used when gluing the arches. A glued arch is built in the selected place. It must be vertical. When the arch is preliminarily built, it is necessary to mark the cut seam of the opening. The grating used can be wooden - metal or similar, it is important that it is straight and not thick, and that it slides easily through the arch detail.





- When drawing the cutting seam, it is important not to move the arch. It is necessary to draw while maintaining the horizontality of the scratch. It is not necessary to press down hard on the scribe to make a groove on the dome with it, it is enough to draw just enough to barely see the line, it can then be highlighted with a pencil just before cutting the opening.



- It is recommended to use an electric chainsaw to cut the opening (a gasoline one can damage the polystyrene of the dome with its hot exhaust gases). When cutting with a power tool, it is necessary to protect the ventilation openings of its motor from polystyrene pellets, as they can clog the openings and the motor will quickly overheat and fail. The ventilation openings of the power tool can be wrapped with a single layer of loose cloth, periodically shaking off the stuck pellets while cutting and occasionally allowing the tool to cool naturally.



- When cutting the opening, it is necessary to maintain the most accurate horizontality in the wall of the dome, regardless of the location of the opening being cut, be it the very top of the arch or a corner. The cut opening must be as accurate as possible for the installation of the arch, i.e. the cut-out angles of the opening must be as similar as possible to the surfaces of the arch to be installed. In any case, all errors and inaccuracies are corrected. An insufficiently cut hole is easily corrected with the same saw, and an overcut hole is filled with glue (extra large gaps are filled with a piece of polystyrene-insert and glue).



- After cutting the hole and inserting the arch into it, it can be temporarily fixed with rods (it is most convenient to use welding electrodes, after breaking the powder coating and smoothing one end for easier insertion).
- The gaps between the arch and the wall of the dome are filled in the same way as between the details of the dome, gradually, allowing the glue to fully expand and set.
- After placing the arch in the dome and gluing it, it may appear that there is not enough arch detail. In fact, the arch is designed in such a way that the elements of the arch that are cut to align with the inner wall of the dome are reused. The cut element is turned over and pasted in the missing place.





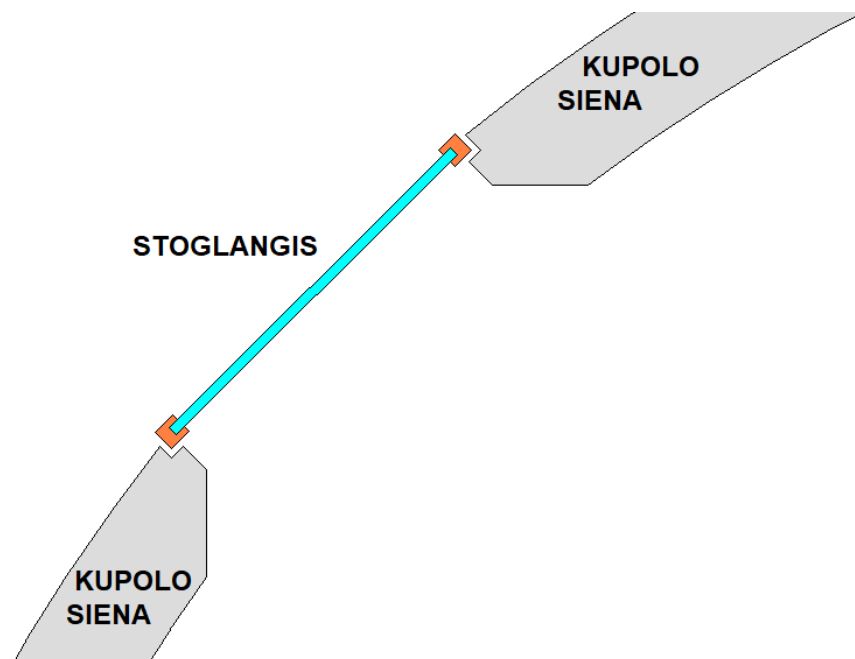
- The setting of the adhesive is accelerated by damp weather, e.g. when it's raining, but when the relative humidity is higher, the work goes faster. If the weather is very dry, when the sun is hot, it is necessary to moisten the blown glue, with a garden sprayer - with clean water.



- In window and door openings, a wooden dot (50/50 mm) is glued. It is glued with the same polystyrene glue with a glue gun.



- When installing windows and doors, they are attached to wooden posts with screws.
- Skylights are installed very similarly to first floor windows. I.e. a niche is prepared into which the skylight is pasted.



- Any unevenness, expanded and hardened glue can be removed with a sharp knife, and then compared with a polystyrene grater or an electric sander with a vibrating pad (note: an angle grinder can create even more irregularities, so it is better not to use it).



- When ready - after forming the dome, all surfaces from the outside and inside are reinforced with exactly the same materials as all buildings, which are insulated with polystyrene foam. Using a cementitious reinforcement mixture and facade reinforcement, glass fabric, mesh.
- Installation of windows is carried out in exactly the same way as in ordinary buildings. By attaching the window/door with self-tapping screws to the wooden post, through the adjustment (mounting) block and sealing with conventional sealing foam.
- Hanging-fixing of lamps inside the dome. After cutting the groove, a wooden dowel is glued (this is done before reinforcement), the place where the dowel is prepared is marked, so that it is easy to find the necessary fixing place after finishing the finish.





- After finishing the interior of the dome, you can use a spiral pin for screwing into polystyrene foam to hang the lights..



- Installation of electric cables. After cutting the grooves, cables, corrugations are inserted, and polystyrene adhesive foam is applied..



- Floor installation. This unit is installed in exactly the same way as in any other construction. One of the most common methods is to lay a heat-insulating layer, foam

polystyrene (EPS100), 10-30 cm layer on a base of compacted (vibrated) gravel, lay a film, prepare a reinforcement network and pour concrete (popularly known as "šteške") in a 5-10 cm layer (such the concrete layer is usually installed in small domes). If underfloor heating is planned, heating elements are installed in the concrete layer (i.e. pipes or electric heating cables), in which case the concrete layer must be thicker (10-30cm).

- The overlay cannot be installed into the dome structure, it must be a separate system from the dome. I.e. the floor of the second floor (the ceiling of the first floor) must rest on the columns, the walls of the first floor, etc. The walls of the dome are not adapted to bear the weight of the overlay.



- Installation of internal partitions. Internal partitions, walls, can be installed from wooden or metal frames, sheathed with plasterboard panels or wooden finishing boards, filling the inside of the walls with sound insulation materials (e.g. rock wool). Masonry walls are also available.





- Attention should be paid to the weight of the structures. If columns will be made, it is necessary to prepare a strong and reliable support point for each column by installing drilled piles (concrete reinforced with a reinforcement frame), or additional reinforcement in the concrete layer must be provided.



- If the internal partitions will be bricked, it is recommended to prepare a full-fledged "pad" under all masonry walls, or additional reinforcement in the concrete layer must be provided.



- If the internal partitions will be installed using tin profiles, the frame is attached to the polystyrene of the dome through wooden dowels that are glued to the wall of the dome (the principle is the same as the installation of hanging lights). In this case, it is not necessary to install the foundation, the frame can be installed immediately on the concrete base (on the "stake"). If underfloor heating is installed, it is necessary to protect the underfloor heating elements, which are installed in the concrete layer, so that they are not damaged when drilling the anchor holes.

Grindu dangą



- Installation of additional elements, after the finish has already been completed. Even after a long period of time, when you decide that there is a lack of light or an additional entrance is needed, it is possible to install an additional window or door. Since the structure of the dome is monolithic and there are no individual elements that carry loads (for example, as in a frame building), an additional element can be installed by cutting a hole. It is very important that such work is done only after consultation with a representative of UAB "Sferos", because the validity of the warranty depends on this.
- During the construction of the dome building, it is necessary to use only those materials that have all the certificates that ensure the safety and quality of the materials. If the Customer or his representative uses materials that do not have certificates, or if materials are used that are not intended, UAB "Sferos" does not provide guarantees for the stability and durability of such a building..
- During construction, it is necessary to comply with all construction requirements and normative acts.
- During the operation of the dome building, defects such as scratches, tears, dents, etc. on the surface of the building must be removed immediately. So that the building does not lose its stability and durability. Defects must be removed in accordance with the

construction laws of the Republic of Lithuania using only certified materials and only under suitable conditions.

- **LAND AND PLOT WORKS.** Excavation of trenches: All earth excavations must be reinforced. Reinforcements are made with the help of wooden structures or metal panels, depending on the depth of the excavation. All earthworks areas must be fenced off and warning signs must be installed to inform of the presence of a danger zone in the vicinity.
- *Filling of ravines: The soil used for filling is specified in the project (if any). Do not use primers if they contain organic or other impurities and salts that dissolve in the soil, which can cause an aggressive effect on adjacent buildings and pipelines. Backfilling of the foundations must be done: With sandy soil, when the foundations are installed in sandy soils. With local loam or sandy loam (protecting it from soaking) by fully compacting to coefficient $k=0.95$. The soil to be compacted is poured in layers with a thickness of 250 to 600 mm depending on the used soil and compaction mechanism. If it is not specified in the project, the quality of the compacted layer is checked with devices of at least 700 m² compacted area, performing at least two samples. The next layer of soil can be poured and compacted when the bottom layer is compacted and checked. Before starting the backfilling work, it is necessary to make sure that the structures or equipment to be buried are in good order and the connections are of good quality and checked. The soil compaction factor is determined from the dry volume weight of the soil (according to the volumetric test) and the maximum dry volume weight of the filled soil. The soil used for filling must meet the requirements of the norms.*
- *Foundation installation: All foundation installation works are carried out using gravel, sand soil and crushed stone. A 200 mm layer of gravel is poured under the floor inside the building, compacting it to a factor of $k=0.95$. Under the existing building, the soil is left as it was until now.*
- **CONCRETING WORKS.** Production of concrete mixtures. The quality of concrete mixes depends on the properly selected concrete composition. The composition of concrete is selected according to the requirements for concrete resistance indicators: strength, resistance to water and cold. Production of mixtures consists of receiving, storing, dosing, mixing and pouring of concrete mixture into transport means of inert and binding materials, fillers and cement..
- *Armature. Only new materials are used for reinforcement. Placement of fittings must be done according to the project. For the production of non-stressed reinforced concrete structures, use S400 class reinforcement with calculated tensile strength $R_s=355$ MPa (365 MPa), A-I class reinforcement with $R_s=225$ MPa. Reinforcement products are tied with wire or welded by the contact-spot method. Anchor bolts and other parts embedded in concrete, such as inserts, pipe glands, cable stacks, pipes, etc. must be fixed in place before the concrete is poured.*
- *Placing the concrete mixture in formwork. The concrete mixture is laid on the prepared base in tested and well-reinforced formwork. The formwork must be clean, the wooden formwork moistened and the cracks in them filled. The surfaces of non-removable formwork and reinforced cement and reinforced concrete panels are washed with a water jet. Before concreting, the assembled reinforcement elements are checked, the quality of welded joints and materials of the installed reinforcement (visually and mechanically), the placement of the inserted details and the reliability of*

the anchoring, the reliability of the fasteners fixing the reinforcement. The preparation of formwork, reinforcement and base for concreting is formalized in the covering works act. When concreting non-reinforced structures, concrete is allowed to fall freely from a height of no more than 6 m. The thickness of the concrete mixture layer must meet (but not exceed) the requirements of construction norms and rules. When performing deep vibration 1.25 of the length of the working part of the vibrator, when performing surface vibration of non-reinforced and single-row reinforcement reinforced structures 250 mm; in constructions with two-row reinforcement 120 mm. The mixture must fill the formwork well between the reinforcing bars and form a protective layer of the required thickness.

- *Labor protection during concrete and reinforced concrete works. When installing formwork, reinforcement and transporting the concrete mixture to the concreting site, it is necessary to ensure the inspection of supporting scaffolding, decks, and railings. Do not install fittings near live wires. When carrying out welding work, metal structures, welding equipment, transformer generators and the like, the housings must be grounded. Concrete bags and other concreting machines are allowed to be lifted to another workplace only after disconnecting the power.*
- *ATTACHMENT DETAILS. All metal fastening products (nails, wood screws, anchors, etc.) are used only with head anti-corrosion protection. Metal frame parts are galvanized or painted with epoxy anti-corrosion paint in two layers. Galvanized or oxidized wood screws are used for fastening plasterboard panels. Rectangular profile twisted or knurled galvanized nails and wood screws are used for fixing supporting structures. If non-factory-made black metal fasteners or profiles are used, they must be cleaned of rust and covered with anti-corrosion protection by painting or galvanizing. All damaged surfaces of metal parts must be additionally covered with anti-corrosion protection during painting. The paint type must match the previous paint type. Fasteners supplied by various companies can be used if their strength indicators comply with the instructions.*
- *Fireproofing and biological protection of wood. All wooden elements of the building are painted with anti-fire - antiseptic paints. Dyeing technology according to the instructions for use of the dye. The ends of wooden elements in contact with concrete and masonry surfaces must be coated with silicone mastics. Wooden structures in contact with masonry or concrete surfaces must be wrapped with one layer of roll waterproofing.*
- *INSULATION WORKS. Insulating materials must not be toxic and must meet fire safety requirements. Materials used for insulation must be intact and undamaged. All structures insulated from the outside and roof structures (including insulating materials) must be approved by the Fire Protection Department of the Republic of Lithuania.*
- *Waterproofing of the floor on the ground. Single-layer roll waterproofing is installed. In the event of a high groundwater level, the waterproofing is glued with strips not less than 100 mm apart from each other. Waterproofing must be installed on dry and leveled surfaces.*
- *Ground insulation of wet rooms. On the foundations, in wet rooms, floor insulation is laid from two layers of roll coating on bitumen (hot or cold) mastic or a fused roll coating is used. When laying the roll covers, they are placed on top of each other by 100 mm. Each new layer is laid after the previous layer has hardened. Layer*

thickness using hot bituminous mastics 2mm +/- 10%. Cold asphalt concrete mastic 7 mm, emulsions 3 mm.



During the construction of the dome, in case of uncertainty, it is recommended to contact the representative of UAB "Sferos" at kupoliniainamaistatyba.lt.

Last changes - entries made on 05/27/2023