Instructions for Underground Installation of Tanks

Reliable Solutions

RAINWATER HARVESTING SYSTEMS

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1. INSTRUCTIONS FOR UNDERGROUND INSTALLATION

1.1 Brief Instructions for Tank Installation Specialists

The brief instructions below, outlining a six-step procedure, are intended for experienced installers who need to refresh their memory on the key points. More detailed and thorough installation instructions can be found in sections 1.2-1.4 of this manual.

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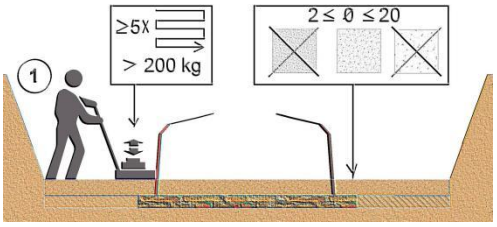
- Provide space for tamping. A free space of 1 meter in length must be reserved on each side of the tank.
- A reinforced concrete slab is installed at the bottom of the excavation, or a layer of crushed gravel is poured (see the more detailed guide)
- Pour a 20 cm layer of crushed gravel and compact the surface five times using a compaction device weighing over 200 kg.
- It is not recommended to use fine-grained soil or large-sized gravel or crushed stone. We recommend using frost-resistant crushed stone or gravel (see the detailed guide).
- The anchor cables are installed according to the manufacturer's recommendations.



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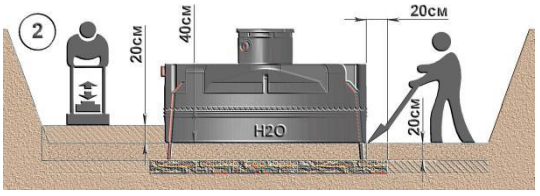
- Install the tank and secure it. Use the standard tools for tensioning the anchor cables.
- Next, the tank should be filled with water up to a level of 40 cm to secure the tank in the desired position.
- Fill the excavation in layers of 20 cm, compacting each new layer sequentially.
- Carefully fill in the excavated areas and all voids with soil.



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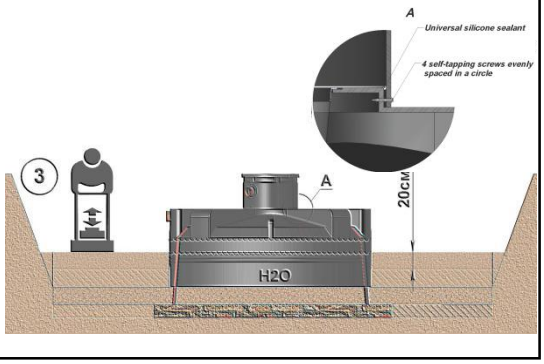
- Add water as the process progresses.
- Secure the technical well to the tank using self-tapping screws.
- Using a syringe, inject sealant into the groove between the tank and the UHPLAST technical well installed on the neck.



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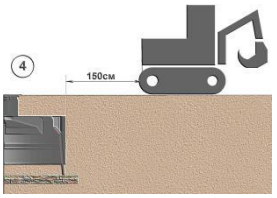
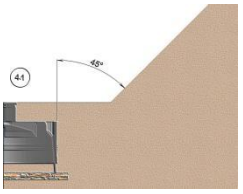
- To facilitate the installation of the tank from a greater distance, use large mobile cranes.
- Until the installation is completed and during the operation of the tank, all vehicular movement on the installation site is prohibited.
- Compaction of the surface above the tank is allowed only if there is a soil layer above it with a thickness of at least 60 cm.
- Installation of the tank is not allowed on slopes or inclines.





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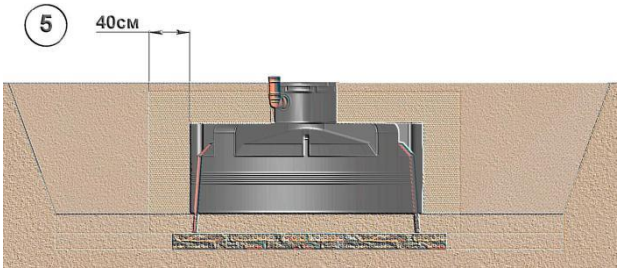
- The backfill of the excavation must be placed at least 40 cm away from the tank.



One of the methods for backfilling during tank installation for heavier soils

- On the outside of the tank, install a ring reinforcement

around the perimeter) along the entire height of the tank using rebar and binding wire or directly with a metal mesh at a distance of 70-100 mm

- Perform the backfilling of the tank, which consists of several stages. Fill the tank with water to a height of 200-250 mm from the bottom. The backfilling is done with a sand-cement mixture to a height of 150-200 mm. Thoroughly water the sand-cement mixture. For better quality backfilling, it is recommended to use a liquid sand-cement mixture without coarse gravel. The grain size of the gravel used should be within 5-10 mm maximum. After the first layer has hardened, repeat the backfilling process following the same sequence.

It should be noted that in the presence of loose soil, formwork must be used during backfilling to prevent the collapse of the excavation walls.

- Prepare the sand-cement mixture for backfilling in a 4:1 ratio.
- Failure to follow the backfilling stages or the absence of metal mesh or reinforcement may lead to deformation of the tank and the formation of cracks.

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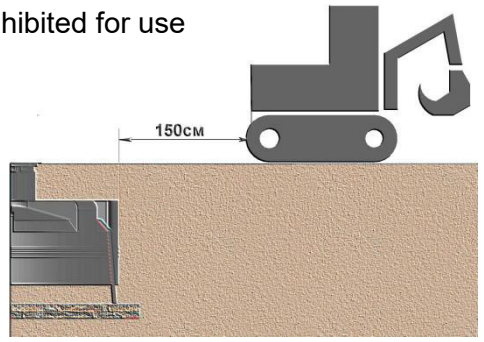
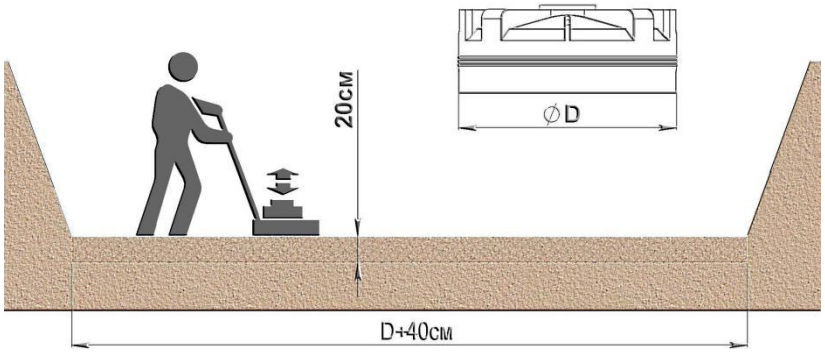
- When installing the tank, the condition of the access roads must be taken into account. Protection against soil freezing is of great importance. Frozen soil is prohibited for use during the work.
- The quality of compaction can be checked after the work is completed.
- The tank should be installed in an area closed to vehicular traffic. It is recommended to separate this area from the rest of the site using, for example, fencing, barriers, or similar devices.
- Familiarize yourself with the process of tank installation into the ground in the more detailed instructions!



1.2 Excavation, compaction of the excavation, and anchoring of the tank.

1. The excavation should be of sufficient size to allow for the compaction of the backfill soil adjacent to the tank. A layer of crushed gravel or crushed stone, at least 200 mm thick, should be placed on the bottom of the excavation. This layer should be leveled and compacted using a compaction device, suitable for the subsequent installation of the foundation slab. The bottom of the excavation and the gravel/crushed stone should be free from frozen soil.

Fig.1 *Determining the dimensions of the excavation and the bottom layer of soil for compaction of the excavation floor.*



If the soil at the tank installation site does not meet the required standards and has low bearing capacity, it is recommended to expand the excavation so that the distance between the tank walls and the excavation is at least equal to the radius of the tank. In this case, the soil quality and installation conditions can be improved by driving piles.

2. A reinforced concrete installation slab (which will also serve for anchoring) must be poured onto the leveled and compacted bottom of the excavation as a supporting layer if:

- The groundwater level during the installation of the tank is above the bottom of the tank
- The soil has poor water permeability
- The soil has insufficient bearing capacity

The use of a concrete slab is usually required when installing in clayey soils, silty soils, soils containing organic matter, and soils with high moisture content that poorly allow water to pass through.

In some other cases, pouring a concrete slab is recommended because it stabilizes the soil and facilitates anchoring. Use concrete and reinforcement for the slab casting. When pouring the slab, it is necessary to form anchor eyes (more details on this are provided below). We recommend pouring a single slab for the entire system. The dimensions of the slab:

- The length and width of the slab = the diameter of the tank + 400 mm.
- The thickness of the slab = 150 mm

3. The tank must be secured to prevent the rising groundwater from causing movement. Additionally, soil compaction around the tank can easily lead to the tank being pushed upward, creating a layer of soil with insufficient density beneath its bottom surface. Anchoring can also prevent the tank from being pushed upward, which may occur during the installation of the tank.

Anchoring may be omitted if **ALL** of the following conditions are met:

- Only the types of backfill materials recommended in this manual are used during installation.
- The soil has sufficient bearing capacity, the groundwater level during tank installation is below its bottom, and the soil allows water to pass through easily.
- At the start of the installation, water was poured into the tank up to the beginning of the first layer of backfill, 400 mm high, to prevent the tank from being pushed upward during its installation.

Below are more detailed instructions for anchoring the tank:

The recommended main structure for anchoring is a reinforced concrete installation slab. The slab must have the necessary number of loops (with a diameter of at least 10 mm) made of stainless steel on both sides for securing the anchor cables. The locations of the loops are determined based on the placement of the anchor cables. The anchor cables are positioned according to the manufacturer's specified locations on the tank. Cables should not be installed on the inlet and outlet pipe connections. When installing cables on the end parts of the tank, care should be taken to prevent the cables from slipping off the surface of the tank. For anchor cables, flat, stretch-resistant polyester cables of 50 mm, 4000 kg, with a tensioning device, should be used. Excessive tensioning of the cables should be avoided to prevent damage to the tank. The tensioning of the cables should be carried out in two stages: First, tension each cable until the tensioning device's force starts to significantly increase. Ensure that the tensioning devices do not press on the surface of the tank. After this, repeat the operation starting with the first cable and tension the cables as much as the first time. **Any auxiliary tools are prohibited from being used to achieve the required level of tension.** Use only cargo ropes for anchoring. Attention! The locations of the anchor ropes are not marked on the tank by its manufacturer. Figure 2 shows the schematic diagram of the tank's attachment to the anchor plate and the arrangement of the anchor ropes around the tank.

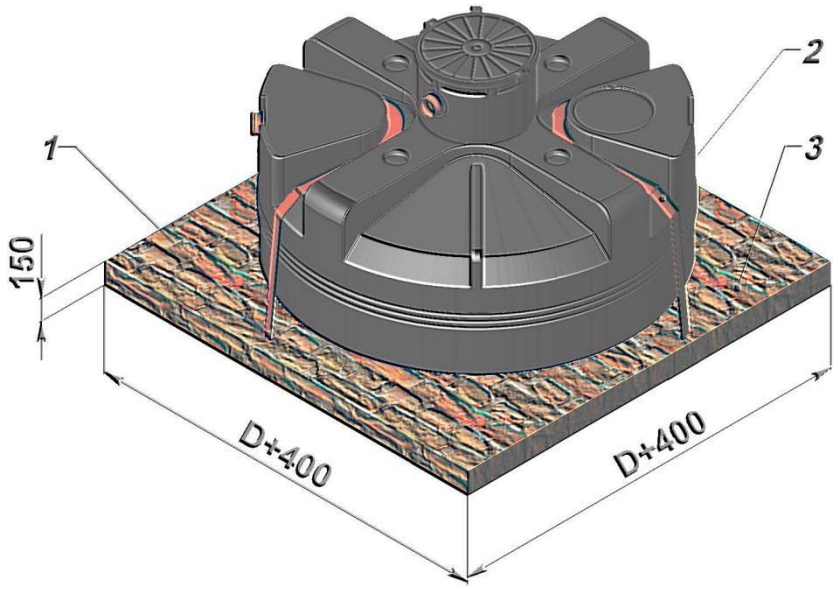


***Fig. 2** Anchoring of the tank in areas with groundwater and on soils with low bearing capacity.*

1. Stainless steel loop T10	2. Anchor cable
3. Anchor plate	The width and length of the plate = the diameter of the tank + 400 mm. The thickness of the plate = 150 mm.

1.3 Tank Installation

In order for the soil to serve as a support for the container, special attention should be paid to its placement around the container and its compaction. Therefore, a **compaction device** should be used for soil compaction, and **gravel or crushed stone** should be used as the soil.

The aggregate size should be less than 20 mm, with a low content of fine particles. It is recommended to use gravel or crushed stone with a grain size of 2/16 mm as backfill material. The final section of the tank installation instructions provides information on recommended soil types and permissible aggregate size ranges. **The acceptable grain size ranges include our recommended 2/16 mm gravel/crushed stone (or a similar material).** The use of frozen soil is prohibited.

Compaction of the soil should be carried out using a tamping device weighing at least 200 kg. The backfilling of the excavation must be done in layers, with compaction performed after the placement of each successive 200 mm layer. To achieve the required soil density, the compacted layer must be processed with the tamping device at least five times. The height of the compacted layer must be uniform across the entire area surrounding the tank.

Before the final installation of the tank, make sure that no vehicles or construction machinery come closer than 150 cm to the tank.

The warranty is void if the tank installation was carried out in violation of the rules outlined here!

Follow the installation of the tank according to the instructions provided below (before reviewing the steps of the tank installation, read the text in the box marked with an exclamation mark). The parts of the text depicting the stages of the installation work are numbered the same as in the section with the condensed step-by-step outline of the installation procedure.

1. Secure the anchor cables on both sides of the tank to the stainless steel loops (see the anchoring instructions in the previous section). Compact a 200 mm thick layer of gravel (2/16 mm) or crushed stone over the support layer/installation slab of the excavation. Perform the compaction of the soil using a tamping machine.

   Place the tank on the layer of crushed stone, adjust the position of the tank, and fill it with water to a height of 400 mm to stabilize the tank and prevent it from being displaced upwards due to the compaction of the soil.

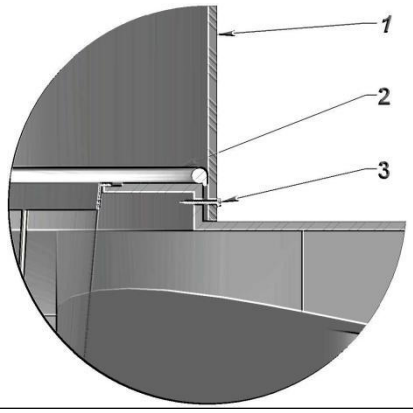
2. Secure the tank using non-elastic anchor cables on the foundation slab. If the number of anchor cables is insufficient or their tension is not high enough, the tank may be displaced to the surface due to the rising groundwater. Run the cables around the tank and tighten them. Tensioning is recommended to be done using appropriate tensioning devices.

Start laying the next layer of gravel approximately 200 mm thick. Use special bars to push and compact the gravel under the bottom of the tank, as well as along the rails and the end parts. Compact the layer with a compaction device. There should be no empty cavities or insufficiently compacted areas of soil around the tank.

Continue compacting the soil around the tank by laying it in 200 mm layers, compacting each new layer with a compaction device. The height of the soil layer must be absolutely uniform on both sides of the tank. As before, push the gravel until it fully contacts the surface of the tank and the curved lower surfaces of the end part. If the previously excavated soil from the excavation is of good quality, it can be used to fill the outer parts of the excavation, provided that the radius of the gravel layer around the tank, pipe connections, technical well, and other surfaces is at least 400 mm. As the installation progresses, add water to the tank so that it is completely filled by the time the backfill reaches the top surface of the tank. When compacting the backfill around the tank, the load on the tank filled with water is lower than on an empty tank.

Connect the tank to the sewer pipes when the level of the compacted backfill reaches the bottom of the pipe connections. Compact the gravel around the pipes and connections to ensure they do not move relative to the tank and are also supported by the soil.

3a. When the compacted layers of gravel reach the top plane of the tank, the technical well(s) should be installed. Secure the technical well to the tank with self-tapping screws, tightening them to avoid deforming the surface and ensuring uniform alignment with the neck. A sealant resistant to petroleum products should be injected into the gap between the neck of the tank and the UHPLAST technical well using a syringe. The technical wells are installed in a vertical position on the mounting neck (Fig. 4).



	UHPLAST -
1	Technical well
2	Sealant
3	Self-tapping screw

Fig. 3 *Installation of the tank's technical well.*

3. During the installation of the tank and the backfilling of the excavation, construction machinery must not approach the tank closer than 150 cm, even if the soil has sufficient bearing capacity. This is because at this stage the soil does not yet fully support the tank, and the pressure exerted by construction equipment may cause damage to the tank.

The tank must not be installed on slopes or inclines. Accumulation of excavated soil near the tank should also be avoided. There must be an angle of at least 45 degrees between the tank and the edge of the slope on each side of the tank.

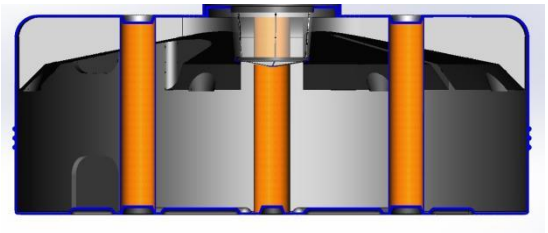
Continue compacting even after the backfill reaches the top level of the tank. At this stage, the layer thickness may be increased to 300 mm. Do not use heavy compaction equipment when placing the first two 300 mm layers directly above the tank and pipe connections. Continue backfilling the pit with gravel until it reaches ground level.

1.4 Ground frost protection

The tank must be installed in a way that ensures protection against ground frost. The degree of frost protection depends on the depth of the pipelines and local conditions. We recommend installing frost protection. This can be achieved using insulation boards specifically designed for this purpose. The thickness and dimensions of the boards should be determined individually for each specific case.

1.5 Photo of the assembly of the tank components

- After installing the tank in place on the compacted ground of the excavation, install the support pipes inside the reservoir.



- Make a hole in the tank at the location of the outlet pipe connection with a diameter of 127 mm
- Apply sealant to the gasket groove and insert the fitting as shown in the photo.
- Grease the inner gasket sleeve and insert the pipe with a diameter of 110 mm and a length of 500 mm up to the bell end.

- Make two holes in the tank with diameters of 10 mm and 12 mm for the passage of the pump outlet pipe and cable, on the shelf of the mounting neck of the technical manhole.
- Apply sealant to the grooves of the seals and insert the fitting as shown in the photo.

- Make a hole in the UHPLAST technical well, at the height of the inlet fitting, with a diameter of 127 mm.
- Cut the technical well to the installation height.
- Apply sealant to the gasket groove and insert the fitting as shown in the photo.

1.6 Diagram of load on the tank walls

Calculation of the load on the tank from medium-weight soil based on a maximum depth of 0.8m x 1.3 tons/m²