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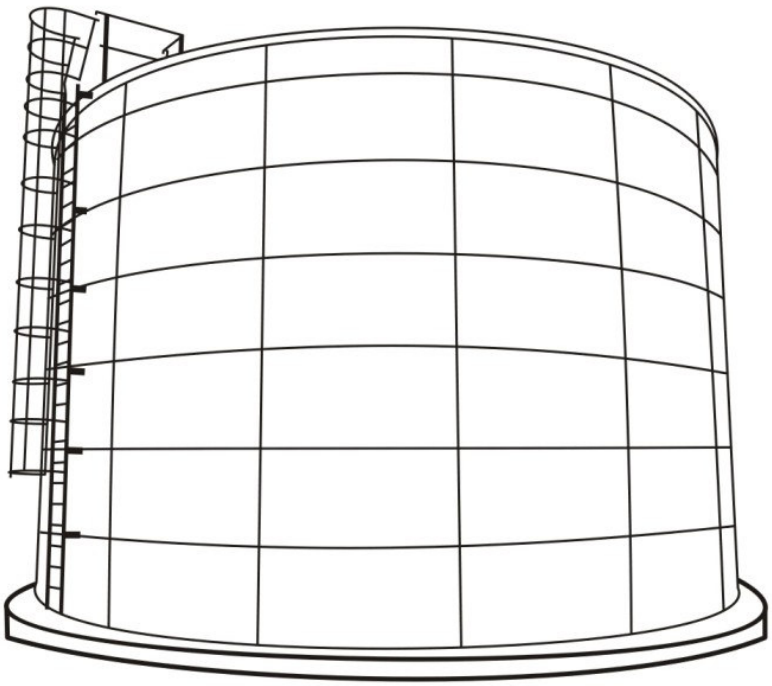
SPRINKLER TANKS

(Polish Scientific and Research Centre for Fire Protection
Report no 4033/BS/08)

TECHNICAL SPECIFICATION



Manufacture » Delivery » Assembling » Service

"MOSTOSTALEX"

Warsaw 5.2009

DESIGN

Tanks **"MOSTOSTALEX"** with Scientific and Research Centre for Fire Protection Report no 4033/BS/08 are designed for fire protection water supplies storage. Tanks construction design was developed by own science-design department and conform to standards required by Polish norm PN-90/B-03200 Konstrukcje Stalowe – Obliczenia Statyczne i Projektowanie; German DIN-18800 Stahlbauten – Stabilitäsfälle, Schalenbeulen and American ANSI/AWWA-D103 Factory-Coated Bolted Steel Tanks For Water Storage and also conform to FM system tanks requirements of Approval Standard for Ground Supported Flat Bottom Steel Tanks for Fire Pump Suction published by FM Global. Cylindrical tanks shell is bolted and performed with particular hot dip galvanized steel sheets. Roof cover construction composed with insulated roof panels fitted to hot dip galvanized steel zed cross-section roofing purlins. Steep shape of roof surface guarantees raining water outflow – no risk of water accumulation on the roof. The roof is self-supported – supporting columns do not require a tank inside.

» Tanks construction is designed for two calculation options, i.e. the tank water filled up and empty tank affected by wind pressure.

SEALING

The tank is lined inside with synthetic bag-shaped rubber membrane from EPDM (or Butyl) matching tank dimensions. The purpose of liner application is to separate stored water from steel walls of the tank and its insulation.

Membrane consists of two rubber layers. Liner total thickness is 1.00mm. The foundation base is lined with industrial felt matting as protection from local irregularities of base surface which could cause membrane damage.

EPDM is very flexible material (after elongation to 300% rubber can regain and retain its original shape and size). The liner is easy to assemble and does not require special care during first water filling (if properly unrolled inside the tank). Membrane fabrication (vulcanization) is provided at factory works and supplied as a rolled bag, ready to be installed.

» EPDM liners are designed for 30 years durability.

CORROSION PROTECTION

All steel construction compounds and equipment are hot dip galvanized, which protects coating from atmospheric influence. Tank waterproof sealing system using EPDM membrane bag prevents stored water from direct contact with steel walls of tank (from inside), which guarantees long durability of cylindrical shell. Nominal water level is kept below bottom edge of galvanized roofing purlins. All

applied bolts are hot dip galvanized (zinc layer of ca. 40μm). Roof panels consist of insulation core and double-sided galvanized steel sheets, which are additionally painting coated.

In addition, outer steel walls of the tank are factory painted using electrostatic powder coating method. Besides improving its aesthetic appearance, shell plates painting extends the tank's durability.

» Tank walls painting does not mean steel plates zinc thickness reduction. Paint layer is an ADDITIONAL protection coating.

THERMAL INSULATION

WALLS INSULATION. Tank walls insulation consist of XPS polystyrene panels installed inside the tank – between membrane liner and steel shell (internal insulation technology). Insulation is rigidly fitted to the shell by bolts. Expanded polystyrene of higher hardness is characterized by maximum 2% deflection during long-lasting water column pressure ! Insulation is water-resistant so moisture does not cause polystyrene degradation. Optionally, tank walls can be externally covered by mineral wool and cladding of trapezoid or corrugated sheets (external insulation technology).

ROOF INSULATION. Roof insulation consist of composite roof panels with EPS polystyrene core ("Sandwich" system). Panels are fitted to the roofing purlins.

HEATERS. The tank is equipped with two immersion heaters whose purpose is emergency water heating during extremely low winter temperatures. Heaters are installed in tank shell at 500mm below nominal water level, close to supply pipe outlet or float-valves. Flange connection through tank shell with assembling thread orifice allows easy heaters removal (e.g. for cleaning). Electrical clamps are located in plastic box made in IP67 standard outside the tank. Heaters supplying by three-phase current.

In cylindrical steel tanks, stored water loses the bulk of heat through non-insulated roof. Providing the tank with insulated composited roof panels would allow reduction of walls thickness insulation and significant reduction of demand for heating.. Heaters power calculation does not include heat loss through foundation base and possible water exchange in tank.

Thermal insulation of **MOSTOSTALEX** tanks:

- Insulated panels with EPS polystyrene core on roof – 60mm;
- XPS polystyrene panels for walls insulation – 40mm;
- Heaters power – 2 x 4kW or 2 x 6kW;

Optional:

- External insulation of mineral wool – 60mm;

» Selection of insulation type and thickness, and heaters power calculation shall be made by the tank producer. **MOSTOSTALEX** company guarantees that water will not freeze over during winter.

FOUNDATION BASE

MOSTOSTALEX company will prepare foundation base project on reception of results of geological exploration carried out in the tank location.

For uniform settlement and non frost heave soil, it is recommended to build foundation base of 18-20cm thickness. Concrete type C25/30, F75, W4, concrete reinforcement top and bottom by bars ϕ12 class AIII with 25cm spacing both sides. Foundation surface smoothly polished. Surface level allowance is ±3.00mm.

CAPACITY

Several models of the tank are available for the capacity required. Extensive table of dimensions allow to match and select the tank suitable for the building architecture – fitting free ground area for tank accommodation, total height of the building or dimensions of pumping station.

For Customer comfort, volumes are working capacities (net) and are automatically reduced by volumes of:

- freeboard
- bottom dead water
- internal insulation (if used)

The tank can be equipped with combination of 2 suction pipes with different inlet level elevation, which configure and split tank capacity for two (or more) water zones of separated applications. In that case, bottom volume will be master source of water. For example, sprinkler tank can be applied for technological water storage simultaneously.

In accordance to fire protection definitions and standards, working capacity is calculated excluding bottom dead-water, i.e. certain water column height counting from tank bottom. This volume is real water mass and for foundation base water weight loading design it have to be added to tabled working capacity.

ANCILLARIES

Tank ancillaries such as internal pipeworks with float-valves and cut-off valves are supplied. Pipelines connections in the tank wall (steel shell) or bottom (foundation base). Configuration of pipeworks in foundation base does not require insulation – pipes are placed below frost penetration deep in ground. If pumping station building is located near tank, more economical solution will be tank shell connection (at least suction and return from pump pipeworks).

On account of water column pressure and direct contact with stored water, all pipeworks inside the tank

are steel and galvanized.

Tank producer DOES NOT RECOMMEND connecting pipeworks manufactured from other materials, such as PE, PVC or cast iron to the tank. On account of technological problems, connecting two pipes of different material on the tank border can cause water penetration and consequently tank leaking. If water & sewage pipelines system on site is provided with materials other than steel, it is recommended to change to steel pipes beyond foundation base circumference.

In the case of pipeworks connected to the tank through foundation base, pipe connection has to be made with two FLAT FLANGES on tanks bottom (liner). Only the flat flange (without gasket mill) guarantees symmetrical holding pressure at whole flange surface and leakproofness of the main stream flow hole and bolts holes. Standard flanges with rebate application will make it impossible to keep bolts holes connections waterproof and cause water leaking outside the tank.

While determining height levels of pipe connections through tanks walls, horizontal rows of bolts of shell have to be passed over. For proper pipes axes elevation design please contact tank producer.

Tank producer recommends providing overflow pipe outside by shell (not base) and finishing it above sewage sump grid located near tank.

Ancillaries of the tank and pipeworks include valve fittings. Tank water supply pipe ends with self-acting float-valves. Drainage pipe is equipped with cut-off valve. Pipeworks for fire fighters brigade (direct water outlet) end with cut-off valves and fire hose caps.

Since float-valves are susceptible to being clogged by impurities, it is recommended to use clarifier (or other filter) on the water supply pipeline – outside the tank line.

The tank is equipped with external steel caged ladder. Platform with guard railing, access manhole and float-valves box are installed on the roof.

The roof has built-in air-escape. It levels the pressure inside the tank during water suction or drainage – sudden water level falling down.

AUTOMATIC CONTROL

The tank is equipped with system controlling 4 water levels.. Conductance probes are installed inside and suspended on the fixed heights (water level indication). Tank producer recommends the following configuration:

- Nominal level (water level height is proper for determined working capacity). Additional, water level above immersion heater indication (heaters are sunk) – automatic system allow for heater working.
- Low level – probe suspended inside the tank at the level of about 50% of tanks height. Other water level control choice is possible.
- Empty tank level – probe is settled at 100mm above suction pipe vortex plate edge, which means that

working water volume has been finished and bottom dead water drainage has commenced. This probe level indicates the risk of suction pumps working without water !

- Alert level – probe position between nominal water level and overflow pipe inlet edge. Water level inside the tank is too high, which can mean uncontrolled water overflowing.

Indication signals from probes are redirected to the relay installed inside electrical box.

The tank roof is equipped with a temperature sensing element for measuring water temperature and providing analogue signal to control unit built-in electrical box. Sensor type Pt100 indicates temperature at the end of 1.0m long bar. It is not affected by air temperature.

Electrical box is necessary for non-failure tank operation. It is usually installed inside pumping station building or room, where the tank's electrical devices are monitored in one place together with pumps system control. If tank does not operate with pumping station or the location distance is too long, electrical box can be fabricated for external working (higher international protection rating) and installed directly beside the tank on earlier prepared concrete base or steel construction.

Electrical box has the following applications:

- Immersion heaters work control depending on water temperature indication (turns on when water temperature falls down below +5°C).
- Immersion heater control depending on water level (work permission if nominal water level reached).
- Immersion heaters cyclic turning on using time relays.
- Current stored water level display. Signaling lamps are built in the electrical box cover.
- Water levels signals provided to external connection terminal strip for further use.
- Current stored water temperature display.
- Water temperature signal provided from non-potential contacts to external connection terminal strip for further use.
- All three phase power display.
- Master switch power disconnection.
- Immersion heater power disconnection with maintenance switches.

COLOUR

MOSTOSTALEX company offers tanks painted in accordance with RAL color palette. Galvanized shell plates are paint-coated in the factory before delivery. All steel sheets are coated in powder paint shop to keep pain layer uniform on the whole surface of the tank walls and to get the best visual appearance effect. Paints for external application are used. They are resistant to the influence of atmospheric conditions.

Roof panels are coated with RAL9010 (white) color to reflect sun lighting.

Attic and flashings are manufactured in the same color as tanks shell or other RAL color – depending on Customer choice.

The rest of the tank construction and equipment compounds such as bolts, external ladder, wind stiffener or electric cable housings will not be painted – zinc color remaining.

SERVICE

DESIGNING. Prior to delivery and assembly, the tank manufacturer shall prepare executive project of foundation base and technical documentation of the tanks including construction design. Papers are translated into the local language.

DELIVERY. Delivery includes all elements of tanks and its equipment with unloading on the construction site or customer's warehouse.

ASSEMBLING. The tank is erected with hydraulic jacks set – sequential lifting of the tank's steel construction with simultaneous assembly of internal insulation, EPDM membrane lining and other equipment fittings.

WATER PROOF TRIAL. After shell and roof construction has been erected and all pipeworks installed inside the tank, water filling can be started. At first stage, the tank should be filled only up to the level of about 1.5 m to check that all shell or base pipeworks connections are waterproof. In the second stage further filling to the designed nominal water level can be continued. Self-acting float-valves will cut off water supply. In accordance with local norm requirements, for tanks with non-absorbable walls, water proof trial timing is only 24 hours.

While the tank is being filled with water, dew can form on the external tank shells, which is the result of temperature difference between the supplied water and the air outside. Water flowing down the walls can cause insignificant moisture accumulation on the foundation base around the tank. It does not mean that the tank is leaking.

ELECTRICAL DEVICES TESTING. After positive tank waterproofness test, all electrical devices tests can be carried out including switchgears cabinet. Electrical system is designed to prevent turning on immersion heaters when water is below the heater level. Full water volume (nominal) is required to start the heaters.

APPROVALS. Immediately after positive waterproof test, electrical and wiring, assembly, the manufacturer shall prepare and send as-built documentation including necessary certificates. Papers are translated into the local language.

STANDARDS

MOSTOSTALEX guarantees tank designing and manufacturing in accordance with required standards, which will be confirmed by National Certificate of Conformity.

Fire protection standards:
PN-EN 12845 Stałe urządzenia gaśnicze – Automatyczne urządzenia tryskaczowe – Projektowanie, instalowanie i konserwacja.
VdS-CEA 4001 Sprinkleranlagen. Planung und Einbau.
NFPA 22 Water Tanks for Private Fire Protection.
FM Data Sheets 3-2 Water Tanks For Fire Protection

» NFPA standard choice for a tank, means designing and manufacturing tank construction in accordance with American standard AWWA-D103 (note in NFPA 22 Chapter 4 Factory-Coated, Bolted Steel Tanks 4-5 Design Details). Requirements include steel plates for tank shell of minimum 2.5mm thickness.

WARRANTY

Tank producer gives 5-year warranty for the tank and 12-month warranty for mechanical and electrical devices.

» For valid warranty keeping, only It is required to carry out 1 technical inspection including inside cleaning in the third year of tank use (starting from date of first water filling) to keep the warranty valid.