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WATER STORAGE TANK
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PART 1 GENERAL

- 1.01 SECTION INCLUDES
Water storage tanks
- 1.02 RELATED SECTIONS
Water supply piping, water use piping, electrical, irrigation, foundations, site plans.
- 1.03 REFERENCES
IBC, FDA , NSF-61, NFPA-22
- 1.04 SUBMITTALS
Tank dimension drawings shall be submitted for approval prior to tank materials fabrication.
- 1.05 QUALIFICATION AND EXPERIENCE
Tank fabricator shall be experienced in manufacturing corrugated galvanized steel bolted tanks. Tank installer shall be experienced in the installation of tanks exceeding 20,000 gallons and working on commercial construction job sites. Tank installer shall be trained in confined space protocols (OSHA) and be able to prove a minimum of five (5) years of tank building experience.
- 1.06 DELIVERY, STORAGE AND HANDLING
Tank materials shall be shipped from factory on wood pallets designed to protect materials from normal shipping damage. Tank materials shall be stored to prevent the development of white rust onto galvanized steel.
- 1.07 WARRANTY
The manufacturer shall warrant the tank structure against defects in workmanship and materials for a period of thirty (30) years from the date of shipment of the materials from the factory. The manufacturer shall warrant the main liner against defects in workmanship and materials for a minimum of (10) ten years from the date of shipment of the materials from the factory on a pro-rata basis.

PART 2 PRODUCTS

- 2.01 WATER STORAGE TANK
- A. General
The water storage tanks shall be standard factory engineered galvanized steel tanks with liquid tight liners. The water storage tanks shall be assembled and erected on site. The tank structure shall consist of corrugated, galvanized steel wall sheets, roof panels, one roof panel with access hatch, standard peak cap, roof ladder angles, anchor clips and necessary hardware for tank assembly.
- B. Acceptable manufacturers
Water Storage Tanks, Inc. (www.waterstoragetanksinc.com; 800-463-1898)
Specified Water Systems (www.specwater.com; 512-301-5632)
- C. Bolted Tank Structure
Galvanized steel tank wall and roof panels shall be pre-punched at the factory for field assembly.
- D. Preliner

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A 6 oz. black geotextile preliner shall be installed inside of the tank structure. The preliner shall cover the tank floor and the walls on all surfaces at which the main liner could contact the tank structure.

E. Main Liner

Water containment system shall be a factory welded seam, flexible membrane main liner. The liners shall be installed inside of the water tank by the CorGal® method utilizing liner hanger bolts, seal washers and grommets for suspension.

2.02 TANK DESIGN CRITERIA

Water tank shall be designed to meet or exceed Seismic Zone 2B (Seismic Design Category C) conditions, 90 MPH (UBC), 110 MPH (IBC) wind speed and 20 PSF roof live load. The tank structure shall be designed to contain potable or non-potable water having a density of 62.4 pounds per cubic foot.

2.03 STRUCTURAL MATERIALS

Per NFPA-22 Section 6.3.1, "Tanks shall meet requirements for resistance to earth quake damage in accordance with the earthquake design provisions of AWWA D103."

Per NFPA-22 Section 6.4, "Steel plates or sheets shall meet the minimum design criteria in accordance with AWWA D103, as well as any additional requirements outlined in 6.4.1.1 through 6.4.1.4."

The water tank must be supported with a structural design calculation package, stamped by a licensed engineer, confirming the selected tank meets or exceeds these structural design criteria.

Wall sheets shall be continuous 2-2/3" depth x 1/2" pitch (67.7 MM x 12.7 MM) annularly corrugated galvanized steel, 20-gauge steel or heavier with minimum yield strengths of 57,000 psi (3990 Kg/CM²) (Tensile strength 65,000+ psi [4550 Kg/CM²+]). All zinc coating shall conform to G-115 (275 grams/square meter) specifications or higher. Bottom wall sheets have an inward return flange for additional bearing on foundation. Wall sheets shall have a coverage length of 9' 4-1/2" (2,858 M) long, except for some 6' 3" (1,905 MM) long sheets used adjacent to the access door.

Holes in vertical seams shall be punched for single row or double row connections at 1-1/3" o.c (34 MM). Use of single row or double row of bolts at vertical seam is dependent upon diameter and depth of tank.

Horizontal seams shall have a single lap connection with a maximum bolt spacing to be 9-3/8" (238 MM).

One-piece, 12 gauge (2.67 MM) or heavier galvanized steel die-formed or welded anchor clips shall be supplied for a minimum of one anchor clip per base wall panel. Anchor clips shall be bolted to the tank wall with four bolts to contact a concrete base.

Per NFPA-22 Section 13.3.2.4, "Where roofs have a slope of less than 30 degrees, they shall be designed to support a uniform weight of 25 lb/ ft² (122 kg/m²) on the horizontal projection. The water tank shall have a roof pitch of 30 degrees unless structural engineering confirms a lesser pitch meets these standards.

Roof sheets shall have triangular sections of galvanized steel, with brake-formed raised ribs along each side, flat area between ribs (except 6' & 9' [1.83 M & 2.74 M] diameter), and a 90° formed drip edge at the eave. Roof panels shall be manufactured from G-115 galvanized steel conforming to ASTM A 446, Grade C, or greater.

Roofs of tanks 6' (1.83 M) diameter shall have 6 roof panels. Nine-foot (2.74 M)

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diameter tanks shall have 9 roof panels. Panels may have a non-ribbed, flat design type, with crimped edge designed to seal over wall sheets.

Roofs of tanks 12' & 15' (3.66 M & 4.57 M) shall have 23 panels (22 straight panels, and 1 double wide with roof hatch). Roofs of tanks 18' through 24' (3.66 M – 7.32 M) diameter shall have 24 roof panels. Roofs of tanks 27' through 36' (8.23 M – 10.97 M) diameter shall have 36 roof panels. Panels shall have a formed box-type rib with a rib height of 3-1/4 inch (82 MM) rise above flat area.

All roof panels (except 6', 8' & 9' [1.83 M & 2.74 M] non-ribbed style) shall be connected to the eave of the tank with center clips and a varying number of rib clips depending on tank diameter. Holes in the top ring wall sheets shall be factory punched for clip installation. Press-on bulb type neoprene eave seal and silicone caulking shall be used to seal between the top wall panel and the roof panel.

Roof ladder cleats shall extend from eave to center cap. Ladder cleats shall consist of galvanized steel cold-formed angles of varying lengths bolted to top of one roof panel. (Not supplied on 6' [1.83 M] diameter.)

2.04 TANK ACCESS

A 22" round access hole with cover shall be at the top center of the roof (36" for tanks 27' in diameter or larger). For tanks 12' in diameter or greater, a 31" X 16" X 19" trapezoidal access hole with hinged cover shall be located on the lower end of one roof sheet. For 6', 8', and 9' diameter tanks a round inspection hatch will be an appropriate replacement. A 20" X 40" bolted side access panel shall be located 22" above the floor on a side panel. The side access shall be bolted closed before final installation of the main liner.

2.05 TANK PENETRATIONS

The fire outlet penetration flange shall be a sch. 40 galvanized steel material with PVC gasket and grade 18-8 stainless steel cap screws for clamping. The overflow penetration flanges shall be a sch. 80 PVC material with PVC gasket and grade 18-8 stainless steel cap screws for clamping. Liquid seam sealant may be used to ensure effective sealing. Tank erector will install penetration flange onto tank for piping connections by others.

The tank shall have one (1) 6" wall mounted flange for outlet fire connection, one (1) 2" wall mounted flange for drain and one (1) 4" wall mounted flange for overflow.

It is NOT acceptable to utilize flanges which use a single set of through-bolts which essentially "sandwich" the liner and flanges faces to the steel wall. This method may cause additional leak points and may compromise the structural integrity of the tank wall.

2.06 TANK FOUNDATION

The tank foundation shall be a concrete pad that will extend at least 9" outside of the tank wall in all directions. The foundation design and construction is not covered by this section of the specifications.

2.07 WATER LEVEL INDICATOR

Tank gauge shall consist of a stainless-steel frame and stainless steel hardware with nylon sheave pulleys. Cable shall be nylon coated stainless steel with a minimum breaking strength of 270lbs. The gauge shall read the true level of the stored water (outside indicator shall match the water level inside the tank).

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2.08 HARDWARE

All bolts and nuts shall be electro-galvanized with JS-1000 clear coat protective coating. Roof bolts shall have factory-installed steel-backed vinyl washers. Wall sheet bolts shall have slotted button heads for insertion from inside toward outside. All bolts shall be heat treated and meet SAE Grade 8.2 or stronger specifications.

2.09 FLEXIBLE MEMBRANE LINER

The flexible membrane liner shall have minimum a rated thickness of 24 mil (+/- 10%) and a minimum finished coated weight of 22.0 oz/yd² (+2/-1 oz/yd²). The liner shall be a PVC coated polyester fabric liner or polypropylene coated fabric reinforced liner. If the tank is intended for potable use, then the liner shall carry the NSF-61 certification. The liner shall be fabricated with a minimum of 1.5" factory welded seams and shall have a poly rope in the top hem for reinforcement. Metal or PVC grommets shall be evenly spaced along the top hem to facilitate the CorGal® method of liner hanging.

2.10 ANCHOR CLIPS

The anchor clips and anchor bolts shall conform to the structural design calculation package, if provided, and shall always meet site-specific requirements to properly anchor the tank in accordance with seismic, wind load, and other environmental conditions. Anchor clips shall be placed no less than every 39" around the perimeter of the tank.

Where seismic anchors are not required, the base anchor shall be a pre-formed anchor clip made of 12 GA. hot dipped galvanized steel which conforms to the tank wall corrugations. The anchor clip shall have a 1" hole in the base to accommodate the specified anchor bolt. The anchor clip shall be secured to the wall of the tank with no fewer than four 3/8" bolts.

Where seismic anchors are not required, but wind loads or other environmental conditions exceed base tolerances, then a heavy duty anchor clip shall be used. The heavy duty anchor clip shall be made from 7 GA. hot dipped galvanized steel. The anchor clip shall have a 1" hole in the base to accommodate the specified anchor bolt. The anchor clip shall be secured to the wall of the tank with no fewer than four 3/8" bolts.

Where seismic anchor clips are required, an anchor "chair" shall be utilized with the anchor bolt extending through the base plate and through a 1" hole in the top plate of the chair. A minimum of 9 15/16" inches shall separate the two plates to allow for stretch of the anchor bolt during a seismic event. Additional spacing may be required for various duty of chairs. The anchor chair shall be secured to the wall of the tank with no fewer than six 3/8" bolts.

2.11 LADDERS

In compliance with NFPA-22 the tank shall have an external ladder permanently affixed to the tank wall. The water storage tank shall have a galvanized steel external ladder comprised of multiple pre-fabricated sections, 42 1/2" in length, that are bolted together and subsequently bolted to the tank exterior. 1" x 1" square anti-slip Ladder rungs are 19" wide and spaced 16" between rungs. Each rung penetrates the 1 1/2" x 1 1/2" square side bar and is riveted in place.

An external, OSHA-compliant safety cage shall be affixed to the external ladder. The bottom of the safety cage will be approximately 7' above grade. The safety cage will feature a lockable security cover or, alternatively, bottom rungs of the ladder will be covered with a lockable cover to prevent climbing by unauthorized personnel.

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The internal ladder shall be a modified steel, aluminum, or fiberglass extension ladder that is fitted to a custom pulley system, affording the ability to remove the ladder from the water when not in use and minimizing corrosion. The ladder will be easily lowered to the tank floor when service or inspection are required.

2.12 ANTI-VORTEX ASSEMBLY

Per NFPA-22 14.2.13, "The discharge outlet for every suction tank shall be equipped with an anti-vortex plate assembly... The assembly shall consist of a horizontal steel plate that is at least twice the diameter of the outlet on a long radius elbow fitting, where required, mounted at the outlet a distance above the bottom of the tank equal to one-half the diameter of the discharge pipe."

For a 6" discharge pipe, the water storage tank shall be equipped with a 12" diameter galvanized steel anti-vortex plate that is affixed to the long radius elbow with a grooved coupler (e.g. Victaulic®). Four stainless steel risers will support the assembly nominally at 6" above the bottom of the support plate which rests on the bottom of the tank, but this height may be adjusted in the field. The assembly will affix to a galvanized steel flange, mounted to the tank wall, with a grooved coupler.

2.13 ROOF VENT

Per NFPA Section 4.15., "Where the steel roof is essentially airtight, there shall be a substantial vent above the maximum water line... A vent pipe shall have a cross-sectional area equal to a minimum of one-half the area of the discharge pipe(s) or fill pipe, whichever is the larger."

The water tank shall have either a Gooseneck-style screened vent (196 sq. inch opening) or one or more Low-profile (49 sq. inch opening) screened vent(s) affixed to the steel roof with sheet metal screws.

2.14 FIRE DEPARTMENT CONNECTIONS

A 6" check valve shall be connected to the 6" flange coming off the tank via a grooved coupler. The check valve shall connect to a 6" indicating valve via a grooved coupler or flanged connection. The indicating valve shall connect to a 5" Storz fitting. The Storz fitting shall have a standard cap. All valves shall be UL listed and may also be FM rated.

Two sections of 10' hard hose with 5" Storz connections shall be housed in PVC housing next to the tank. The housing shall have a flap gate on one end for rapid access to the hard hose.

PART 3 EXECUTION

3.01 INSTALLATION

Tanks shall be and assembled by personnel trained and experienced in the erection of bolted steel tanks and the installation of flexible membrane liners so as to not void any manufacturer warranties. Installation personnel entering the tank must be trained on confined space OSHA protocols.

3.02 FIELD QUALITY CONTROL

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A representative of the tank materials supplier shall inspect the tank structure before installation of the preliner and main liner. Tank assembly contractor shall comply with tank supplier recommendations for the proper assembly techniques.

3.03 CLEANING and MAINTENANCE

Water tanks are classified as confined spaces and qualified personnel should be employed for any tank entry. The preferred method for cleaning the tanks is to open the bottom drain valve and drain the tank. Then open the roof side cover and use a hand-held water hose to wash down the tank walls and floor toward the tank drain. After cleaning is complete, close and secure the roof access cover and close the bottom drain valve.