

ELEVATED WATER STORAGE TANK SPECIFICATION
Composite or Steel Pedestal Design

PART 1 – GENERAL

1.1 DESCRIPTION

- A) The work of this section includes, but is not limited to:
- 1) Design, furnish and erect an elevated composite water storage tank, including foundation, composite or steel support column, Fusion Bond coated, bolted steel tank structure and tank appurtenances as shown on the Contract Drawings and described herein.
 - 2) Contractor shall provide all required labor, materials, and equipment.

1.2 QUALITY ASSURANCE

- A) Qualifications of Tank Supplier:
- 1) The bidder shall offer a new elevated water storage tank as supplied from a U.S.A tank manufacturer specializing in the design and erection of fusion applied, powder coat bolted steel tanks.
 - 2) The tank shown on the drawings and specified herein will be a LIQ Fusion 7000 FBE™ powder-coated, RTP bolted tank as manufactured by Tank Connection Affiliate Group.
 - 3) The Engineer's selection of a Fusion Bond powder coated bolted steel tank is predicated on a thorough examination of design criteria, construction methods, and optimum coating for resistance to internal and external tank corrosion. Deviations from the specified design, construction or coating details will not be permitted.

1.3 SUBMITTALS

- A) General: Submit in accordance with Section _____.
- B) Design Drawings:
- 1) Submit detailed design drawings for tank and accessories bearing the seal of a Professional Engineer registered in _____.
- C) Tank Foundation Design:
- 1) Submit tank foundation and footing design computations bearing the seal of a Professional Engineer registered in _____.
 - 2) Submit specification for foundation concrete describing ingredients, concrete compressive strength, reinforcement, air content, slump, placement and consolidation, curing and finishing. Submit concrete design mix including ingredient proportions, minimum cement content, and water/cement ratio.
 - 3) Submit detailed shop drawings of reinforcing bars including bar lists.
- D) When approved, two sets of such prints and submittal information will be returned to the bidder marked "APPROVED FOR CONSTRUCTION" and these drawings will then govern the work detailed thereon. The approval by the Engineer of the tank supplier's drawings shall be an approval relating only to their general conformity with the bidding drawings and specifications and shall not guarantee detail dimensions and quantities, which remains the bidder's responsibility.

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E) Certificates

- 1) Submit certification attesting that all materials, accessories and design incorporated into the tank complies with AWWA D103 and these specifications.

PART 2- PRODUCTS

2.1 DESIGN CRITERIA

A) Tank Size: As shown on the Contract Drawings.

B) Tank capacity:

- 1) Tank working capacity shall be _____ gallons; with bottom of water elevation (pedestal height) set at _____ ft.
- 2) Freeboard space in top of tank shall be _____ ft.

C) Floor Elevation

- 1) Finished tank floor elevation shall be as shown on the Contract Drawings.

D) Tank Design Standards

- 1) The materials, design, fabrication, and erection of the bolted together tank shall conform to the AWWA Standard for "Factory Coated Bolted Steel Tanks for Water Storage" - ANSI/AWWA D103, latest revision.
- 2) The tank coating system shall conform solely to Section 10.6 Thermoset Powder Coatings of ANSI/AWWA D103, latest revision.
- 3) All materials furnished by the tank manufacturer, which are in contact with stored water, shall be certified to meet ANSI/NSF Additives Standard No. 61. Certification of a coating type alone will not be sufficient to meet this requirement. Certification of a distributor, and not the tank or coating manufacturer, will not be accepted.
- 4) The RTP (rolled, tapered panel) bolted tank design shall have lap joint connections on both vertical and horizontal shell seams. American Petroleum Institute (API 12B) flanged panel tank design will not be acceptable.

E) Design Loads

- 1) Specific Gravity: 1.0
- 2) Wind velocity per IBC/AWWA
- 3) Shape Factor: 0.6
- 4) Allowable Soil: 10,000 psf
- 5) Roof Snow Load: 25 psf
- 6) Seismic per IBC/AWWA

2.2 MATERIALS

F) Plates and Sheets

- 1) Plates and sheets used in the construction of the tank shell and tank roof shall comply with the minimum standards of AWWA D103.
- 2) Design requirements for mild strength steel shall be ASTM A36 or ASTM A1011 Grade 36 (min), 40, 50, 60 or 70.

G) Rolled Structural Shapes

- 1) Material shall conform to minimum standards of ASTM A36 or ANSI 1010.

H) Horizontal Wind Stiffeners

- 1) Design requirements for intermediate horizontal wind stiffeners shall be of the “web truss” design with extended tail to create multiple layers of stiffener, permitting wind load to transfer around tank.
- 2) Web truss stiffeners shall be of steel with hot dipped galvanized coating.

I) Bolt Fasteners

- 1) Bolts used in tank lap joints shall be 1/2” – 13 UNC – 2A rolled thread, and shall meet the minimum requirements of AWWA D103, Section 2.2.
- 2) Bolt Material:
 - (a) SAE Grade 5
 - (1) Tensile Strength - 120,000 psi min
 - (b) SAE Grade 8
 - (1) Tensile Strength – 150,000 psi min.
- 3) Bolt Finish – JS500 electro-plated
- 4) Bolt Head Encapsulation:
 - (a) High impact polypropylene co-polymer encapsulation of entire bolt head up to the splines on the shank.
 - (b) Natural resin with UV (ultraviolet) light inhibitor. Color to be blue.
- 5) All tank shell bolts shall be installed such that the head portion is located inside the tanks, and the washer and nut are on the exterior.

J) Sealants:

- 1) The lap joint sealant shall be a one component, moisture cured, polyurethane compound. The sealant shall be suitable for contact with potable water and meet applicable FDA Title 21 regulations, as well as, ANSI/NSF Additives Standard 61.

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- 2) The sealant shall be used to seal lap joints, bolt connections, and sheet edges. The sealant shall cure to a rubber like consistency, have excellent adhesion to the Fusion Bond coating, have low shrinkage, and be suitable for interior and exterior exposure.
- 3) Sealant curing rate at 73 degrees F and 50% RH.
 - (a) Tack-free time: 6 to 8 hours.
 - (b) Final cure time: 10- 12 days.
- 4) Neoprene gaskets and tape type sealer shall not be used in liquid contacting surfaces.

2.3 FUSION BOND POWDER COAT SPECIFICATION

A) Cleaning

- 1) Following the fabrication process, sheets and tank components shall be thoroughly washed and rinsed.
- 2) Washing shall be with a 3-4% solution of DuBois MC-726 and 140°F water.
- 3) The PH level shall be monitored and maintained at 10 to 12.
- 4) Rinsing shall be in a two stage booth and ambient temperature fresh water in the second stage.
- 5) All water shall be removed from sheets and tank components with forced air at ambient temperature.

B) Surface Preparation

- 1) Sheets and tank components shall be blasted using steel shot S-230.
- 2) Sheets and tank components shall be blasted on both sides providing a surface profile of SSPC-SP10. Anchor profile shall be 1.0 mil minimum.

C) Powder Coating System

- 1) After cleaning and blasting, the sheets and tank components shall receive a Fusion Bond powder coating on both sides of steel. The powder coating shall be applied with an electrostatic process. The thermoset powder coat system shall be as specified:

2) LIQUID STORAGE	FUSION SYSTEM	DFT*	Range (min/max)
Interior Lining	LIQ Fusion 7000 FBE™	7mils	6-9 mils
Exterior Primer	EXT Fusion 5000 FBE™	3mils	3-5 mils
Exterior Topcoat	EXT Fusion SDP™	3 mils	3-5 mils

*DFT – Nominal dry film thickness

- 3) Interior lining, LIQ Fusion 7000 FBE™ will be applied at 7 mils nominal DFT, with a min/max range from 6-9 mils.
- 4) Exterior prime coat, EXT Fusion 5000 FBE™ will be applied at 3 mils nominal DFT, with a min/max range from 3-5 mils.
- 5) Coating thickness shall be maintained by the use of PLC controlled automatic spray guns preset for the application.

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- 6) Visual inspection for coverage shall be made after powder application and before the first oven cure. Areas with light coverage shall be re-sprayed with a manual spray gun.

D) Powder Curing

- 1) Sheets and tank components shall then be heated in an oven to achieve a metal temperature of 375° and held for 15 minutes.
- 2) After oven curing, the sheets and tank components shall cool down to a metal temperature of 125° or less.
- 3) Both visual inspection and dry film test shall be randomly performed before the application of the top coat.

E) EXT Fusion SDP™ Top Coat (super durable polyester)

- 1) SDP exterior top coat shall be applied at 3 mils nominal DFT, with a min/max range from 3-5 mils.
- 2) The SDP top coat shall provide excellent gloss retention and UV resistance. Color to be selected from 5 standard colors (chart) with special formulated and premium colors as available options.
- 3) Visual and wet mil thickness testing shall be randomly performed before the second oven curing.

F) Final Curing

- 1) Sheets and tank components shall then pass through the final cure oven where the oven temperature ranges from 300° to 475° based upon the metal thickness.

G) Inspection

- 1) During final cool down, sheets shall be randomly inspected for cure, adhesion, coating thickness and holidays.
- 2) Cure shall be confirmed using MEK rub.
- 3) Adhesion shall be confirmed using 100 squares test.
- 4) Coating thickness shall be confirmed using dry film thickness gage.
- 5) Holiday testing shall be performed with tinker & razor wet sponge.

H) Packaging

- 1) After cool down and inspection, the sheets and tank components shall be unloaded and packaged for shipment.
- 2) Sidewall sheets shall be stacked on wooden skids with paper placed between each sheet to prevent any scuffing.
- 3) Skids shall be loaded to 5,600 pound maximum weight. Each skid shall be wrapped in heavy mil, black poly reinforced plastic and then steel banded.

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- 4) Roof sheets and hopper or bottom sheets as well as other tank components shall be packaged to prevent damage and then wrapped and banded.

2.4 SUPPORT PEDESTAL/COLUMN – Concrete or steel pedestal design

- A) The support column for the water storage tanks shall be of jump-form concrete construction in accordance with ACI standards 313-91 and ACI 371R-98.
- B) Concrete:
 - 1) Compressive Strength:
 - (a) Concrete support structure = 4,000 psi (28Mpa)
 - (b) Foundations = 3,500 psi (24Mpa)
 - 2) Air Entrainment:
 - (a) Per ACI 318
 - 3) Curing:
 - (a) Conform to ACI 318 and ACI 308
 - (b) Curing compounds shall be membrane forming or combination curing/surface hardening types conforming to ASTM C309.
 - 4) Formwork
 - (a) Formwork design, installation and removal shall conform to the requirements of ACI 318 and the recommendations of ACI 347 R.
 - 5) Concrete Finish
 - (a) Per Section 3.5 of ACI 371R-98
 - (b) A beveled-edge rectangular pattern (the size of the 4' tall jump forms) shall be formed into the outer column surface.
- C) A steel pedestal design utilizing RTP construction with Fusion Bond coating system can be proposed as an alternate pedestal design.
- D) An opening shall be made at the base of the column for a 3' x 7' personnel door.
- E) An opening shall be made near the top of the column for 3' x 7' personnel door.
- F) An opening shall be made at the base of the column for a 12' x 12' roll-up access door.
- G) A 6" thick reinforced concrete floor poured over a 3" compacted layer of crushed #57 or 2A stone shall be installed inside at the base of the column.

2.5 ROOF

- A) Roofs shall be constructed of non-corrugated triangular aluminum panels which are sealed and firmly clamped in an interlocking manner to a fully triangulated aluminum space truss system of wide flange extrusions, this forming a spherical dome structure.
- 1) The dome shall be clear-span and designed to be self-supporting from the periphery structure with primary horizontal thrust contained by an integral tension ring. The dome dead weight shall not exceed 3 pounds per square foot of surface area.
 - 2) The dome and tank shall be designed to act as an integral unit. The tank shall be designed to support an aluminum dome roof including all specified live loads.
 - 3) Materials:
 - (a) Triangulated space truss: 6061-T6 aluminum struts and gussets.
 - (b) Triangular closure panels: .050"t 3003-H16 aluminum sheet.
 - (c) Tension ring: 6061- T6 aluminum.
 - (d) Fasteners: 7075 – T73 anodized aluminum or series 300 stainless steel.
 - (e) Sealant and gaskets: silicone rubber.
 - (f) Dormers, doors, vents and hatches: 6061 – T6, 5086-H34 or 3003-H16 aluminum.
 - 4) Roof Vent
 - (a) A properly sized vent assembly in accordance with AWWA D103 shall be furnished and installed the maximum water level of sufficient capacity so that at maximum possible rate of water fill or withdrawal, the resulting interior pressure or vacuum will not exceed 0.5" water column.
 - (b) The overflow pipe shall not be considered to be a tank vent.
 - (c) The vent shall be constructed of aluminum.
 - (d) The vent shall be so designed in construction as to prevent the entrance of birds and /or animals by including an expanded aluminum screen (1/2 inch) opening. An insect screen of 23 to 25, mesh polyester monofilament shall be provided and designed to open should the screen become plugged by ice formation.

2.6 APPURTENANCES (PER AWWA D103, SECTION 5)

- A) Pipe Connections
- 1) Where pipe connections are shown to pass through tank panels, they shall be field located saw cut, and utilize an interior and exterior flange assembly.
 - 2) Overflow piping shall be 8 inch diameter ASTM A312, TP 304L; Schedule 40 stainless steel pipe and ANSI B36.19. The piping shall be installed on the exterior of the tank (as close to the tank as possible), pass thru the walkway, pass into and down the inside of the column, and exit the column near the base emptying onto a stone rip-rap trench.

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- 3) Inlet and outlet piping shall extend thru the tank floor, column floor and down the inside wall of the column with standoff brackets every 20 ft. The piping shall extend thru the floor of the column and be encased in concrete as it extends out under the tank foundation below the applicable frost level where connections will be made to valves or other yard piping.

B) Access Ladders

- 1) An outside tank ladder shall be furnished and installed as shown on the Contract Drawings.
- 2) An interior caged ladder shall be furnished and installed as shown on the Contract Drawings.
- 3) Ladders shall be fabricated of hot-dipped galvanized carbon steel, per OSHA.
- 4) Safety cage as well as intermediate and top step –off platforms shall be fabricated of hot-dipped galvanized carbon steel.

C) Perimeter Walkway

- 1) One outside perimeter walkway shall be supplied and installed by the tank contractor as shown on the Contract Drawings.
- 2) Walkway materials
 - (a) Extruded shapes & bars – hot-dipped galvanized ASTM A36 carbon steel
 - (b) Bolts, nuts, washers – SAE Gr2 min galvanized
 - (c) Concrete anchors – galvanized ASTM A36 carbon steel (for support arms from walkway to column wall)
 - (d) Grating – hot-dipped galvanized ASTM A36 carbon steel
 - (e) Nosings - ASTM A36 carbon steel
- 3) Handrail Materials
 - (a) Posts and horizontals – galvanized carbon steel
 - (b) Toe Plate- hot-dipped galvanized ASTM A36 carbon steel
 - (c) All hardware – SAE Gr2 min galvanized
 - (d) Post spacing – not to exceed 5’-6”
- 4) Walkway Fabrication
 - (a) Brackets: will bolt directly to concrete column wall using galvanized carbon steel anchors & fasteners.
 - (b) Platform Sections
 - (1) Where indicated will be shop assembled in sections

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- (2) Weld corners and seams continuous complying with AWS recommendations at exposed connections, grind exposed welds smooth and flush
 - (c) Finish: hot-dipped galvanized
 - (d) Standards
 - (1) Complies with OSHA codes
 - (2) Designed to support a superimposed live load of 100 PSF
- 5) Handrail Fabrication:
 - (a) Handrail shall be provided on both sides of stairs.
 - (b) Fabricated to match stair rise and tank radius in 15-20 foot sections
 - (c) Finish: hot-dipped galvanized
 - (d) Standards
 - (1) Complies with OSHA codes
 - (2) Designed for 200 pound load or 50 pounds per square foot
- D) Access Doors
 - 1) A 3' x 7' mandoor shall be installed at the base or the column for entry of utility personnel.
 - 2) A 3' x 7' mandoor shall be installed at the top of the column for entry to the exterior platform. The door shall include and 8" square (minimum) window and 6"H x 12"L louvered & screened vent.
 - 3) A 12' x 12' vertical lift door shall be installed at the base of the column to permit entry for vehicles, equipment, and water utility supplies.
- E) Tanks Sidewall Access Manway
 - 1) One tank sidewall access manway shall be provided as shown on the Contract Drawings in accordance with AWWA D-103.
 - 2) The manhole opening shall be a minimum of 24 inches in diameter. The access door (shell manhole) and the tank shell reinforcing shall comply with AWWA D103, Sec. 5.1.
- F) A manufacturer's identification nameplate shall list the tank serial number, tank diameter and height, and maximum design capacity. The nameplate shall be affixed to the tank exterior sidewall location approximately five (5) feet above tank floor elevation.

PART 3- EXECUTION

3.1 ERECTION

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A) Foundation and Support Column

- 1) The tank column and foundation shall be designed by a Registered Professional Engineer retained by the Tank Manufacturer to safely sustain the structure and its live loads.
- 2) Tank column footing design shall be based on 10,000 psi soil bearing capacity or greater as determined by geotechnical analysis. The cost of this investigation and analysis is to be included in the bid price.

B) Concrete Tank Floor (support column cap)

- 1) The tank floor/support column cap design is of reinforced concrete with an embedded powder coated steel starter sheet per AWWA D103-97 section 11.4.1.6 and the Tank Manufacturer's design.
- 2) Leveling of the starter ring shall be required and the maximum differential elevation within the ring shall not exceed one-eighth (1/8) inch, nor exceed one sixteenth (1/16) inch within any ten (10) feet of length.
- 3) A leveling plate assembly, consisting of two 18" anchor rods (3/4" dia.) and a slotted plate (3 1/2" X 11" X 3/8" thick), shall be used to secure the starter ring, prior to encasement in concrete.
- 4) Two water stop seals made of a butyl rubber elastomer shall be placed on the inside surface of the starter ring below the concrete floor line. These materials shall be installed as specified by the Tank Manufacturer.

C) Steel Tank Floor

- 1) For steel pedestal design, the tank floor will utilize bolted RTP construction with Fusion Bond FBE coating system on interior and exterior.
- 2) Steel floor plate/sheet shall conform to the requirements of AWWA D103-97.
- 3) Steel floor support beams:
 - (a) Shall be constructed of members meeting ASTM requirements.
 - (b) Members and connection shall be designed per AISC Manual of Steel Construction and ANSI/AISC 360 Specification for Structural Steel Buildings.
 - (c) Finish: Hot-dipped galvanized or Fusion Bond powder coating system.

D) Sidewall Structure

- 1) Field erection of Fusion Bond powder coated, bolted steel tank shall be in strict accordance with the procedures outlined in the Tank Manufacturer's erection manual, and performed by an authorized dealer of the Tank Manufacturer, regularly engaged in erection of these tanks.
- 2) Specialized erection jacks and building equipment developed and manufactured by the Tank Manufacturer shall be used to erect the tanks.
- 3) Particular care shall be taken in handling and bolting of the tank panels and members to avoid abrasion of the coating system. Prior to liquid test, all surface areas shall be visually inspected by the Engineer.

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- 4) The placement of sealant on each panel may be inspected prior to placement of adjacent panels. However, the Engineer's inspection shall not relieve the bidder from his responsibility for liquid tightness.

3.2 FIELD TESTING

A) Hydrostatic

- 1) Following completion of erection and cleaning of the tank, the structure shall be tested for liquid tightness by filling tank to its overflow elevation.
- 2) Any leaks disclosed by this test shall be corrected by the erector in accordance with the manufacturer's recommendations.
- 3) Water required for testing shall be furnished by the Owner at the time of tank erection completion and at no charge to the Contractor. Disposal of test water shall be the responsibility of the Contractor.

B) DISINFECTION

- 1) See Section _____, Water Tank Disinfection

END OF SECTION

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