SECTION 22 12 19 WELDED STEEL TANK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes welded-steel tank for storage of potable and fire-suppression water. This section includes furnishing and erecting one (1) 88,000-gallon nominal capacity potable and fire-suppression water storage welded steel tank (22' diameter x 32' height w/seal welded umbrella roof), and necessary piping and appurtenances, per AWWA D100 specifications.

B. The tank will be constructed on completed foundation which will be furnished by the Tank Manufacturer. All the design drawings will be PE sealed by a Pennsylvania state licensed engineer.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of facility ground-mounted, potable-water storage tank, include rated capacities, accessories, appurtenances, and furnished specialties.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details for each facility ground-mounted, potable-water storage tank, including the following:

1. Tank, roof, and shell openings.
2. Safety railings and ladders.
3. Plans, elevations, sections, and attachment details.
4. Structural analysis data signed and sealed by the qualified professional engineer, licensed in the state of Pennsylvania, responsible for their preparation.
5. Diagram power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Shop drawings showing dimensions, nozzle locations, manway locations, weld details, construction details, ladder details, vent details, orientation of each and all else necessary in accordance with the contract documents.

C. Foundation design including dimensions and type of foundation, rebar details, pipe encasement details, concrete strength requirements, geotechnical and seismic assumptions used, and all else

necessary in accordance with these specifications. Foundation design calculations showing all the geotechnical and seismic assumptions that have been utilized and with the appropriate factor of safety.

D. Seismic Qualification Data: Certificates, for facility ground-mounted, potable-water storage tanks and components, from manufacturer.

1. Basis for Certification: Include calculation upon which withstand certification is based.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
4. Retain “Welding certificates” Paragraph below if retaining “Welding Qualifications” Paragraph in “Quality Assurance" Article.

E. Welding certificates.

F. Bacteriological test results.

G. Field quality-control reports.

H. Tank appurtenance information such as tank insulation, tank mixer and/or tank heater.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For the following to include in emergency, operation, and maintenance manuals:

1. Obstruction lighting.
2. Lightning protection.
3. Cathodic protection.
4. Tank heaters.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Employ a qualified structural engineer to prepare calculations, Shop Drawings, and other structural data for fabrication and erection of ground-mounted, potable-water storage tanks and foundation.

1. Engineering Responsibility: Preparation of data for ground-mounted, potable-water tanks, accessories, specified appurtenances, and concrete supports and foundations, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
3. AWS D1.4/D1.4M, "Structural Welding Code - Reinforcing Steel."

C. Pipe Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding, Brazing, and Fusing Qualifications."

1.8 QUALIFICATION OF SUPPLIER

A. The selection of welded steel tank supplier will be based on examination that the tank meets the Design criteria, construction methods and optimum coating requirements for corrosion protection as per this specification.

B. Erection of the tank is to be by the tank manufacturer or approved contractor. The installer shall be fully responsible for the entire installation including tank erection, and the ultimate water tightness of the complete installation. The contractor and installer shall strictly follow the standards of fabrication, erection, product, quality, and long-term performance, established in this Specification and as required by the Owner and Engineer

C. Tank supplier shall submit the following to Engineer/Owner for consideration:

1. List of tank materials, tank drawing showing size and piping, accessories, appurtenances and tank coating technical specifications meeting all NSF-61, NFPA, and AWWA standards and specification requirements. The components of the tank in contact with stored water shall be certified to meet ANSI/NSF Additives Standard No. 61

2. List of 10 similar projects along with qualification of welded steel tank installation superintendent.

3. The contractor and supplier shall have the minimum 10 years of experience and knowledge to furnish and erect similar highest quality of welded steel tanks through the services of a licensed and qualified welder with experience in similar projects. Under no circumstances shall an inexperienced contractor be awarded the project. The contractor and supplier shall be fully responsible for the entire installation including appurtenances and the final product.

D. The welded steel tank supplier will self-perform all work except for field painting and tank insulation which will be done by others/subcontractors. The subcontractor shall complete the manufacturers pre-qualification process to ensure they meet or exceed the qualification requirements for the project.

E. A site-specific safety and health manual and quality control manual shall be provided as specified and the work will be executed in accordance with these requirements. All work will be managed by one supplier who will coordinate the work with the rest of our team which includes engineering, purchasing, fabrication, construction contractor, and any subcontractors.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS:

A. The welded steel tank shall meet the design data requirements shown below:
B. Tank Diameter 22'-0” (Inside)

C.	Tank Height	32’-0”
D.	Overflow Level	31'-0”
E.	High Liquid Level	30.5'-0”
F.	Normal Liquid Level	30'-0”
G.	Low Liquid Level	1'-0”
H.	Total Capacity	88,145 gallons
I.	Working Capacity	82,458 gallons
J.	Empty Tank weight	40,400 lbs
K.	Design Standard	AWWA D-100-11
L.	Lowest One-Day Mean Temperature	-5 °F
M.	Operating Temperature	80 °F
N.	Design Temperature	199 °F
O.	Roof Live Load	20.00 psf
P.	Roof Design Snow Load	30.00 psf
Q.	Additional Roof Loads	0.00 psf
R.	Ultimate Design Wind Speed:	
	Velocity	120 mph
	Exposure	B

S.	Seismic:	
	Transitional Period (TL)	6
	S_{DS}	0.220 g
	Site Class	D
	Importance Factor	1.25
	Use Group	U
	Ss Value	20.60%
	S1 Value	6.20%

T.	Specific Gravity	1.00
	Internal Pressure (Design).....	Atmospheric
	(Operating).....	Atmospheric
	External Pressure (Design).....	Atmospheric
	Combination Factor.....	0.40
	Corrosion Allowance:	
	Bottom	0.0000 in
	Shell Courses 1 - 1	0.0000 in
	Courses 2 - 2	0.0000 in
	Courses 3 - 4	0.0000 in
	Roof	0.0000 in
	Compression Ring	0.0000 in
	Anchor Bolts	0.0000 in
	Anchor Chairs	0.0000 in

All calculations are to be in the corroded condition.

U. Structural Performance: Ground-mounted, potable-water tank, including structural reinforcement and foundation, shall withstand the effects of dead and live gravity loads and ultimate wind speeds of 120 mph.

V. Seismic Performance: Ground-mounted, potable-water storage tank, including structural reinforcement and foundation, shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
2. Importance Factor: 1.25

W. Thermal Movements: Ground-mounted, potable-water tank, including structural reinforcement and foundation, shall allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F, ambient; 180 deg F

X. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

Y. Tanks for Potable-Water Storage and Fire-Suppression Water Supply: Comply with NFPA 22, "Water Tanks for Private Fire Protection,"

Z. Comply with NSF 61 and NSF 372.

AA. Comply with 29 CFR 1910.

2.2 WELDED-STEEL TANK

A. Manufacture welded-steel tank with welded-steel plates, bolts, rods, and reinforcing steel.

B. The welded steel tank, piping, accessories and appurtenances as shown on contract drawings and stated in this specification shall be fabricated and supplied by Fisher Tank Company, Superior Tank Co. Inc, or Approved equal.

C. Standard: Designed and fabricated according to AWWA D100, AWWA M42, NFPA 22, NSF-61.

D. Pipe Connections: Comply with AWWA D100. Match size of water-distribution pipe.

E. Suction and Fill Piping: See design drawings for details

F. Internal Riser Pipe: See design drawings for details

G. Overflow Piping: ASTM A53/A53M, Grade B, Schedule 40, welded-steel pipe with ASTM A234/A234M, Grade WPB, Schedule 40, carbon-steel butt-weld fittings.

H. Drain Piping:

I. Roof Opening Hatch at Ladder: Comply with AWWA D100. Steel, hinged cover, 24-inch diameter minimum or as required by OSHA, with 4-inch curb and 2-inch downward overlap with hasp and lock, located over interior ladder and adjacent to exterior ladder.

J. Roof Floating Mixer Opening: Comply with AWWA D100. Steel, removable, 24 by 24-inch opening minimum cover with 4-inch minimum-height neck and minimum 2-inch downward overlap with hasp and lock. Construct opening with capability of supporting the specified floating mixer.

K. Shell Sidewall Manholes: Comply with AWWA D100. Provide two steel manways. One circular, 36 inches minimum in diameter with bolted cover along sidewall as shown on contract drawing. The second, circular, 24 inches minimum in diameter with hinged cover on top of tank roof as shown on contract drawings.

L. Painter's Accessories: Include lugs/couplings/rail inside and outside tank for painting.

M. Tank Mushroom Vent: Include a 12” Mushroom vent with stainless-steel screen, constructed to prevent entrance of rain, insects, birds, and animals.

N. Foundation: Reinforced concrete. See Section 033000 "Cast-in-Place Concrete."

O. Structural Attachments shall be galvanized.

P. The tank shall meet following requirements and include accessories and fittings as listed below. They shall be included by tank manufacturer along with the tank:

1- 36” sidewall manway with bolted cover
1- 24” x 24” top manway with hinged cover
1- 8” floor penetration – suction
1- 8” floor penetration – fill line
1- 12” Vortex plate (suction)
1- 8” shell nozzle – drain
2- 8” shell nozzle spare
3- Additional shell nozzle (size TBD for tank heater if one is required.
1- 8” fill diffuser (round)
1- 8” internal fill pipe
1- 8” stub sidewall overflow with conical
1- 24” AWWA ventilation on roof
2- Ground lug
1- Liquid Level indicator
1- 12” Mushroom vent
1- 8” Guage Hatch

Caged Ladder
Safety Climb Device (Stainless Steel)
Safety Climb Harness
Intermediate Rest Platform
Ladder - Straight
360 Roof Handrail – all pipe meeting OSHA standards
Top Angle – 3 x 3 x 1 / 4
Roof type – Umbrella Roof
Roof Weld – Double Lap Welded
Bottom Weld – Single Lap Welded

Welding – AWS Radiographic Inspection per Code
Hydro testing – By tank supplier and manufacture
Joint efficiency – 100%
Single Lap Welded ring wall with concrete base

2.3 PAINT MATERIALS

A. Once the hydro testing of the welded steel tank is complete the tank supplier and manufacturers field representative shall mobilize to begin painting the tank.

B. During the field painting, the unprimed and abraded areas of the tank's exterior shall be blasted and primed with Epoxy Mastic (min 4-6 mils DFT) and then the entire exterior finish painted with Mastic (4-6mils DFT) then Aliphatic Polyurethane Enamel (2-3 mils DFT) in accordance with the manufacturer's specifications. Blasting on the exterior of the tank will be minimal since if the exterior is shop painted. The unprimed and abraded interior surfaces shall also be blasted and primed and finish painted with (2) coats of Epoxy Phenolic (5-7 mils DFT each) in accordance with the manufacturer's specifications. Blast media will be left on site to be mixed in with the final grade by others.

C. Prior to putting tank in service confirm that the interior coating has fully cured.

D. Tank Shell Interior Finish Paint: Tank fabricator's epoxy-polyamide paint complying with NSF 61 and NSF 372, and compatible with prime coat.

E. Color: As selected by Owner from tank manufacturer's paint chart.

2.4 SHOP PAINTING

A. Factory coating according to AWWA D103.

B. Tank Shell Interior Finish Coat: Comply with NSF 61 and NSF 372.

C. Tank Shell Exterior Finish Coat: Factory coating according to AWWA D103.

2.5 WELDED STEEL TANK APPURTENANCES

A. Water-Level Controls: Automatic controls for maintaining water level in tank, with valves, piping, and audible and visual alarms to indicate the following:

1. High- and low-water levels.
2. Tank overflowing or tank not filling.

B. Obstruction Lighting: Comply with requirements of authorities having jurisdiction.

C. Lightning Protection: Comply with requirements in Section 264113 "Lightning Protection for Structures."

D. Cathodic Protection: Furnish & Install 57-year anode life embedded Concentric Cathodic Protection. Comply with requirements in Section 134713 "Cathodic Protection" and with AWWA D104.

E. Insulation system: Furnish & Install Insulation System –
Roof – 4" 8# Aluminum & Mineral Wool Radial Panels
Shell Insulation System – 1" Foam w/ vapor barriers plus 3" 4# Aluminum & Mineral Wool Radial Panels

F. Provide either Tank Heater or Mixer – see below G or H

G. Tank Heaters: Furnish & Install 20kW Immersion Heater w/ 12" Shell Nozzle and QD Jacket. Comply with NFPA 22 and with capacity to maintain 42 deg F water temperature inside surface water-storage tank.

H. Tank Floating Mixer: Furnish & Install Medora Grid Bee GS-9 floating mixer or approved equal. The mixer shall have 75' long electric cord with cord fixture. Furnish required stainless steel chain, chain grab tools, top of tank mounted junction box for conduit connection and disconnect, mixer control panel. The tank floating mixer shall be installed as shown on contract drawings and per supplier recommendations. Include complete operation and maintenance manual for the mixer.

I. Exterior Ladder: Straight, vertical ladder rungs.

1. Material: Galvanized steel.
2. Size: Custom sized to tank.
3. Accessories: Including step off platform.
4. Safety Devices: As required by 29 CFR 1910 (OSHA) safety and health regulations.
5. Standards: Comply with AWWA D100.

J. Interior Ladder: Straight, vertical ladder rungs.

1. Material: Stainless steel.
2. Size: Custom sized to tank.
3. Accessories: Including step off platform.
4. Safety Devices: As required by 29 CFR 1910 (OSHA) safety and health regulations.
5. Standards: Comply with AWWA D100.

2.6 FOUNDATION

A. The Foundation design will be provided by the tank manufacturer and will be constructed by other (General Contractor). The foundation of tank provided by others shall comply with the construction standards for the tanks. The foundation provided by others are to be furnished level within +/- 1/8" in 30' of circumference and shall at no point vary more than ¼" from an established elevation. Tank manufacturer and supplier shall confirm adequacy of the foundations upon mobilization. Supply and installation of anchor bolts, if necessary.

B. Benchmarks (center and quadrants) on each foundation are to be provided by others.

C. Tank supplier and manufacturer shall include the appropriate specifications for anchor bolts at time of final drawing, to be supplied by others. Site clearing, rough grading, and finish grading will be performed by others.

D. Tank foundation design shall be based on a net allowable soil bearing capacity of 3,000 psf per the attached Geotechnical report. The existing soil will be suitable but should unsuitable soil be encountered it should be replaced with compacted engineered fill. Tank manufacturer and supplier shall provide details on all loads on soil beneath including bearing pressure results for the ringwall or other type of foundation. The total loads shall include but not be limited to live loads acting on tank shell, snow loads, shell plate load, shell and roof appurtenances and compression ring and shell stiffener loads.

PART 3 - EXECUTION

3.1 STEEL, GROUND-MOUNTED, POTABLE-WATER STORAGE TANK INSTALLATION

A. Welded-Steel Tanks:

1. Erect tank shell, accessories, and appurtenances according to AWWA D100 and AWWA M42.
2. Fabricate steel plate sections in the shop. Erect tank shell by welding plate sections in the field.

3.2 PIPING CONNECTIONS

A. Connect tanks to to process piping and drains as shown on contract drawings.

3.3 ELECTRICAL CONNECTIONS

A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted.

D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.4 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring according to Section 260523 "Control-Voltage Electrical Power Cables."

3.5 SURFACE PREPARATION OF STEEL TANKS

A. Field Cleaning: After erecting tank shell, remove burrs, dirt, and construction debris and repair damaged finishes. Remove weld splatter, sharp edges on weld seams, and scabs and slivers by grinding. Remove weld flux, slag, fins, and laminations.

B. Field Surface Preparation: After field cleaning, prepare steel surfaces where shop prime coat has been damaged, according to the Specifications listed above for shop cleaning, and remove dust or residue from cleaned surfaces.

C. If surface develops rust before prime coat is applied, repeat field surface preparation.

3.6 FIELD PAINTING

A. Apply paint according to AWWA D102.

B. Prime-Coat Touchup: Apply primer to cleaned areas and where shop finish has been damaged during shipping, handling, and erection. Apply prime coat to a dry film thickness of 3.0 to 5.0 mils for tank interior and to a dry film thickness of 2.0 to 3.0 mils for exterior tank and support surfaces.

C. Tank Shell Interior Finish Coats: Apply two coats of interior finish paint above bottom ring to a dry film thickness of 4.0 to 5.0 mils. Apply interior finish paint to surfaces below bottom ring to a dry film thickness of 8.0 to 10.0 mils.

D. Tank Shell Exterior Coats: Apply intermediate paint to a dry film thickness of 2.0 to 3.0 mils. Apply finish paint to a dry film thickness of 2.0 to 3.0 mils.

E. Concrete tanks do not require painting.

F. Tank Exterior Lettering and Logo: Apply two coats of urethane paint to a dry film thickness of 2.0 to 3.0 mils.

G. Overflow Pipe: Paint pipe exterior that is outside tank and structure as indicated for tank exterior.

H. Exterior Ladders: Paint as indicated for tank shell exterior.

I. Do not paint if ambient temperature is less than 50 deg F or is expected to drop below 40 deg F in the next 18 hours. Do not paint if temperature of steel surface is higher than 125 deg F. Do not apply paint if surfaces are wet or damp, if precipitation is expected, or if relative humidity will exceed 85 percent. Do not spray paint when wind velocity exceeds 15 mph. Maintain at least a 24-hour waiting period between coats. Provide adequate ventilation in tank during

painting to maintain clear atmosphere and provide explosion-proof flood lighting and spot lighting.

J. Complete daily painting to allow time for paint to dry before condensation is expected.

3.7 SURFACE WATER-STORAGE TANK APPURTENANCE INSTALLATION

A. Install and adjust water-level control valves, piping, and alarms.

B. Install obstruction lighting according to authorities having jurisdiction.

C. Install lightning protection according Section 264113 "Lightning Protection for Structures."

D. Install cathodic protection according to Section 134713 "Cathodic Protection" and AWWA D104.

E. Install tank heaters according to NFPA 22.

3.8 SITE CONDITIONS

The contractor shall provide for site conditions that shall allow the delivery, fabrication and erection of welded steel tank in the field.

A. The site conditions shall include unobstructed access roadway over which material and equipment may be moved by heavy trucks, tractor-trailer and construction equipment.

B. A foundation at approximately ground level with at least twenty feet (20') of access room around the outside of the entire foundation.

C. Ample unobstructed space adjacent to the foundation for unloading and storing material and equipment for normal erection operation.

D. Removal or remediation of any conditions at the tank site which present a safety hazard to workmen or equipment, including but not limited to, overhead electric lines, telephone wires, pipelines.

E. The site and the access to the tank foundation shall be maintained and kept free of water so that mobilization and movement of equipment is not hindered or impeded by mud and/or standing water until the work has been completed and accepted.

F. Sufficient room for erection of the tank, build the roof and mobilize crane to set it.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative and license welder to test and inspect components, assemblies, and equipment installations, including connections.

D. Perform the following tests and inspections with the assistance of a factory-authorized service representative and a licensed and qualified welder.

E.

1. Tank Weld Test: Use radiographic method according to AWWA D100. Repair failures and retest. The tank weld design thickness of tank and X-ray requirements for butt welded steel tanks shall follow the API and AWWA standards. Confirm with Owner and Engineer on the tank weld design thickness indicating the percentage of welds to be tested prior to conducting the weld testing. Include test of the door sheet that is cut open at time of welding the tank inside and outside and also test the ring wall area.

2. Leak Test: Comply with AWWA D100 and NFPA 22. Fill tanks with potable water and test for leaks after installation. Repair leaks and retest until no leaks exist.

   a. Water will be furnished by Owner.

3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

F. Unit will be considered defective if it does not pass tests and inspections.

G. Prepare weld test and inspection reports for review of Owner and Engineer.

H. Clean, chemically compatible, suitable water shall be provided by others to tank supplier and manufacturer at a minimum rate of 250 gpm. Tank supplier and manufacturer shall coordinate with contractor on suitable means of disposing the test water. Water must be available at least 1 week prior to the completion of the tank test.

I. The tank supplier and manufacturer shall specify and provide sand base under the ring wall to take care of the soil pH along with the cathodic protection system.

3.10 CLEANING

A. Clean interior and exterior of ground-mounted, potable-water storage tanks.

B. Disinfect surface water-storage tanks according to AWWA C652.

3.11 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the following:

1. Obstruction lighting.
2. Water-level controls.
3. Tank heaters.

3.12 SAFETY

A. Upon mobilization to the site, the tank supplier and manufacture shall coordinate with contractor and allow up to 1 hour for on-site safety and health training.

B. Confined space procedures will be in accordance with tank supplier and manufacturers company safety manual and shall comply with OSHA 1926 Subpart AA.

C. During construction of the welded steel tank, the tank supplier and manufacturer's activities inside a confined space shall not create, nor have the potential to create a hazardous atmosphere, as defined by OSHA and ANSI. The tank during all phases of construction will be treated as a "Non-permitted Confined Space.

END OF SECTION 22 12 19