SECTION 331616 - MULTI-COLUMN ELEVATED STEEL WATER STORAGE TANKS

This Section specifies design, fabrication, and erection of welded-steel elevated water tanks. This Section places responsibility for design on Contractor, because specialized design expertise is not usually found within most consultant engineering firms. Edit this Section accordingly.

1. GENERAL
   * + 1. SUMMARY
          1. Section Includes:

Welded-steel elevated water tank.

Tank foundation.

Tank painting.

* + - * 1. Related Requirements:

List other Sections directly related to or affecting Work of this Section. Include Sections specifying information expected to be found in this Section as well as Sections required to describe complete system or assembly requirements.

Document 003132 - Geotechnical Data: Subsurface investigation report; borehole locations and findings of subsurface materials.

Section 032000 - Concrete Reinforcing: Product and execution requirements for steel reinforcing bars.

Section 033000 - Cast-in-Place Concrete: Product, execution, and testing requirements for concrete.

Section 099713.24 - Steel Water Storage Tank Painting: Preparation and field painting of water tanks.

Section 310000 - Earthwork: Excavation requirements for water tank.

Section 310001 - Earthwork Materials: Backfilling requirements for water tank.

Section 330110.58 - Disinfection of Water Utility Piping Systems: Flushing and disinfecting of water tank.

Section 331413 - Public Water Utility Distribution Piping: Connection to water distribution system.

Section 331416 - Site Water Utility Distribution Piping: Connection to water distribution system.

* + - 1. DEFINITIONS

Limit list of definitions to terms unique to this Section and not provided elsewhere.

* + - * 1. Purchaser: Director’s Representative, as it pertains to this Contract, is the State of New York.
      1. REFERENCE STANDARDS

List reference standards included within text of this Section, with designations, numbers, and complete document titles.

LEED requires compliance with specific editions of referenced standards. Consider including publication dates for referenced standards in this Section to ensure the correct standard is used for LEED compliance.

* + - * 1. American Concrete Institute:

ACI 318 - Building Code Requirements for Structural Concrete.

* + - * 1. American Society of Mechanical Engineers:

ASME BPVC - Boiler and Pressure Vessel Code, Section IX: Welding and Brazing Qualifications.

* + - * 1. ASTM International:

ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

* + - * 1. American Water Works Association:

AWWA D100 - Welded Carbon Steel Tanks for Water Storage.

* + - * 1. NSF International:

NSF 14 - Plastics Piping System Components and Related Materials.

NSF 61 - Drinking Water System Components - Health Effects.

NSF 372 - Drinking Water System Components - Lead Content.

* + - 1. COORDINATION
         1. Coordinate Work of this Section with connection to water distribution system.
      2. PREINSTALLATION MEETINGS
         1. Convene minimum [**one week**] [**<\_\_\_\_\_\_\_\_> weeks**] prior to commencing Work of this Section.
      3. SUBMITTALS

Only request submittals needed to verify compliance with Project requirements.

* + - * 1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
        2. Manufacturer’s installation instructions shall be provided along with product data.
        3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
        4. Product Data:

Submit manufacturer information for expansion joint fittings and other piping specialty fittings.

Submit manufacturer information for ladder and ladder safety devices.

* + - * 1. Shop Drawings:

Tank:

Submit complete plan, elevation, and sectional drawings showing critical dimensions.

Indicate structural plate and support member sizes and thicknesses.

Indicate weld types and sizes.

Indicate water supply and overflow piping details, including fittings, expansion joints, pipe support methods, and <**\_\_\_\_\_\_\_\_**>.

Indicate ladder and ladder safety device details.

Indicate handrail details.

Indicate access hatch details.

Tank Foundation:

Submit specification for foundation concrete, describing ingredients, reinforcement, air content, slump, placement and consolidation, curing, and finishing.

Indicate concrete design mix, including ingredient proportions, minimum cement content, and water-cementitious materials ratio.

Submit drawings of reinforcing bars, including bar lists.

* + - * 1. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

Include separate paragraphs for additional certifications.

Include following paragraph when Contractor is responsible for designing products or assemblies. List affected products when Section specifies more than one product.

* + - * 1. Delegated Design Submittals: Submit Shop Drawings with design calculations and assumptions for tank and tank foundation. All Shop Drawings shall be signed and sealed by a licensed engineer in the State of New York.
        2. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.
        3. Source Quality-Control Submittals: Indicate results of [**shop**] [**factory**] tests and inspections.
        4. Field Quality-Control Submittals:

Indicate results of Contractor-furnished tests and inspections.

Details of Welded Joints: [**Comply with AWWA D100, Section 1.4**] [**Not required**].

* + - * 1. Manufacturer Reports: Certify that tank, tank foundation, and anchor bolts have been properly installed and leveled.
        2. Qualifications Statements:

Coordinate following subparagraphs with requirements specified in QUALIFICATIONS Article.

Submit qualifications for fabricator, erector, welders, welding operators, tackers, and licensed professional.

Submit fabricator's approval of erector.

Submit names and qualifications of welders, welding operators, and tackers before performing welding.

Remove paragraph if not LEED project.

* + - 1. SUSTAINABLE DESIGN SUBMITTALS
         1. Section 018113 - LEED Documentation Requirements: Requirements for sustainable design submittals.
         2. Manufacturer's Certificate:

Certify that products meet or exceed specified sustainable design requirements.

Insert material certifications list below to suit products specified in this Section and Project sustainable design requirements. Specific certificate submittal and supporting data requirements are specified in Section 018113.

Materials Resources Certificates:

Certify source and origin for [**salvaged**] [**and**] [**reused**] products.

Certify recycled material content for recycled content products.

Certify source for regional materials and distance from Project Site.

* + - * 1. Product Cost Data:

Submit cost of products to verify compliance with Project sustainable design requirements.

Exclude cost of labor and equipment to install products.

Provide cost data for following products:

Edit list of material cost data below to suit products specified in this Section and Project sustainable design requirements. Specific cost data requirements are specified in Section 018113.

Salvaged, refurbished, and reused products.

Products with recycled material content.

Regional products.

<**\_\_\_\_\_\_\_\_**>.

* + - 1. CLOSEOUT SUBMITTALS
         1. Section 017716 - Contract Closeout: Requirements for submittals.
         2. Project Record Documents: Record actual location, layout, and final configuration of elevated tank and accessories.
         3. Submit radiographic films cross-referenced to shell plate diagrams at completion of Work.
      2. MAINTENANCE MATERIAL SUBMITTALS
         1. Extra Stock Materials: Furnish [**two**] <**\_\_\_\_\_\_\_\_**> safety harnesses for ladder safety rail system.
      3. QUALITY ASSURANCE

Include this Article to specify compliance with overall reference standards affecting products and installation included in this Section.

* + - * 1. Perform Work according to AWWA D100.
        2. Materials in Contact with Potable Water: Certified to NSF Standards 14, 61, and 372.
        3. Perform Work according to [**NYSDOH**] standards.

Include following paragraph only when cost of acquiring specified standards is justified.

* + - * 1. Maintain <**\_\_\_\_\_\_\_\_**> [**copy**] [**copies**] of each standard affecting Work of this Section on Site.
      1. QUALIFICATIONS

Coordinate following paragraphs with requirements specified in SUBMITTALS Article.

* + - * 1. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum [**three**] <**\_\_\_\_\_\_\_\_**> years' [**documented**] experience.
        2. Fabricator: Company specializing in fabricating products specified in this Section with minimum [**three**] <**\_\_\_\_\_\_\_\_**> years' [**documented**] experience.
        3. Erector: Company specializing in performing Work of this Section with minimum [**three**] <**\_\_\_\_\_\_\_\_**> years' [**documented**] experience [**and approved by manufacturer**].
        4. Welders, Welding Operators, and Tackers:

ASME Section IX qualified within previous 12 months for employed weld types.

Comply with AWWA D100, Section 11.3 - Welders' Credentials.

* + - * 1. Licensed Professional: [**Professional Engineer**] <**\_\_\_\_\_\_\_\_**> experienced in design of specified Work and licensed [**in the State of New York**].
      1. EXISTING CONDITIONS
         1. Field Measurements:

Verify field measurements prior to fabrication.

Indicate field measurements on Shop Drawings.

1. PRODUCTS
   * + 1. SYSTEM DESCRIPTION
          1. Design, fabricate, and erect <\_\_\_\_\_\_\_\_>-gal. elevated tank and accessories.
          2. Design and construct reinforced-concrete center riser foundation and column footings, complete and in place.
          3. Following information is provided by purchaser of tank, pursuant to AWWA D100, III.A.1:

Capacity: <\_\_\_\_\_\_\_\_> gal.

[**Height: As indicated on Drawings.**]

Bottom Capacity Level (BCL): <\_\_\_\_\_\_\_\_> feet above top of column foundations.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Top Capacity Level (TCL): <\_\_\_\_\_\_\_\_> feet above top of column foundations.

Roof Type: As indicated on Drawings.

Head Range: <\_\_\_\_\_\_\_\_> to <\_\_\_\_\_\_\_\_> feet in elevation.

Diameter of Riser: <\_\_\_\_\_\_\_\_> inch.

Riser Type: <**\_\_\_\_\_\_\_\_**>.

Location of Site: As indicated on Drawings.

Nearest Town and Distance from Site: <**\_\_\_\_\_\_\_\_**>.

Railroad Siding and Distance from Site: <**\_\_\_\_\_\_\_\_**> [**Unknown**].

Access Road: <**\_\_\_\_\_\_\_\_**> [**As indicated on Drawings**].

* + - 1. PERFORMANCE AND DESIGN CRITERIA
         1. Design and construct foundation based upon subsurface investigation report [**as specified in Document 003132 - Geotechnical Data**] <**\_\_\_\_\_\_\_\_**>.
      2. ELEVATED WATER TANK
         1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8772&mf=04&src=wd):

Caldwell Tanks, Inc., 4000 Tower Rd., Louisville, Kentucky 40219, (502) 964-3361.

CBI Industries - CBI Services, Inc., 2 Penn’s Way, Suite 405, New Castle, Delaware 19720, (302) 325-8400.

Approved equivalent.

Insert descriptive specifications below to identify Project requirements and to eliminate conflicts with products specified above.

* + - * 1. Furnish materials complying with this Section and standards in AWWA D100, except as modified under Performance and Design Criteria Paragraph.

Most of following information is to be provided by purchaser of tank, pursuant to AWWA D100, III.A.1.

* + - * 1. Performance and Design Criteria:

Snow Loading: Minimum <\_\_\_\_\_\_\_\_> psf.

Wind Load Requirements: <\_\_\_\_\_\_\_\_> mph.

Earthquake Design: According to AWWA D100, Section 13.

Tank Low Level: Defined as water level when tank emptied through specified discharge fittings, unless otherwise indicated on Drawings.

Pipe and Fittings for Fluid Conductors: Modify AWWA D100, Section 2, to indicate only welded joints for conductors are acceptable.

Roof Support: [**Self-supporting**] <**\_\_\_\_\_\_\_\_**>.

Corrosion Allowance: <**\_\_\_\_\_\_\_\_**> [**None required**].

Balcony: [**Required**] [**None required**].

Manholes, Ladders, and Other Accessories:

Provide one manhole, <\_\_\_\_\_\_\_\_> by <\_\_\_\_\_\_\_\_> inches in size, <\_\_\_\_\_\_\_\_> feet above tank base, and located as indicated on Drawings.

Provide tower, outside, and roof ladders.

Pipe and Pipe Connections:

Provide <\_\_\_\_\_\_\_\_>-inch diameter inlet pipe.

Extend inlet pipe through bottom of tank.

Provide removable stainless-steel silt stop and mechanical joint gland.

Provide other accessories as indicated on Drawings.

Removable Silt Stop: [**Provide according to AWWA D100, Section 5**] [**None required**].

Overflow:

Welded-joint steel overflow pipe as indicated on Drawings, suitably supported and extending to grade level.

Diameter: As indicated on Drawings.

Overflow Weir Box: Designed to handle flow rate of <\_\_\_\_\_\_\_\_> gpm at high water level.

Overflow Piping: Terminate at 3 feet above finished grade to provide air break.

Provide [**aluminum**] [**or**] [**stainless steel**] mesh insect screen and screen holder over air break opening.

Roof Ladder: As indicated on Drawings and designed to meet AWWA D100, Section 5 requirements.

Safety Cages, Rest Platforms, Roof-Ladder Handrails or Other Safety Devices: Provide safety rail complying with OSHA standards along entire ladder length and extending 42 inches above tank roof.

Special Vent Required for Screening of Tank Vent:

Total Free Open Vent Area: <\_\_\_\_\_\_\_\_> sq. in.

Insect Screen: [**Aluminum**] [**, fiberglass**] [**, or**] [**stainless steel**].

Type: Frost proof.

Additional Accessories: According to AWWA D100, Section 5.

<**\_\_\_\_\_**>

Butt-Joint Welds: Modify AWWA D100, Section 8 to include that lap welds tack-welded on one side are not permitted; seal welding is required.

Written Report Certifying Work: Prepare and submit according to AWWA D100, Section 11.

Submit radiographic film and test segments.

Complete-Joint-Penetration Welded Shell Butt Joints: Inspect according to AWWA D100, Section 11.

Surface Preparation: As specified in Section [**099713.24 - Steel Water Storage Tank Painting**] <**\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_**>.

Seal Welding:

According to AWWA D100, Section 8.

Provide seal welds for lap joints in wet areas, including interior roof surfaces.

Soil Investigation and Foundation:

According to AWWA D100, Section 12.

Soil Data: Available for review from [**Director’s Representative**].

Pile-Supported Foundation:

According to AWWA D100, Section 12 and [**fabricator's**] [**manufacturer's**] design.

Effect of Buoyancy on Foundation Design: According to AWWA D100, Section 12.

Concrete: Comply with ACI 318.

Vertical Distance from Finished Ground Level to Crown of Inlet and Outlet Pipes (Earth Cover) at Tank Foundation:

According to AWWA D100, Section 12 and as indicated on Drawings.

Specification Sheet for Seismic Data: [**According to AWWA D100, Section 13**] [**Not required**].

Vertical Design Acceleration: [**According to AWWA D100, Section 13.3.3**] [**Not required**].

Reinforcing Steel: Modify AWWA D100, Section 2 to use Grade 60 only.

Minimum Thickness: [1/4] <\_\_\_\_\_\_\_\_> inch for parts of tank not in contact with water, except web thickness in rolled shapes may be less than [1/4] <\_\_\_\_\_\_\_\_> inch.

Refer to NFPA 22 when editing paragraph below.

Insulation for Inlet/Outlet Pipe: Polyurethane modified polyisocyanurate cellular plastic, 2 inches thick; TRYMER 2000 by Dow Chemical Company, 2211 H.H. Dow Way, Midland, MI 48674, (989) 686-1000, or equal.

Minimum R Value: 5.3 per inch.

Maximum Permeability: 4 perm-inch; ASTM Method E96.

Insulation Jacket: Strap-on z-crimp aluminum, 0.032 inch thick.

Install insulation with vapor barrier and jacket on all exposed piping in accordance with manufacturer’s printed recommendations.

Provide vapor barrier with facing tape and sealants on longitudinal and circumferential seams.

Use two aluminum bands for each section of insulation.

Secure jacketing on longitudinal seams with stainless steel, pan head, No. 8 x 1/2 inch self-tapping screws at 6 inches oc.

Remove paragraph if not LEED project.

* + - 1. SUSTAINABILITY CHARACTERISTICS

Insert sustainable design characteristics in this Article to suit content of this Section and Project sustainable design requirements as specified in Section 018113.

* + - * 1. Section 018113 - LEED Documentation Requirements: Requirements for sustainable design compliance.
        2. Material and Resource Characteristics:

Recycled Content Materials: Furnish materials with maximum available recycled content [**including:**] [**.**]

Insert list of materials specified in this Section required to have recycled content.

<**\_\_\_\_\_\_\_\_**>.

Regional Materials: Furnish materials extracted, processed, and manufactured within 500 miles of Project Site [**including:**] [**.**]

Insert list of materials specified in this Section required to be regional materials.

<**\_\_\_\_\_\_\_\_**>.

* + - 1. MATERIALS
         1. Reinforcement:

Steel Reinforcing Bars:

Grade: [**40**] [**60**].

Comply with [**ASTM A615**] [**and**] [**ACI 318**].

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Steel Reinforcing Bars: As specified in Section [**032000 - Concrete Reinforcing**] <**\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_**>.

* + - * 1. Concrete:

Comply with ACI 318.

Minimum Compressive Strength: 4,000 psi at 28 days.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Concrete: As specified in Section [**033000 - Cast-in-Place Concrete**] <**\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_**>.
        2. Inlet, Outlet, and Overflow Piping:

Comply with ASTM A53, Grade B, Schedule 40 steel pipe.

Joints: Welded.

* + - * 1. Other Materials:

Comply with AWWA D100, Section 2.2.

* + - 1. FABRICATION
         1. Comply with AWWA D100, Section 9 - Shop Fabrication.
      2. SOURCE QUALITY CONTROL
         1. Inspection and Testing of Welds:

Examine weld joints according to AWWA D100, Section 11 and Appendix C.

Comply with procedural requirements of AWWA D100, Section 11 and Appendix C prior to proceeding with radiographic work.

Immediately notify Director’s Representative of weld locations failing to meet standards of AWWA D100, Section 11 and Appendix C.

Repair and reinspect defective welds until acceptable.

Include one or both of following paragraphs to require Director’s Representative inspection or witnessing of test at factory.

* + - * 1. Director’s Inspection:

Make water tank available for inspection at manufacturer's factory prior to packaging for shipment.

Notify Director’s Representative at least [**seven**] <**\_\_\_\_\_\_\_\_**> days before inspection is allowed.

* + - * 1. Director’s Witnessing:

Allow witnessing of factory inspections and test at manufacturer's test facility.

Notify Director’s Representative at least [**seven**] <**\_\_\_\_\_\_\_\_**> days before inspections and tests are scheduled.

Include following paragraph if reliance on fabricator's approved quality-control program is sufficient for Project requirements.

* + - * 1. Certificate of Compliance:

If fabricator is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.

Specified shop tests are not required for Work performed by approved fabricator.

1. EXECUTION
   * + 1. EXAMINATION
          1. Verify that elevations and grading for elevated tank and location of elevated tank are as indicated on [**Shop**] Drawings.
       2. INSTALLATION

Edit following paragraphs to suit Project requirements.

* + - * 1. Excavation: As specified in Section 310000 - Earthwork.
        2. Install tank and tank foundations according to AWWA D100 and following Subparagraphs:

Delete following subparagraph if tank is to be placed on rock foundation.

Comply with AWWA D100, Section 10, except as modified in following Subparagraphs:

Insert number of gallon or liter increments.

Delay Grouting of Column and Riser Bases until Following is Accomplished:

Fill tank in <\_\_\_\_\_\_\_\_>-gal. increments, one increment each week.

Measure differential settlement of foundations before and after each incremental loading.

If differential settlement exceeds <\_\_\_\_\_\_\_\_> inches between column and riser pipe foundations, re-level tank prior to adding next incremental loading.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Insert following subparagraph when tank is on rock foundation.

No changes or modifications AWWA D100, Section 10.

Comply with AWWA D100, Section 11, except as modified in following Subparagraph:

Field Painting: As specified in Section [**099713.24 - Steel Water Storage Tank Painting**] <**\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_**>.

* + - * 1. Backfilling: As specified in Section 310000 - Earthwork.
      1. FIELD QUALITY CONTROL
         1. Inspection and Testing:

[**Contractor to provide**] [**or**] [**the State will provide**] **the services of an independent, qualified testing agency during the erection of the tank to inspect and test materials and workmanship in accordance with AWWA D100**

Hydrostatic Testing:

Test completed and cleaned tank for liquid tightness by filling tank to its overflow elevation with water [**provided by State**] [**or**] [**provided by the General Contractor**].

Correct leaks disclosed by this test. Coordinate with Director’s Representative.

Drain and legally dispose of test water off Site.

Field Welds: Test and inspect according to AWWA D100, Section 11.

Test foundation concrete as specified in Section 033000 - Cast-in-Place Concrete.

* + - * 1. Manufacturer Services: Furnish services of manufacturer's representative experienced in installation of products furnished under this Section for not less than <**\_\_\_\_\_\_\_\_**> days on Site for installation, inspection, startup, field testing, and instructing the Facility personnel in maintenance of equipment. Coordinate with Director’s Representative.
        2. Equipment Acceptance:

Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.

Make final adjustments to equipment under direction of manufacturer's representative.

Coordinate all repairs with the Director’s Representative.

* + - * 1. Furnish installation certificate from equipment manufacturer's representative attesting that equipment has been properly installed and leveled.
      1. CLEANING
         1. Section 017716 - Contract Closeout: Requirements for cleaning.
         2. Clean interior and exterior of tank to remove debris, construction items, and equipment.
         3. Disinfect tank as specified in 330110.58 - Disinfection of Water Utility Piping Systems. Coordinate disinfection with the Director’s Representative. Tank may not be brought online until written approval is received by the NYSDOH and Director’s Representative.

END OF SECTION 331616