SECTION 221219 - FACILITY GROUND-MOUNTED, POTABLE-WATER STORAGE TANKS

Revise this Section by deleting and inserting text to meet Project-specific requirements.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

1. GENERAL
	* + 1. RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

* + - * 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
			1. SUMMARY
				1. Section Includes:

Welded-steel, ground-mounted, potable-water [**reservoirs**] [**standpipes**].

Bolted-steel, ground-mounted, potable-water [**reservoirs**] [**standpipes**].

Wire- or strand-wound, concrete, ground-mounted, potable-water storage tanks.

Paint materials.

Shop painting.

Ground-mounted, potable-water storage tank appurtenances.

* + - * 1. Related Requirements:

Retain subparagraph below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.

Section 221216 "Facility Elevated, Potable-Water Storage Tanks" for multiple-column, elevated water-storage tanks and for single-pedestal, elevated water-storage tanks.

* + - 1. DEFINITIONS

Retain terms that remain after this Section has been edited for a project.

* + - * 1. Bottom Capacity Level (BCL): Water level above which the specified capacity is provided. In a ground-supported tank (reservoir or standpipe), the BCL is the water level in the tank shell when the tank is emptied through the specified discharge fittings, unless otherwise specified.
				2. Capacity: Net volume, in gallons, that may be removed from a tank filled to TCL and emptied to BCL.
				3. CR: Chlorosulfonated polyethylene synthetic rubber.
				4. Minimum Capacity within Operating Range: Capacity when water level is at BCL.
				5. NR: Natural rubber.
				6. Range of Head: Vertical distance between TCL and BCL.
				7. Reservoir: Flat-bottomed, cylindrical, steel ground-mounted water-storage tank with shell height equal to or less than its diameter.
				8. SDWA: Safe Drinking Water Act.
				9. Standpipe: Flat-bottomed, cylindrical, ground-mounted water-storage tank with shell height greater than its diameter.
				10. Top Capacity Level (TCL): Water level defined by the lip of the overflow elevation.
			1. SUBMITTALS
				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 submitted and tabbed (for combined submittals).
				4. Product Data: For each type of facility ground-mounted, potable-water storage tank, include rated capacities, accessories, appurtenances, and furnished specialties.
				5. Shop Drawings: Signed and sealed by a qualified professional Director’s Representative. Show fabrication and installation details for each facility ground-mounted, potable-water storage tank, including the following:

Tank, roof, and shell openings.

Safety railings and ladders.

Plans, elevations, sections, and attachment details.

Structural analysis data signed and sealed by the qualified professional Director’s Representative responsible for their preparation.

Diagram power, signal, and control wiring.

Retain "Seismic Qualification Data" paragraph below if required by seismic criteria applicable to Project. Coordinate with Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment." See ASCE/SEI 7 for certification requirements for equipment and components.

* + - * 1. Seismic Qualification Data: Certificates, for facility ground-mounted, potable-water storage tanks and components, from manufacturer.

Basis for Certification: Include calculation upon which withstand certification is based.

Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

Retain "Welding certificates" paragraph below if retaining "Welding Qualifications" paragraph in "Quality Assurance" Article.

* + - * 1. Welding certificates.
				2. Bacteriological test results.

Retain "Field quality-control reports" paragraph below if Contractor is responsible for field quality-control testing and inspecting.

* + - * 1. Field quality-control reports.
			1. CLOSEOUT SUBMITTALS
				1. Operation and Maintenance Data: For the following to include in emergency, operation, and maintenance manuals:

Obstruction lighting.

Lightning protection.

Cathodic protection.

Tank heaters.

* + - 1. QUALITY ASSURANCE
				1. Fabricator Qualifications: Employ a qualified structural Director’s Representative to prepare calculations, Shop Drawings, and other structural data for fabrication and erection of ground-mounted, potable-water storage tanks.

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.

Retain "Welding Qualifications" paragraph below if shop or field welding is required. If retaining, also retain "Welding certificates" paragraph in "Informational Submittals" Article.

* + - * 1. Welding Qualifications: Qualify procedures and personnel according to the following:

Retain applicable standards in subparagraphs below.

AWS D1.1, "Structural Welding Code - Steel."

AWS D1.3, "Structural Welding Code - Sheet Steel."

AWS D1.4, "Structural Welding Code - Reinforcing Steel."

Retain "Pipe Welding" paragraph below for pipe welding.

* + - * 1. Pipe Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding, Brazing, and Fusing Qualifications."
1. PRODUCTS

Manufacturers and products listed in SpecAgent and MasterWorks paragraph Builder are neither recommended nor endorsed by the AIA or Deltek. Before inserting names, verify that manufacturers and products listed there comply with requirements retained or revised in descriptions and are both available and suitable for the intended applications.

* + - 1. PERFORMANCE REQUIREMENTS

Revise wind load in "Structural Performance" paragraph below to suit local conditions.

* + - * 1. Structural Performance: Ground-mounted, potable-water tank, including structural reinforcement and foundation, shall withstand the effects of dead and live gravity loads and winds of [**100 mph**] <**Insert value**>.

Retain "Seismic Performance" paragraph below with "Seismic Qualification Data" paragraph in "Informational Submittals" Article for projects requiring seismic design. Delete paragraph if performance requirements are indicated on Drawings. Model building codes and ASCE/SEI 7 establish criteria for buildings subject to earthquake motions. Coordinate requirements with structural engineer.

* + - * 1. 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**] <**Insert requirement**>.

Retain first subparagraph below to define the term "withstand" as it applies to this Project. Definition varies with type of building and occupancy and is critical to valid certification. Option is used for essential facilities where equipment must operate immediately after an earthquake.

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**]."

For life-safety components required to function after an earthquake (such as fire-sprinkler systems, components that contain hazardous content, and storage racks in structures open to the public), the Component Importance Factor is 1.5. For other components, the Component Importance Factor is 1.0 unless the structure is Seismic Use Group III and component is necessary for continued operation of facility or failure of component could impair continued operation of facility, in which case the Component Importance Factor is 1.5.

Component Importance Factor: [**1.5**] [**1.0**].

See ASCE/SEI 7, Coefficients for Architectural Component Table and Seismic Coefficients for Mechanical and Electrical Components Table for requirements to be inserted in subparagraph below.

<**Insert requirements for Component Amplification Factor and Component Response Modification Factor**>.

* + - * 1. 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.

Differential values in "Temperature Change" subparagraph below (for aluminum in particular) are suitable for most of the U.S.

Temperature Change: [**120 deg F, ambient; 180 deg F, material surfaces**] <**Insert temperature change**>.

* + - * 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 “Standard for Electrical Safety in the Workplace”, by a qualified testing agency, and marked for intended location and application.

Retain "Tanks for Potable-Water Storage and Fire-Suppression Water Supply" paragraph below if tank is used for both potable and fire-protection water storage.

* + - * 1. Tanks for Potable-Water Storage and Fire-Suppression Water Supply: Comply with NFPA 22 “Standard for Water Tanks for Private Fire Protection”, "Water Tanks for Private Fire Protection,"
				2. Comply with NSF 61 “Drinking Water Systems Components - Health Effects” and NSF 372 “Drinking Water System Components - Lead Content”.
				3. Comply with 29 CFR 1910 “Definition and Requirements for a Nationally Recognized Testing Laboratory”.
			1. WELDED-STEEL, GROUND-MOUNTED, POTABLE-WATER [**RESERVOIRS**] [**STANDPIPES**]

Welded-steel, ground-mounted, potable-water storage tanks in this article have capacities of 50,000 to 5,000,000 gal. Some authorities having jurisdiction may have more stringent requirements. Consult authorities having jurisdiction and manufacturers.

* + - * 1. Description: Manufactured, welded-steel tank with welded-steel plates, bolts, rods, and reinforcing steel.

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=13100) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Brown Tank, LLC](http://www.specagent.com/Lookup?uid=123457177301).

[Fisher Tank Company](http://www.specagent.com/Lookup?uid=123457177304).

[Superior Tank Co., Inc](http://www.specagent.com/Lookup?uid=123457177307).

Approved equivalent.

* + - * 1. Standard: Designed and fabricated according to [**AWWA D100 and AWWA M42**] [**AWWA D100, AWWA M42, and NFPA 22**] <**Insert standards**>.
				2. Capacity: [**50,000 gal.**] [**5,000,000 gal.**] <**Insert capacity**>.
				3. Minimum Capacity within Operating Range: <**Insert capacity**>.
				4. Shell Roof:

Retain first subparagraph below if self-supporting roof is required.

[**Dome**] [**Ellipsoidal**] welded steel and self-supporting.

Retain subparagraph below if supported roof is required.

Conical with[**knuckle and**] column-rafter support.

Retain "Reservoir Shell Diameter" paragraph below for reservoir tanks.

* + - * 1. Reservoir Shell Diameter: <**Insert feet**>.

Retain "Standpipe Shell Height" paragraph below for standpipe tanks when there is no specific BCL requirement. Retain "Standpipe Range of Head" paragraph and delete "Standpipe Shell Height" paragraph for standpipe tanks when there is a specific BCL requirement. Retain "BCL" paragraph for standpipe and reservoir tanks when there is a specific BCL requirement.

* + - * 1. Standpipe Shell Height: <**Insert height in feet**> from top of foundation to overflow level.
				2. Standpipe Range of Head: <**Insert height in feet**> from BCL to overflow level.
				3. BCL: <**Insert height in feet of level above foundation**>.
				4. Pipe Connections: Comply with AWWA D100 “Standard for Welded Carbon Steel Tanks for Water”. Match size of water-distribution pipe.
				5. Overflow Piping: ASTM A53 “Standard Specification for Pipe, Steel, Black and Hot-Dipper, Zinc-Coated, Welded and Seamless”, Grade B, Schedule 40, welded-steel pipe with ASTM A234 “Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service”, Grade WPB, Schedule 40, carbon-steel butt-weld fittings.
				6. Roof Opening Hatch at Ladder: Comply with AWWA D100 “Standard for Welded Carbon Steel Tanks for Water”. Steel, hinged cover, [**24 by 24 inches**] <**Insert dimensions**> minimum or as required by OSHA, with [**4-inch**] <**Insert dimension**> curb and [**2-inch**] <**Insert dimension**> downward overlap with hasp and lock, located over interior ladder and adjacent to exterior ladder.
				7. Roof Center Opening: Comply with AWWA D100 “Standard for Welded Carbon Steel Tanks for Water”. Steel, removable, [**20-inch-**] <**Insert dimension**> minimum-diameter cover with [**4-inch-**] <**Insert dimension**> minimum-height neck and minimum [**2-inch**] <**Insert dimension**> downward overlap with hasp and lock. Construct opening with capability of supporting ventilation fan.
				8. Shell Sidewall Manholes: Comply with AWWA D100 “Standard for Welded Carbon Steel Tanks for Water”. Provide two steel manholes. One circular, 30 inches minimum in diameter. The second, [**circular, 24 inches in diameter**] [**circular, 36 inches**] [**elliptical, 18-by-22-inch- minimum size**] <**Insert shape and dimensions**>.

Retain "Painter's Accessories" paragraph below if tank is more than 25 feet high. Consult manufacturers to determine if lugs, couplings, or rail option is preferred.

* + - * 1. Painter's Accessories: Include [**lugs**] [**couplings**] [**rail**] inside and outside tank for painting.

Retain both options in "Tank Vent" paragraph below if required by authorities having jurisdiction.

* + - * 1. Tank Vent: Steel pipe with stainless steel screen, constructed to prevent entrance of rain,[**insects**] birds, and animals.[**Include pressure-vacuum screened vent or separate pressure-vacuum relief mechanism to maintain clear screen.**]
				2. Foundation: Reinforced concrete. See Section 033000 "Cast-in-Place Concrete."
			1. BOLTED-STEEL, GROUND-MOUNTED, POTABLE-WATER [**RESERVOIRS**] [**STANDPIPES**]

Bolted-steel, ground-mounted, potable-water storage tanks in this article have capacities of 4000 to 160,000 gal. Some authorities having jurisdiction may have more stringent requirements. Consult authorities having jurisdiction and manufacturers.

* + - * 1. Description: Manufactured tank with bolted-steel plates, bolts, rods, and reinforcing steel.

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=13101) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[American Tank Company, Inc](http://www.specagent.com/Lookup?uid=123457177308).

[Superior Tank Co., Inc](http://www.specagent.com/Lookup?uid=123457177311).

Approved equivalent.

* + - * 1. Standard: Designed and fabricated according to [**AWWA D103 and AWWA M42**] [**AWWA D103, AWWA M42, and NFPA 22**] <**Insert standards**>.
				2. Capacity: [**4000 gal.**] [**160,000 gal.**] <**Insert capacity**>.
				3. Minimum Capacity within Operating Range: <**Insert capacity**>.
				4. Shell Roof: Comply with AWWA D103 “Standard for Factory-coated Bolted Carbon Steel Tanks for Water Storage”.

Retain "Reservoir Shell Diameter" paragraph below for reservoir tanks.

* + - * 1. Reservoir Shell Diameter: <**Insert feet**>.

Retain "Standpipe Shell Height" paragraph below for standpipe tanks when there is no specific BCL requirement. Retain "Standpipe Range of Head" paragraph and delete "Standpipe Shell Height" paragraph for standpipe tanks when there is a specific BCL requirement. Retain "BCL" paragraph for standpipe and reservoir tanks when there is a specific BCL requirement.

* + - * 1. Standpipe Shell Height: <**Insert height in feet**> from top of foundation to overflow level.
				2. Standpipe Range of Head: <**Insert height in feet**> from BCL to overflow level.
				3. BCL: <**Insert height in feet of level above foundation**>.
				4. Pipe Connection: Comply with AWWA D103 “Standard for Factory-coated Bolted Carbon Steel Tanks for Water Storage”. Match size of water-distribution pipe.
				5. Overflow Piping: ASTM A53 “Standard Specification for Pipe, Steel, Black and Hot-Dipper, Zinc-Coated, Welded and Seamless”, Grade B, Schedule 40, welded-steel pipe with ASTM A234 “Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service”, Grade W.B., Schedule 40, carbon-steel butt-weld fittings.
				6. Roof Opening Hatch above TCL: Comply with AWWA D103 “Standard for Factory-coated Bolted Carbon Steel Tanks for Water Storage”. Steel, hinged cover, [**24 by 15 inches**] <**Insert dimensions**> 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.
				7. Roof Center Opening: Comply with AWWA D103 “Standard for Factory-coated Bolted Carbon Steel Tanks for Water Storage”. steel, removable, [**20-inch-**] <**Insert dimension**> minimum-diameter cover with 4-inch- minimum-height neck and minimum [**2-inch**] <**Insert dimension**> downward overlap with hasp and lock. Construct opening with capability of supporting ventilation fan.

In "Shell Sidewall Manholes" paragraph below, options listed are allowed options in AWWA D103. Retain one option below. If designating a different size, ensure that size complies with range of size options in AWWA D103.

* + - * 1. Shell Sidewall Manholes: Comply with AWWA D103 “Standard for Factory-coated Bolted Carbon Steel Tanks for Water Storage”. Provide two steel manholes, [**circular, minimum 24 inches in diameter**] [**square, minimum 24 by 24 inches in diameter**] [**elliptical, minimum 18 by 22 inches**] [**flush rectangular, minimum length 24 inch in shortest direction and maximum length 48 inches in the longest direction**] <**Insert shape and dimensions**>.

Retain "Painter's Accessories" paragraph below if tank is more than 25 feet high and is to be field painted. Consult manufacturers to determine if lugs, couplings, or rail option is preferred. Delete if retaining "Painting, Factory-Applied, Internal" and "Painting, Factory-Applied External" paragraphs.

* + - * 1. Painter's Accessories: Include [**lugs**] [**couplings**] [**rail**] inside and outside tank for painting.

Retain "Painting, Factory-Applied, Internal" and "Painting, Factory-Applied, External" paragraphs below if factory-applied painting is needed.

* + - * 1. Painting, Factory-Applied, Internal: [**Epoxy powder coating, NSF and FDA compliant**] <**Insert coating type**>.
				2. Painting, Factory-Applied, External: [**Polyester powder coating**] <**Insert coating type**>.

Retain both options in "Tank Vent" paragraph below if required by authorities having jurisdiction.

* + - * 1. Tank Vent: Steel pipe with stainless steel screen, constructed to prevent entrance of rain,[**insects,**] birds, and animals.[**Include pressure-vacuum screened vent or separate pressure-vacuum relief mechanism to maintain clear screen.**]
				2. Foundation: Reinforced concrete. See Section 033000 "Cast-in-Place Concrete."
			1. WIRE- OR STRAND-WOUND, CONCRETE, GROUND-MOUNTED, POTABLE-WATER STORAGE TANKS

Concrete, ground-mounted, potable-water storage tanks in this article have capacities of 100,000 to 40,000,000 gal. Some authorities having jurisdiction may have more stringent requirements. Consult authorities having jurisdiction and manufacturers.

* + - * 1. Description: Wire- and strand-wound, circular prestressed concrete tank with option of four types of core walls: Type I - cast-in-place concrete with vertical prestressed reinforcement; Type II - shotcrete with steel diaphragm; Type III - precast concrete with steel diaphragm; Type IV - cast-in-place concrete with steel diaphragm.

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=13098) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[DN Tanks](http://www.specagent.com/Lookup?uid=123457177299).

[Preload Inc](http://www.specagent.com/Lookup?uid=123457177298).

Approved equivalent.

* + - * 1. Standard: Designed and fabricated according to [**AWWA D110**] [**AWWA D110 and NFPA 22**] <**Insert standards**>.
				2. Capacity: [**100,000 gal.**] [**40,000,000 gal.**] <**Insert capacity**>.
				3. Minimum Capacity within Operating Range: <**Insert capacity**>.

Retain at least one of first two paragraphs below.

* + - * 1. Tank Height: <**Insert height in feet**> from top of foundation to overflow.
				2. Tank Inside Diameter: <**Insert feet**>.
				3. Range of Head: <**Insert height in feet**> from BCL to overflow level.
				4. BCL: <**Insert height in feet of level above foundation**>.
				5. Tank Floor: Reinforced, cast-in-place concrete.

Retain one of first four paragraphs below. Not all manufacturers offer each type. Consult manufacturers.

* + - * 1. Tank Wall, Cast-in-Place Concrete Tank (AWWA D110 Type I):

Materials: Cast-in-place concrete. Mix proportions shall meet minimum 28-day [**4000-psig**] <**Insert pressure**> compressive strength.

* + - * 1. Tank Wall, Shotcrete with Steel Diaphragm Tank (AWWA D110 Type II):

Materials: Shotcrete. Mix proportions shall meet minimum 28-day [**4500-psig**] <**Insert pressure**> compressive strength. Include steel diaphragm.

* + - * 1. Tank Wall, Precast Concrete with Steel Diaphragm Tank (AWWA D110 Type III):

Materials: Precast concrete. Comply with AWWA D110. [**4000-psig**] <**Insert pressure**> compressive strength. Include steel diaphragm.

* + - * 1. Tank Wall, Cast-in-Place Concrete with Steel Diaphragm (AWWA D110 Type IV):

Materials: Cast-in-place concrete. Comply with AWWA D110 “Standard for Wire- and Strand-Wound, Circular, Prestressed Concrete Water Tanks”. Mix proportions shall meet minimum 28-day [**4000-psig**] <**Insert pressure**> compressive strength. Include steel diaphragm.

Retain one of four options in "Internal Baffling" paragraph below if required to meet disinfection retention time requirements for groundwater systems. Coordinate requirement with authorities having jurisdiction. Coordinate baffling type with manufacturers' availability.

* + - * 1. Internal Baffling: [**Polypropylene curtain(s) supported by glass-fiber angles**] [**Steel-reinforced concrete block masonry wall(s)**] [**Cast-in-place concrete or shotcrete wall(s)**] [**Precast concrete wall(s)**].

Baffles: Configured to comply with SDWA-mandated disinfectant contact times.

Retain "Domed Tank Roof" or "Flat Tank Roof" paragraph below.

* + - * 1. Domed Tank Roof: Reinforced, [**cast-in-place**] [**precast**] [**shotcrete**] concrete.
				2. Flat Tank Roof: Reinforced, [**cast-in-place**] [**precast**] concrete complying with applicable requirements of ACI 350 “Code Requirements for Environmental Engineering Concrete Structures and Commentary”, with special attention to crack control.
				3. Reinforcing Steel: ASTM A767 “Standard Specification for Zinc-Coated Steel Bars for Concrete Reinforcement”, Grade 60, zinc-coated billet steel bars.
				4. Waterstops: Comply with AWWA D110 “Standard for Wire- and Strand-Wound, Circular, Prestressed Concrete Water Tanks”.
				5. Bearing Pads:

In "Material" subparagraph below, retain hardness option and delete compliance with AWWA D110 if a more stringent requirement than in AWWA D110 is needed. AWWA D110 hardness range is 30 to 50.

Material: [**Comply with AWWA D110**] [**NR**] [**ASTM D2240, CR, with durometer hardness of 40 to 50**].

Minimum Thickness: [**1/2 inch**] <**Insert dimension**> under walls and [**1/2 inch**] <**Insert dimension**> under roof.

Minimum Width: [**3 inches**] <**Insert dimension**> under walls and [**2 inches**] <**Insert dimension**> under roof.

* + - * 1. Bolts, Nuts, Washers, and Expansion Sleeve Inserts: Stainless steel.

In first two paragraphs below, delete last option if no portion of tank is buried.

* + - * 1. Construction and Maintenance Hatch: [**Aluminum**] [**Galvanized-steel**] frame and cover at least 3/16 inch thick, 48-by-48-inch- minimum-size, hinged cover with a 4-inch neck and 2-inch downward overlap and having a hasp and lock.[**Locate top of hatch above grade.**]
				2. Personnel Hatch: [**Aluminum**] [**Galvanized-steel**] frame and cover at least 3/16 inch thick, 30-inch- minimum, square hinged cover with a 4-inch neck and 2-inch downward overlap and having a hasp and lock. Construct opening with capability of supporting ventilation fan.[**Locate top of hatch above grade.**]

In "Tank Vents" paragraph below, retain last two options if required by authorities having jurisdiction.

* + - * 1. Tank Vents: [**Fiberglass**] [**Galvanized-steel**] pipe with [**aluminum**] [**stainless steel**] screen, constructed to prevent entrance of rain,[**insects,**] birds, and animals.[**Include pressure-vacuum screened vent or separate pressure-vacuum relief mechanism to maintain clear screen.**]
				2. Tank Interior Surface Sealer: Cementitious coating modified with acrylic or styrene-acrylic based polymer.
			1. PAINT MATERIALS

Retain "Paint" paragraph below for welded-steel reservoirs or standpipes. Delete this article and retain "Shop Painting" Article for bolted-steel reservoirs or standpipes.

* + - * 1. Paint: Comply with AWWA D102 “Standard for Coating Steel Water Tanks”.
				2. Primer: Tank fabricator's [**epoxy-polyamide**] <**Insert paint**> paint.
				3. Tank Shell Interior Finish Paint: Tank fabricator's [**epoxy-polyamide paint**] <**Insert paint**> complying with NSF 61 “Drinking Water Systems Components - Health Effects” and NSF 372 “Drinking Water System Components - Lead Content”, and compatible with prime coat.
				4. Tank Shell Exterior Intermediate Paint: Tank fabricator's [**epoxy-polyamide**] <**Insert paint**> paint compatible with prime and finish paint. Intermediate coat shall have a slight color contrast with finish coat.
				5. Tank Shell Exterior Finish Paint: Tank fabricator's [**urethane**] <**Insert paint**> paint.

Color: [**As selected by Director’s Representative from tank manufacturer's paint chart**] <**Insert color**>.

* + - 1. SHOP PAINTING

Retain this article for bolted-steel reservoirs or standpipes.

* + - * 1. Factory coating according to AWWA D103 “Standard for Factory-coated Bolted Carbon Steel Tanks for Water Storage”.
				2. Tank Shell Interior Finish Coat: Comply with NSF 61 “Drinking Water Systems Components - Health Effects” and NSF 372 “Drinking Water System Components - Lead Content”.
				3. Tank Shell Exterior Finish Coat: Factory coating according to AWWA D103 “Standard for Factory-coated Bolted Carbon Steel Tanks for Water Storage”.
			1. GROUND-MOUNTED, POTABLE-WATER STORAGE TANK APPURTENANCES
				1. Water-Level Controls: Automatic controls for maintaining water level in tank, with valves, piping, and audible and visual alarms to indicate the following:

High- and low-water levels.

Tank overflowing or tank not filling.

<**Insert required alarms**>.

Retain "Obstruction Lighting" paragraph below if required.

* + - * 1. Obstruction Lighting: Comply with requirements of authorities having jurisdiction.
				2. Lightning Protection: Comply with requirements in Section 264113 "Lightning Protection for Structures."
				3. Cathodic Protection: Comply with requirements in Section 134713 "Cathodic Protection" and with AWWA D104 “Standard for Automatically Controlled, Impressed-Current Cathodic Protection for the Interior Submerged Surfaces of Steel Water Storage Tanks”.

Retain "Tank Heaters" paragraph below if required.

* + - * 1. Tank Heaters: Comply with NFPA 22 “Standard for Water Tanks for Private Fire Protection” and with capacity to maintain 42 deg F water temperature inside surface water-storage tank.

Retain "Spiral Staircase" or "Exterior Ladder" paragraph below.

* + - * 1. Spiral Staircase:

Material: [**Galvanized steel**] <**Insert material**>.

Size: Custom sized to tank.

Accessories: Including step off platform.

Safety Devices: As required by 29 CFR 1910 “Definition and Requirements for a Nationally Recognized Testing Laboratory” (OSHA) safety and health regulations.

Standards: Comply with [**AWWA D100**] [**AWWA D103**] [**AWWA D110**].

* + - * 1. Exterior Ladder: Straight, vertical ladder rungs.

Material: [**Powder-coated or galvanized**] [**Stainless**] steel.

Size: Custom sized to tank.

Accessories: Including step off platform.

Safety Devices: As required by 29 CFR 1910 “Definition and Requirements for a Nationally Recognized Testing Laboratory” (OSHA) safety and health regulations.

Standards: Comply with [**AWWA D100**] [**AWWA D103**] [**AWWA D110**].

Interior ladders are not recommended for bolted-steel tanks according to AWWA D103. The standard also indicates that if interior ladders are specified instead, they need to comply with AWWA D103, Section 7.4.1.

* + - * 1. Interior Ladder: Straight, vertical ladder rungs.

Material: [**Powder-coated or galvanized**] [**Stainless**] steel.

Size: Custom sized to tank.

Accessories: Including step off platform.

Safety Devices: As required by 29 CFR 1910 “Definition and Requirements for a Nationally Recognized Testing Laboratory” (OSHA) safety and health regulations.

Standards: Comply with [**AWWA D100**] [**AWWA D103**] [**AWWA D110**].

* + - * 1. <**Insert accessories**>.
1. EXECUTION
	* + 1. INSTALLATION OF STEEL, GROUND-MOUNTED, POTABLE-WATER STORAGE TANKS
				1. Welded-Steel Tanks:

Erect tank shell, accessories, and appurtenances according to AWWA D100 “Standard for Welded Carbon Steel Tanks for Water” and AWWA M42 “Standard for Steel Water Storage Tanks”.

Fabricate steel plate sections in the shop. Erect tank shell by welding plate sections in the field.

* + - * 1. Bolted-Steel Tanks:

Erect tank shell, accessories, and appurtenances according to AWWA D103 “Standard for Factory-coated Bolted Carbon Steel Tanks for Water Storage” and AWWA M42 “Standard for Steel Water Storage Tanks”.

Fabricate tank sections and drill or punch bolt holes in the shop. Install bolts during field erection of tank.

* + - * 1. Set top of reinforced-concrete foundation at least 6 inches above finish grade.
				2. Install roof hatch near exterior[**and interior**] ladder(s).
				3. Install roof center opening near center of roof.
				4. Install tank vent at center of roof.
				5. Install two manholes in tank wall near grade.
			1. INSTALLATION OF CONCRETE, GROUND-MOUNTED, POTABLE-WATER STORAGE TANKS

Retain "Tank Wall" paragraph below for wire- or strand-wound, prestressed-concrete, surface water-storage tanks.

* + - * 1. Tank Wall: Construct tank wall and install accessories and appurtenances according to AWWA D110 “Standard for Wire- and Strand-Wound, Circular, Prestressed Concrete Water Tanks”.
				2. Floor: Reinforced, cast-in-place concrete. Slope floor 1.0 to 1.5 percent from highest point to water outlet pipe. Pour monolithically without cold joints and provide mechanical float finish.

Retain "Dome Roof" or "Flat Slab Roof" paragraph below. In "Dome Roof" paragraph, retain option if backfill level is within 6 inches of top of tank wall.

* + - * 1. Dome Roof: Install reinforced, cast-in-place concrete with circumferential prestressing.[**Place 6-inch waterstop between roof and wall.**]

Install curb on roof perimeter with no fewer than 6 downspouts spaced [**60 degrees**] <**Insert number**> and no more than [**50 feet**] <**Insert dimension**> apart.

In "Flat Slab Roof" paragraph below, retain option if backfill level is within 6 inches of top of tank wall.

* + - * 1. Flat Slab Roof: Install reinforced, cast-in-place concrete with drop panels and support having reinforced, cast-in-place concrete columns. Place solid neoprene bearing pads[**and 6-inch waterstop**] between roof and wall. If voids are present between wall and roof after use of solid bearing pads, fill voids with closed-cell CR pads and soft mastic.

Install curb on roof perimeter with no fewer than 6 downspouts spaced [**60 degrees**] <**Insert number**> and no more than [**50 feet**] <**Insert dimension**> apart.

In first paragraph below, retain first option if no ladder.

* + - * 1. Install construction and maintenance hatch near [**wall**] [**ladder**].

In paragraph below, retain option if tank diameter is greater than 100 feet.

* + - * 1. Install ventilators at highest point of roof.[**Install additional units where indicated.**]
			1. PIPING CONNECTIONS

Coordinate piping installations and specialty arrangements with Drawings and with requirements specified in piping systems. If Drawings are explicit enough, these requirements may be reduced or omitted.

* + - * 1. Connect tanks to water-distribution piping.
				2. Connect drains to storm-drainage piping.
			1. ELECTRICAL CONNECTIONS
				1. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
				2. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
				3. Install electrical devices furnished by manufacturer, but not factory mounted.
				4. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

Retain one of two subparagraphs below. First subparagraph cross-references Section 260553 "Identification for Electrical Systems" and should be retained for consistent electrical identification. Second subparagraph is an abbreviated version of the product specified in Section 260553 "Identification for Electrical Systems."

Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."

Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

* + - 1. CONTROL CONNECTIONS
				1. Install control and electrical power wiring to field-mounted control devices.
				2. Connect control wiring according to Section 260523 "Control-Voltage Electrical Power Cables."
			2. SURFACE PREPARATION OF STEEL TANKS

Retain this article only for welded-steel, ground-mounted reservoir or standpipes.

Retain first paragraph below if surface preparation is specified in Section 099114 "Exterior Painting" or Section 099600 "High-Performance Coatings."

* + - * 1. Surface preparation is specified in [**Section 099114 "Exterior Painting."**] [**Section 099600 "High-Performance Coatings."**]
				2. 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.
				3. 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.
				4. If surface develops rust before prime coat is applied, repeat field surface preparation.
			1. FIELD PAINTING

Retain first paragraph below if painting is specified in Section 099114 "Exterior Painting" or Section 099600 "High-Performance Coatings."

* + - * 1. Surface preparation is specified in [**Section 099114 "Exterior Painting."**] [**Section 099600 "High-Performance Coatings."**]

Retain first four paragraphs below for welded-steel, ground-mounted, potable-water reservoirs and standpipes.

* + - * 1. Apply paint according to AWWA D102 “Standard for Coating Steel Water Tanks”.
				2. 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.
				3. 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.
				4. Tank Shell[**and Steel Support**] 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.

Retain one of first two paragraphs below.

* + - * 1. Concrete tanks do not require painting.
				2. Paint concrete, surface water-storage tanks according to [**Section 099114 "Exterior Painting."**] [**Section 099600 "High-Performance Coatings."**]

Retain first paragraph below for all ground-mounted, potable-water reservoirs, standpipes, and tanks.

* + - * 1. Tank Exterior Lettering[**and Logo**]: Apply [**one coat**] [**two coats**] of urethane paint to a dry film thickness of 2.0 to 3.0 mils [**for each application**].
				2. Overflow Pipe: Paint pipe exterior that is outside tank and structure as indicated for tank exterior.

Delete first paragraph below if no exterior ladders or if galvanized surface is required.

* + - * 1. Exterior Ladders: Paint as indicated for tank shell exterior.
				2. 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.
				3. Complete daily painting to allow time for paint to dry before condensation is expected.
			1. INSTALLATION OF SURFACE WATER-STORAGE TANK APPURTENANCES
				1. Install and adjust water-level control valves, piping, and alarms.
				2. Install obstruction lighting according to authorities having jurisdiction.
				3. Install lightning protection according to Section 264113 "Lightning Protection for Structures."
				4. Install cathodic protection according to AWWA D104 “Standard for Automatically Controlled, Impressed-Current Cathodic Protection for the Interior Submerged Surfaces of Steel Water Storage Tanks”.
				5. Install tank heaters according to NFPA 22 “Standard for Water Tanks for Private Fire Protection”.
			2. FIELD QUALITY CONTROL

Retain one of first three paragraphs below. Retain first option in "Testing Agency" paragraph below if Owner will hire an independent testing agency.

* + - * 1. Testing Agency: [**Director’s Representative will engage**] [**Engage**] a qualified testing agency to perform tests and inspections.

Retain "Manufacturer's Field Service" paragraph below to require a factory-authorized service representative to perform tests and inspections.

* + - * 1. Manufacturer's Field Service: Engage a Company Field Advisor per OGS Spec Section 014216 to test and inspect components, assemblies, and equipment installations, including connections.

Retain "Perform the following tests and inspections" paragraph below to require Contractor to perform tests and inspection and retain option to require Contractor to arrange for the assistance of a factory-authorized service agent.

* + - * 1. Perform the following tests and inspections[**with the assistance of a Company Field Advisor per OGS Spec Section 014216**]:

Retain first two subparagraphs below for welded-steel reservoirs or standpipes.

Tank Weld Test: Use radiographic method according to AWWA D100 “Standard for Welded Carbon Steel Tanks for Water”. Repair failures and retest.

Leak Test for Welded Reservoirs or Standpipes: Comply with AWWA D100 “Standard for Welded Carbon Steel Tanks for Water” [**and NFPA 22**]. Fill tanks with potable water and test for leaks after installation. Repair leaks and retest until no leaks exist.

Water will be furnished by Director’s Representative.

Retain "Leak Test for Bolted Reservoirs or Standpipes" subparagraph below for bolted-steel reservoirs or standpipes.

Leak Test for Bolted Reservoirs or Standpipes: Comply with AWWA D103 “Standard for Factory-coated Bolted Carbon Steel Tanks for Water Storage” [**and NFPA 22**]. Fill tanks with potable water and test for leaks after installation. Repair leaks and retest until no leaks exist.

Water will be furnished by Director’s Representative.

Retain "Leak Test for Concrete Tanks" subparagraph below for concrete, ground-mounted, potable-water storage tanks.

Leak Test for Concrete Tanks: Comply with [**AWWA D110**] [**and NFPA 22**]. Fill tanks with potable water and test for leaks after installation. Repair leaks and retest until no leaks exist.

Water will be furnished by Director’s Representative.

Retain subparagraph below for all ground-mounted, potable-water storage tanks.

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

* + - * 1. Unit will be considered defective if it does not pass tests and inspections.
				2. Prepare test and inspection reports.
			1. CLEANING

Revise this article as required by authorities having jurisdiction.

* + - * 1. Clean interior and exterior of ground-mounted, potable-water storage tanks.
				2. Disinfect surface water-storage tanks according to [**AWWA C652**] [**requirements of authorities having jurisdiction**].
			1. DEMONSTRATION
				1. [**Engage a Company Field Advisor per OGS Spec Section 014216 to train**] [**Train**] Facility’s maintenance personnel to adjust, operate, and maintain the following:

Obstruction lighting.

Water-level controls.

Tank heaters.

END OF SECTION 221219