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SECTION TABLE OF CONTENTS

DIVISION 13 - SPECIAL CONSTRUCTION

SECTION 13210S

ELEVATED STEEL WATER TANK

12/05

PART 1 GENERAL

1.1 REFERENCES
1.2 SUBMITTALS
1.3 GENERAL REQUIREMENTS

PART 2 PRODUCTS

2.1 DESIGN AND FABRICATION
2.2 ACCESSORIES
2.3 PIPES, VALVES, AND FITTINGS
2.3.1 Iron Pipe
2.3.2 Special Fittings
2.3.3 Gate Valves
2.3.4 Check Valves
2.3.5 Altitude Valve
2.3.6 Pressure Gage
2.3.7 Calking
2.3.8 Bracing and Plugging Ends
2.4 INDICATOR GAGES
2.5 SHOP PAINTING

PART 3 EXECUTION

3.1 LOCATION AND ELEVATION
3.2 ERECTION STANDARDS
3.3 INSPECTION AND TESTING STANDARDS
3.4 FOUNDATIONS AND VALVE CHAMBER
3.5 OBSTRUCTION LIGHTING
3.6 BEACON PLATFORM
3.7 FIELD PAINTING
3.7.1 General
3.7.2 Interior
3.7.3 Exterior

3.8 FIELD TESTING

-- End of Section Table of Contents --

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SECTION 13210S

ELEVATED STEEL WATER TANK
12/05

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NOTE: Delete, revise, or add to the text in this section to cover project requirements. Notes are for designer information and will not appear in the final project specification.

This section covers the design, fabrication, and erection of an elevated steel water tank, including foundations for tank column and riser, valve chamber, valves, fittings, and piping.

Recommended changes to a UFGS should be submitted as a Criteria Change Request (CCR).

Use of electronic communication is encouraged.
****

PART 1 GENERAL

1.1 REFERENCES

****
NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a RID outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

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The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B40.1	(1991; R 1997) Gauges - Pressure Indicating Dial Type - Elastic Element

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C104/A21.4	(2003) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
AWWA C110	(2003) Ductile-Iron and Gray-Iron Fittings for Water
AWWA C151	(2002) Ductile-Iron Pipe, Centrifugally Cast, for Water
AWWA C500	(2002; A C500a-95) Metal-Seated Gate Valves for Water Supply Service
AWWA D100	(1996) Welded Steel Tanks for Water Storage

ASME INTERNATIONAL (ASME)

ASME B16.1	(1998) Cast Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-70	(1998) Cast Iron Gate Valves, Flanged and Threaded Ends
MSS SP-80	(2003) Bronze Gate, Globe, Angle and Check Valves
MSS SP-86	(2002) Guidelines for Metric Data in Standards for Valves, Flanges, Fittings and Actuators

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC SP 10	(2000) Joint Surface Preparation, Standard Near-White Metal Blast Cleaning (NACE No. 2)

U.S. DEPARTMENT OF DEFENSE (DOD)

MS DOD-P-15328	(1999d) Primer (Wash), Pretreatment (Formula No. 117 For Metals) (Metric)
MS MIL-E-15145	(Rev C; Am 1) Enamel, Zinc Dust Pigmented, Fresh Water Tank Protective, Formula No. 102

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS QQ-C-40	(Basic; Am 2) Calking: Lead Wool and Lead Pig
FS WW-P-421	(Rev D) Pipe, Cast, Gray and Ductile Iron, Pressure (For Water and Other Liquids)
FS WW-P-521	(Rev G) Pipe Fittings, Flange Fittings, and Flanges: Steel and Malleable Iron (Threaded and Butt-Welding) Class 150

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

21 CFR 175	(1977) Indirect Food Additives: Adhesives and Components of Coatings

1.2 SUBMITTALS

****

NOTE: Review Submittal Description (SD) definitions in Section 01330 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

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Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01330

SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Connection Diagrams shall be submitted by the Contracting Officer prior to start.

Coordination Diagrams shall be submitted for the following in accordance with paragraph entitled, "Design and Fabrication," of this section.

Foundations
Valve Chamber
Welding
Field Painting
Inspection
Testing

Detail Drawings shall be submitted in accordance with paragraph entitled, "Design and Fabrication," of this section.

Installation Drawings shall be submitted for elevated water tank systems showing complete construction and installation details.

SD-03 Product Data

Equipment Foundation Data shall be submitted in accordance with paragraph entitled, "Design and Fabrication," of this section.

SD-04 Samples

Contractor shall submit samples of Calking prior to start of work.

SD-06 Test Reports

Test reports shall be submitted for Hydrostatic Pressure Test.

SD-07 Certificates

Listing of Product Installations shall be submitted in accordance with paragraph entitled, "General Requirements," of this section.

Certificates shall be submitted for the following items showing conformance with the referenced standards contained in this section.

Accessories
Pipes
Valves
Fittings
Indicator Gages
Painting Materials

1.3 GENERAL REQUIREMENTS

****

NOTE: If Section 15003S GENERAL MECHANICAL PROVISIONS is not included in the project specification, applicable requirements therefrom

should be inserted and the following paragraph deleted.

****

Section 15003S GENERAL MECHANICAL PROVISIONS applies to work specified in this section.

Listing of Product Installations for elevated water tanks shall include identification of at least five units, similar to those proposed for use, that have been in successful service for a minimum of five years. List shall include purchaser, address of installation, service organization, and date of installation.

PART 2 PRODUCTS

2.1 DESIGN AND FABRICATION

****

NOTE: Refer to drawings for tank capacity, diameter, and riser size. Verify drawings with the listing below showing minimum requirements and edit this paragraph accordingly.

Warm and Temperate Zones:

Tank Capacity (Liter)	Minimum Diameter (ID) (Meter)	Size Of Riser (ID) (Meter)
380,000	8.5	1
570,000	10.0	1.2
760,000	11.0	1.2
950,000	11.5	1.2
1,140,000	12.0	1.5
1,500,000	14.0	1.5
1,900,000	15.5	1.8

Tank Capacity (Gallons)	Minimum Diameter (ID) (Feet)	Size Of Riser (ID) (Feet)
100,000	28	3
150,000	32	4
200,000	36	4
250,000	38	4
300,000	40	5

400,000	**45**	**5**
500,000	**50**	**6**

In cold climates where the water turnover in the tank is sufficient to make tank heating unnecessary, the following rule will be used to govern the size of the riser, provided the rule would make the riser larger than required by the above listing for warm and temperate zones:

Ambient Temperature	**Diameter**
Plus 10 to minus 20 degrees F	**4-foot riser**
Minus 20 to minus 30 degrees F	**5-foot riser**
Minus 30 degrees F and below	**6-foot riser**
Plus 12 to minus 29 degrees C	**1.2-meter riser**
Plus 29 to minus 34 degrees C	**1.5-meter riser**
Plus 34 to minus and below degrees C	**1.8-meter riser**

In northern areas, water tanks that serve fire systems primarily and those where the daily consumption is small will be provided with heating facilities in accordance with NFPA 22. Size of the heating system may be reduced by an amount commensurate with the Btu Wattage input from makeup water during periods of minimum consumption.

****

Heating facility, when specified, shall be capable of maintaining the coldest water in the tank at a minimum temperature of 42 degrees F 6 degrees C. Frostproof casings shall not be provided in lieu of heat for large riser tanks.

Elevation of tank, high-water level, tops of column elevation, high- and low-water level, and existing grade elevation at tank site shall be as indicated.

Tank shall have an ellipsoidal bottom, with vertical side sheets and a cone-shaped top or shall be of an elliptical or oval design. In the elliptical or oval design, the lower section of the roof shall be used for water storage. Tower supporting the tank shall be constructed of structural shapes of the open type or of tubular sections to permit inspection and painting. Tower shall be thoroughly braced with horizontal struts and diagonal ties. Tower columns shall be vertical or inclined. Main column splices shall be kept to a minimum and shall be located as near as practical to the intersection of the centerlines of the struts. Splice plates shall be properly riveted or welded to hold the members in line and to transmit any tension or shearing stresses to which the members may be subjected. Connections of the tank with the columns shall be made so as to distribute the load properly over the column sections and over the shell of the tank. Around the bottom of the tank, a balcony at least 2 feet 600 millimeter wide with a structural-steel hand railing at least 3 feet 900

millimeter high shall be provided. Balcony floor plates shall be at least 1/4-inch 6 millimeter thick and shall be suitably punched or drilled for drainage [Alternative designs showing different types of construction may be submitted for consideration.]

Design and fabrication of the elevated tank shall be in accordance with the applicable requirements of AWWA D100. Applicable requirements set forth in the following sections shall govern unless otherwise specified. Design shall provide for earthquake resistance for applicable seismic zone.

Equipment Foundation Data for steel water tanks shall include plan dimensions of foundations and relative elevations, equipment weight and operating loads, horizontal and vertical loads, horizontal and vertical clearances for installation, and size and location of anchor bolts.

Connection Diagrams shall be submitted for piping systems showing general physical layout details including piping, valves, and fittings.

Coordination Diagrams shall be composite drawings showing coordination of work between the following trades and with structural and architectural elements of the work. Drawings shall be in sufficient detail to show overall dimensions of related items, clearances, and relative locations of work in allotted spaces. Drawings shall indicate where conflicts or clearance problems exist between the various trades.

Detail Drawings shall be submitted for elevated water tanks consisting of fabrication and assembly drawings for all parts of the work in sufficient detail to enable the Government to check conformity with the requirements of the contract documents.

Installation Drawings shall be submitted for elevated water tank Systems showing complete construction and installation details.

2.2 ACCESSORIES

****

NOTE: For tanks less than 50 feet 15 meter in diameter, a complete roof and outside shell ladder, swiveled around the tank finial and designed to rotate around both roof and tank, may be substituted for the outside tank ladder and the roof ladder.

****

Accessories shall be provided as follows:

A tower ladder shall be connected to a horizontal balcony girder. On all fixed ladders more than 20 feet 6 meter high, a safety cage or guard or a ladder safety device subject to approval shall be provided and shall be securely fastened to the ladder or to the surface to which the ladder is attached.

Outside tank ladder connecting with balcony

Roof hatch

Roof finial

Roof ladder swiveled about the tank finial, designed to rotate around the roof and to be locked in position convenient to top of tank ladder

Roof vent

Steel riser pipe of specified diameter

Pipe connection to tank riser bottom, size as indicated

Heating system, hot water or steam, gravity or forced circulation, when specified

Stub overflow to ground, size as indicated

2.3 PIPES, VALVES, AND FITTINGS

2.3.1 Iron Pipe

Either of the following types shall be used:

Bell-and-spigot pipe: FS WW-P-421, MSS SP-86 or AWWA C151 for 150 (psi) 1050 kilopascal working pressure, mechanical joint, or push- on type as shown on drawings. Coatings shall be in accordance with AWWA C104/A21.4.

Flanged pipe: FS WW-P-421 or AWWA C151 for 150-psi 1050 kilopascal working pressure with ANSI 150-pound flanges

2.3.2 Special Fittings

Iron: AWWA C110, Class D

Fittings for screw-joint pipe: FS WW-P-521, and MSS SP-86, Type II (zinc-coated, galvanized)

Flanged fittings: ASME B16.1 and MSS SP-86

Ring gaskets shall be furnished for all flanged joints.

All joints inside the valve chamber shall be flanged.

2.3.3 Gate Valves

Gate valves shall be opened by counterclockwise rotation of the handle. Valves 2 inches 50 millimeter and larger shall be iron-body, bronze-mounted, outside screw and yoke (OS&Y), conforming to MSS SP-70 or to AWWA C500.

Valves smaller than 2 inches 50 millimeter shall be all bronze and shall conform to MSS SP-80, 125-pound 875 kilopascal steam rating.

Valves located in valve chambers shall be equipped with hand-operated wheels and shall be flanged.

2.3.4 Check Valves

Check valves shall be of the horizontal swing-check type, suitable for the purpose and the operating conditions. Body shall be iron and shall have a removable cover for inspection and removal of the gate assembly. Gate, gate seat, shaft, gate studs, and nuts shall be bronze or other suitable alloy.

2.3.5 Altitude Valve

****
NOTE: See drawings for arrangement and size of altitude valve and check valve.
****

Supply to the tank shall be controlled by an altitude valve, automatic in operation and accurately set to prevent overflow of the tank. Valve shall have flanged ends and a heavy cast-iron body, shall be bronze-fitted with renewable cups and seats, and shall be designed without metal-to-metal seats. Valve shall be cushioned when opening and closing to prevent waterhammer or shock.

2.3.6 Pressure Gage

Pressure gages of the direct reading type equipped with a shutoff cock shall be provided in the valve chamber on the tank side and on the discharge side of the check or altitude valve. Gages shall have 6-inch 150 millimeter dials, shall be stem-mounted, and shall conform to ANSI B40.1, Type I, (gage for air, steam, oil, and water), Class 1 (pressure gage). Gages shall be calibrated in pounds per square inch kilopascal in not more than 2-pound 10 kilopascal increments from 0 to 50 pounds 350 kilopascal. Normal operating pressure of the tank shall be midrange of the gage.

2.3.7 Calking

****
NOTE: Calking may be changed to allow the use of sulfur compound instead of lead as a joint filler.
****

Where pipes pass through sleeves, the space between the sleeve and the pipe shall be calked with lead conforming to FS QQ-C-40, and with jute. The lead shall extend into the sleeve not less than 2-1/4 inches 55 millimeter. One strand of clean, dry, braided jute shall be applied, followed by the required amount of clean, dry, twisted jute, all tightly calked in place. Should the jute allow the lead, during calking, to drive more than 1/4 inch 6 millimeter back from the end of the sleeve at any point, the lead shall be removed and the joint remade. Calking shall produce watertight joints.

2.3.8 Bracing and Plugging Ends

All exposed free pipe ends and bends shall be securely strapped and braced. Where pipe ends are left for future connections, they shall be capped or plugged as directed.

2.4 INDICATOR GAGES

An indicator gage and float shall be furnished. Float shall be not more than 14 inches 350 millimeter in diameter and shall be made of 3/16-inch 5 millimeter steel plate with welded joints. After testing, the float shall be given two coats of approved asphaltum varnish. Cable connecting the float and target shall be copper chain or 1/4-inch 6 millimeter flexible bronze tiller wire.

Sheaves over which the cable runs shall be steel, at least 6 inches 150 millimeter in diameter, enclosed in galvanized steel housings, and turning on brass pins. All clevises, clamps, and other fastenings on the cable

shall be bronze or brass, fitted with bolts or screws of like material. Gage board shall be constructed of a structural steel channel not less than 6 inches 150 millimeter wide and shall be securely attached to the tank or riser pipe. Board shall be accurately marked in feet and tenths of feet millimeter to indicate the water level. Target shall be of 3/16-inch 5 millimeter steel plate of suitable size, and shall be attached to a frame or yoke with countersunk machine screws. Target yoke shall slide freely in the gage board. Target face shall be finished with red enamel. In lieu of the above, a standard equipment package of a reputable manufacturer, which generally meets the above requirements, will be acceptable, subject to approval.

****
NOTE: Coordinate with painting section.
****

2.5 SHOP PAINTING

All steel surfaces, except interior and seam surfaces of tank plates, shall be shop coated with inorganic zinc Painting Materials in accordance with Section 09970S COATINGS FOR STEEL.

PART 3 EXECUTION

3.1 LOCATION AND ELEVATION

****
NOTE: Reword if drawings tie location to benchmark.
****

Contracting Officer will determine the position of the structure by establishing and marking a definite line indicating center and axis of the elevated tank and the location of adjacent existing or proposed water mains.

3.2 ERECTION STANDARDS

Welding shall conform to AWWA D100, Section 8.

Erection shall conform to AWWA D100, Section 10.

3.3 INSPECTION AND TESTING STANDARDS

Inspection shall conform to AWWA D100, Section 11.

Testing shall conform to AWWA D100, Section 11.

3.4 FOUNDATIONS AND VALVE CHAMBER

****
NOTE: Bearing value of earth should be reduced when necessary to suit local conditions or pile footings may be provided. Drawings should detail valve chamber and drain outlet.
****

Foundations for the tank columns, riser, and for the Valve Chamber shall be constructed of concrete, reinforced where necessary. Foundations shall be designed for earth with a bearing value of 4,000 pounds per square foot 200 kilopascal.

Soil investigations and a report shall be provided by the Contractor.

Valve chamber shall be sufficiently large to house all control valves and fittings. Where pipe lines pass through walls of valve chamber, heavy thimbles shall be provided to allow calking around the pipe. Pipes, valves, and fittings shall be supported on concrete blocks where necessary. Valve chamber shall be constructed as indicated. Valves and fittings shall extend from the riser pipe connection to a point one length of pipe outside the valve chamber walls on the main or feed line to the elevated tank; the drain line shall be carried to an outlet as indicated.

3.5 OBSTRUCTION LIGHTING

****
NOTE: Obstruction lighting shall be included only when required and shall be detailed on the drawings. Where it is known that the obstruction lights will be controlled from the control tower, the time switch shall be deleted from the specification.
****

An obstruction lighting system shall be provided on the water tank as indicated. Wiring shall conform to the requirements of Section 16145S STANDARD WIRING SYSTEMS. Obstruction lighting system shall be controlled by a time switch enclosed in a cast-metal, weatherproof housing mounted approximately 6 feet 1800 millimeter above the ground on one of the tower legs.

3.6 BEACON PLATFORM

****
NOTE: Beacon platform should be included only when required by applicable regulation. Where it is known that the beacon will be served by an aerial system, the section of conduit below 18 feet 5500 millimeter above the ground shall be deleted from the specification.
****

Beacon platform conforming to the details shown on drawings shall be provided on the top of the water tank. A 1-inch 25 millimeter rigid conduit for electric service shall be provided from the base of the platform to the ground and shall terminate in a conduit approximately 18 inches 450 millimeter below finished grade. Both ends of conduit shall be capped.

A Style-C conduit fitting with blank cover shall be installed in the conduit approximately 18 feet 5500 millimeter above the ground. Wiring, conduit, and conduit fittings shall conform to the requirements of Section 16145S STANDARD WIRING SYSTEMS.

****
NOTE: Coordinate with painting section.
****

3.7 FIELD PAINTING

3.7.1 General

Field painting shall conform to the requirements specified for shop painting and the following additional requirements.

After the tank has been erected and tested for leakage, the entire structure shall be prepared and treated as the following subparts indicate.

3.7.2 Interior

Interior tank surfaces shall be cleaned to base metal by dry blast cleaning in accordance with SSPC SP 10. As soon after cleaning as practicable, and prior to formation of any form of corrosion, the surfaces shall be cleaned of dust and coated by brush or spray with pretreatment coating conforming to MS DOD-P-15328, at a coverage rate of 250 to 300 square feet per gallon 6 to 8 square meter per liter to give a dry-film thickness of 0.3 to 0.5 mil .008 to .013 millimeter.

Painting of the interior surfaces shall consist of three coats of zinc-dust paint conforming to MS MIL-E-15145. First coat shall be applied not less than 1 hour nor more than 24 hours after application of the pretreatment coating. At least 1-day's drying time shall be allowed between coats, and the final coat shall be allowed to dry at least 7 calendar days before filling the tank.

Interior tank surfaces shall be abrasive blasted to white metal in accordance with SSPC SP 10. Interior tank surfaces shall be coated with a high-solids amine-cured epoxy coating conforming to 21 CFR 175, Section 300. Coating shall be applied in accordance with the coating manufacturer's recommendations.

3.7.3 Exterior

Field welds, surfaces not shop primed, and abrasions in the shop coat shall be abrasive blasted and touched up with inorganic zinc in accordance with Section 09970S COATINGS FOR STEEL. Entire tank surface shall then be rendered clean, dry, and free from all surface contamination and topcoated in accordance with Section 09970S COATINGS FOR STEEL.

3.8 FIELD TESTING

After the tank has been erected and the valves and piping have been installed, and before field painting is begun, the valves and piping shall be subjected for 2 hours to a Hydrostatic Pressure Test of 50 pounds per square inch 350 kilopascal in excess of the anticipated static pressure at the points of reading when the system is put into operation. Any defective material disclosed by the pressure test shall be replaced by the Contractor with sound material at no additional cost to the Government. Test shall be repeated until the test results are satisfactory to the Contracting Officer.

-- End of Section --