****
USACE / NAVFAC / AFCESA / NASA **UFGS-33 16 15 (April 2008)**

Preparing Activity: USACE **Superseding UFGS-13 16 15 (October 2007)**

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2013
****

SECTION TABLE OF CONTENTS

DIVISION 33 - UTILITIES

SECTION 33 16 15

WATER STORAGE STEEL TANKS

04/08

-- End of Section Table of Contents --

****
USACE / NAVFAC / AFCESA / NASA	UFGS-33 16 15 (April 2008)
Preparing Activity: USACE	Superseding
UFGS-13 16 15 (October 2007)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2013
****

SECTION 33 16 15

WATER STORAGE STEEL TANKS
04/08

****
NOTE: This guide specification covers the requirements for steel standpipes, ground storage tanks (reservoirs), and elevated water tanks 380 to 1890 kL (100,000 to 500,000 gallon) capacity.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable items(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).
****

PART 1 GENERAL

****
NOTE: This Section covers welded and bolted steel water storage tanks and includes the design, fabrication, and erection of a complete system to augment an existing or future water distribution system and the inspection and repair of existing water storage tanks. This specification must be edited to specify the required type of tank.

The following information will be shown on the project drawings:

1. Detail plans to show tank location, elevation, valve vault if required, and connection to system.

2. Accessories as depth indicator, telemetering automatic controls, protection against freezing, or other special project requirements.

3. Requirements of Federal Aviation Agency to determine if tank constitutes a hazard to aerial navigation. If so, show pattern for orange and white painting. Detail obstruction lights or beacon and intermediate lights as required. Refer to Federal Aviation Agency Aviation Circular AC 70/7460-1G, "Obstruction Marking and Lighting".

4. Requirements for cathodic protection system, including details of anodes, anode layout, wiring connections, and rectifier (as applicable).

****

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.

****

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 SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7	(2010; Change 2010; Change 2011; Errata 2011; Change 2011) Minimum Design Loads for Buildings and Other Structures

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA B300	(2010; Addenda 2011) Hypochlorites
AWWA B301	(2010) Liquid Chlorine
AWWA C104/A21.4	(2008; Errata 2010) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water

AWWA C105/A21.5	(2010) Polyethylene Encasement for Ductile-Iron Pipe Systems
AWWA C110/A21.10	(2012) Ductile-Iron and Gray-Iron Fittings for Water
AWWA C111/A21.11	(2012) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C115/A21.15	(2011) Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges
AWWA C150/A21.50	(2008) Thickness Design of Ductile-Iron Pipe
AWWA C151/A21.51	(2009) Ductile-Iron Pipe, Centrifugally Cast, for Water
AWWA C500	(2009) Metal-Seated Gate Valves for Water Supply Service
AWWA C504	(2010) Standard for Rubber-Seated Butterfly Valves
AWWA C508	(2009; Addenda A 2011) Swing-Check Valves for Waterworks Service, 2 In. (50 mm) Through 24 In. (600 mm) NPS
AWWA C600	(2010) Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA C652	(2011) Disinfection of Water-Storage Facilities
AWWA D100	(2011) Welded Steel Tanks for Water Storage
AWWA D103	(2009; Errata 2010) Factory-Coated Bolted Steel Tanks for Water Storage

ASME INTERNATIONAL (ASME)

ASME B16.3	(2011) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B40.100	(2005; R 2010) Pressure Gauges and Gauge Attachments

ASTM INTERNATIONAL (ASTM)

ASTM A197/A197M	(2000; R 2011) Standard Specification for Cupola Malleable Iron
ASTM A48/A48M	(2003; R 2008) Standard Specification for Gray Iron Castings
ASTM A53/A53M	(2012) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

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

MSS SP-80	(2008) Bronze Gate, Globe, Angle and Check Valves

NSF INTERNATIONAL (NSF)

NSF/ANSI 61	(2012) Drinking Water System Components - Health Effects

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC PS 4.04	(1982; E 2004) Four-Coat White or Colored Vinyl Painting System (For Fresh Water, Chemical, and Corrosive Atmospheres)
SSPC PS Guide 17.00	(1982; E 2004) Guide for Selecting Urethane Painting Systems
SSPC Paint 104	(1982; E 2004) White or Tinted Alkyd Paint
SSPC Paint 21	(1982; E 2004) White or Colored Silicone Alkyd Paint (Type I, High Gloss and Type II, Medium Gloss)
SSPC Paint 25	(1997; E 2004) Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel, Type I and Type II

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-DTL-24441	(2009; Rev D) Paint, Epoxy-Polyamide, General Specification for
MIL-PRF-23236	(2009; Rev D) Coating Systems for Ship Structures
UFC 3-310-04	(2012) Seismic Design for Buildings

U.S. FEDERAL AVIATION ADMINISTRATION (FAA)

FAA AC 150/5345-43	(2006; Rev F) Specification for Obstruction Lighting Equipment

1.2 SYSTEM DESCRIPTION

Submit certification by an independent third-party organization that all interior coating and materials that come in contact with the potable water comply with NSF/ANSI 61. Submit a certificate signed by a registered professional engineer, providing the following information:

a. Description of the structural design loading conditions used for the design of entire tank including the foundation.

b. Description of the structural design method and codes used in establishing the allowable stresses and safety factors applied in the design.

c. A statement verifying that the structural design has been checked by experienced engineers specializing in hydraulic structures.

d. A statement verifying that the detail drawings have been checked by experienced engineers specializing in hydraulic structures to determine that they agree with the design calculations in member sizes, dimensions, and fabricating process as prescribed by applicable ACI and AWWA standards.

1.2.1 Design and Construction Standards

****

NOTE: When required by the corrosive nature of stored water, lack of proper maintenance facilities, or by climatic conditions, this paragraph will be modified to provide for a corrosion allowance.

Determine basic wind speed for use with ANSI procedure from ANSI,UFC 3 310-01 LOAD ASSUMPTIONS FOR BUILDINGS or UFC 3-320-05A STRUCTURAL DESIGN CRITERIA FOR STRUCTURES OTHER THAN BUILDINGS. The choice between the ANSI and AWWA procedures allows the supplier to provide a tank using the AWWA approach up to the point at which the ANSI procedure will provide the greater pressure. (This usually occurs with a basic wind speed around 145 km per hour (90 miles per hour), depending on the height of the tank.)

Use 1200 Pa (25 psf) snow load for most heavy snow climates; delete snow load where maximum snow is insignificant. In some cases, local climate and topography will dictate that a value greater than 1200 Pa (25 psf) be used for snow loading. This may be determined from UFC 3 310-01.

Provide seismic requirements for tank related equipment supports, if a Government designer is the Engineer of Record, and show on the drawings. Delete the inappropriate bracketed phrase. Pertinent portions of UFC 3-310-04 and Sections 13 48 00 and 13 48 00.00 10, properly edited, must be enclosed in the contract documents. UFC 1-200-01, "Seismic Design for Buildings," does not allow the use of pedestal type elevated tanks in areas of moderate and high seismic activity, so use only elevated tanks with cross-braced columns instead. Bolted tanks are available only as standpipes and ground reservoirs.

****

The design, fabrication, and erection of the [elevated tank] [standpipe] [reservoir] shall be in accordance with the applicable requirements of AWWA D100 or AWWA D103 except as modified herein. Earthquake design shall be [in accordance with UFC 3-310-04 and Sections 13 48 00 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT and 13 48 00.00 10 SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT] [as indicated]. Submit Design Analyses and Calculations. No additional thickness for corrosion allowance

will be required. Design metal temperature shall be [_____] degrees C degrees F. The elevated tank shall be designed for a basic wind speed of [_____] km/hourmph in accordance with ASCE 7 or designed in accordance with AWWA D100 wind load design, whichever provides the greater pressure. [The elevated tank shall be designed for a snow load of 1200 Pa 25 psf [_____]]. The [standpipe] [reservoir] shall be designed for a peak wind speed of [_____] and snow load of [_____].

1.2.2 Welding

Qualification of welding procedures, welders, and welding operators shall be in accordance with Section 8.2 of AWWA D100.

1.2.3 Design Requirements

****

NOTE: The blank spaces will be filled in for capacity and governing elevations; minimum diameters of tank and riser pipe. The following table should be used in selecting minimum requirements:

(Tank capacity, kL	Diameter, minimum	Size of riser (warm and temperate zones)
380	8.50 m	910 mm
570	9.75 m	1220 mm
760	10.95 m	1220 mm
950	11.6 m	1220 mm
1135	12.2 m	1520 mm
1515	13.7 m	1520 mm
1890	15.25 m	1830 mm

(

(Tank capacity, gallons	Diameter, minimum	Size of riser (warm and temperate zones)
100,000	28 ft. 0 in.	3 ft. 0 in.
150,000	32 ft. 0 in.	4 ft. 0 in.
200,000	36 ft. 0 in.	4 ft. 0 in.
250,000	38 ft. 0 in.	4 ft. 0 in.
300,000	40 ft. 0 in.	5 ft. 0 in.
400,000	45 ft. 0 in.	5 ft. 0 in.
500,000	50 ft. 0 in.	6 ft. 0 in.

)

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 preceding table for warm and temperate zones. Where the location shows the following temperatures on the isothermal maps contained in NFPA 22, Water Tanks for Private Fire Protection, the riser size indicated will be used.

Minus 12.2 degrees to minus 28.9 degrees C. 1220 mm (Plus 10 degrees to minus 20 degrees F. 4 ft. 0 in.

riser)

Minus 29 degrees to minus 34 degrees C... 1520 mm (Minus 20 degrees to minus 30 degrees F. 5 ft. 0 in. riser)

Minus 34.4 degrees C..... 1830 mm (Minus 30 degrees F. and below..... 6 ft. 0 in. 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. The size of the heating system may be reduced by an amount commensurate with the W (Btuh) input from makeup water during periods of minimum consumption; however, the heating facility will be capable of maintaining the coldest water in the tank at a minimum temperature of 6 degrees C (42 degrees F). Frostproof casings will not be provided in lieu of heat for large riser tanks.

The capacity of the tank will be based on calculations according to UFC 3-230-09A WATER SUPPLY, WATER STORAGE and UFC 3-230-04A WATER DISTRIBUTION. Generally a balcony around the bottom of the tank will not be provided. The elevation at the top of the foundation will be not less than 200 mm (8 inches) above the finished grade.

****

The elevated tank shall have a storage capacity of [_____] L gallons. The high-water level of tank shall be at elevation [_____] with the top of column foundations at elevation [_____]. The range between high and low water levels shall be approximately [_____] m feet. The existing grade at the tank site is approximately elevation [_____]. The top of straight side sheets, where a cone-shaped roof is furnished, shall not be less than 150 mm 6 inches above the top of the overflow weir. The tank diameter shall be not less than [_____] mm feet and the riser diameter not less than [_____] mm feet. The tank shall [be of the style shown] [have an ellipsoidal bottom, with vertical side sheets and a cone shaped top, or shall be of an elliptical or oval design as approved. In the latter design, the lower section of the roof may be used for water storage]. The tower supporting the tank shall be constructed of structural shapes of the open type, or of tubular sections, to permit inspection and painting. The tower shall be thoroughly braced with horizontal struts and diagonal ties. The tower columns may be vertical or inclined as the design may require. Main column splices shall be as few as possible and shall be located as near as practicable to the intersection of the centerline of the struts. Splice plates shall be welded so as to hold the members in line and transmit any tension or shearing stresses to which the members may be subjected. The connections of the tank, with the columns shall be made to distribute the load properly over the column sections and over the shell of the tank. Around the bottom of the tank a balcony meeting the requirements of Section 4.7.2 of AWWA D100 and conforming to all federal or local laws or regulations shall be provided. Balcony floor plates shall be at least 6 mm 1/4 inch thick and shall be suitably punched or drilled for drainage.

1.2.4 Sizing and Design

Sizing and design of elevated tank shall be in accordance with Section 4 of AWWA D100. Submit a certificate signed by a registered professional engineer providing: (1) description of the entire tank and foundation structural design loading conditions, (2) description of structural design methods and codes used in establishing allowable stresses and safety factors, (3) statement that the structural design has been checked by experienced engineers specializing in hydraulic structures to ensure that design calculations for member sizes, dimensions, and fabrication processes are as prescribed by ACI and AWWA standards, and (4) certification that the completed work was inspected in accordance with AWWA D100 or AWWA D103 as applicable.

1.2.5 [Standpipe] [Reservoir]

The [standpipe] [reservoir] shall have a storage capacity of [_____] L gallons. The high-water level of [standpipe] [reservoir] shall be at elevation [_____] with the top of foundation approximately at elevation [_____]. The range between high and low water levels will be approximately [_____] mm feet. Existing grade at proposed location is approximately elevation [_____]. The [standpipe] [reservoir] shall have such standard shell height and such diameter as will meet the requirements for the selected standard capacity and for the high-water level specified above. The [standpipe] [reservoir] may have [supported cone roof,] [supported toriconical roof,] [self-supporting umbrella roof,] [self-supporting dome roof, or] [ellipsoidal roof,] [aluminum self-supporting dome roof,] as approved. The [standpipe] [reservoir] shall be of welded or bolted construction.

1.2.6 Sizing of Standpipe and Reservoir

Section 6 of AWWA D100 or Section 4 of AWWA D103.

1.2.7 Coatings Certification

Coating materials for interior applications and all other materials which will be in normal contact with potable water shall conform to NSF/ANSI 61. Certification by an independent third-party organization that all interior coatings and materials, that come in contact with potable water, comply with NSF/ANSI 61 shall be provided.

1.3 SUBMITTALS

****

NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project.

The Guide Specification technical editors have designated those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item, 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.

****

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.][information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Tank Installation[; G][; G, [_____]]

SD-03 Product Data

System Description
Foundations

SD-06 Test Reports

Tank Installation
Testing of Valves and Piping

SD-07 Certificates

System Description
Foundations

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver paint in unopened containers with unbroken seals and labels showing designated name, specification number, color, directions for use, manufacturer, and date of manufacture, legible and intact at time of use. Handle and store water storage tank systems, components, and parts to prevent distortions and other damage that could affect their structural, mechanical, or electrical integrity. Replace damaged items that cannot be restored to original condition. Store items subject to deterioration by exposure to elements, in a well-drained location, protected from weather, and accessible for inspection and handling.

PART 2 PRODUCTS

2.1 MATERIALS

Provide materials conforming to the following requirements:

2.1.1 Steel

Section 2 of AWWA D100 or Section 2 of AWWA D103.

2.1.2 Shop Fabrication

Section 9 of AWWA D100 or Section 7 of AWWA D103.

2.1.3 Ductile-Iron Pipe

Pipe for fluid conductors, except for overflow pipe, shall be ductile-iron pipe and shall be either of the following:

2.1.3.1 Bell-and-Plain End Pipe

****
NOTE: See AWWA C150/A21.50 or C151 for thickness design of ductile iron pipe. Piping materials, other than ductile iron, conforming to Section 33 11 00 WATER DISTRIBUTION may be used when warranted.
****

AWWA C150/A21.50 and AWWA C151/A21.51, for not less than 1035 kPa 150 psi working pressure, unless otherwise shown or specified. Joints shall be push-on or mechanical-joint conforming to AWWA C111/A21.11. Pipe shall be cement mortar lined in accordance with AWWA C104/A21.4. Linings shall be standard thickness.

2.1.3.2 Flanged Pipe

Flanged pipes shall conform to the applicable portions of AWWA C110/A21.10, AWWA C115/A21.15 and AWWA C151/A21.51, for not less than 1035 kPa 150 psi working pressure, unless otherwise shown or specified. Pipe shall have flanged ends in accordance with AWWA C115/A21.15. Pipe shall be cement mortar lined in accordance with AWWA C104/A21.4. Linings shall be standard thickness.

2.1.4 Specials and Fittings (except for overflow pipe)

2.1.4.1 Ductile-Iron with Bell-and-Plain End

AWWA C110/A21.10 and AWWA C151/A21.51 for not less than 1035 kPa 150 psi working pressure, unless otherwise shown or specified. Specials and fittings shall be cement mortar lined in accordance with AWWA C104/A21.4. Linings shall be standard thickness.

2.1.4.2 Ductile-Iron with Flanged Ends

AWWA C110/A21.10 and AWWA C151/A21.51 for not less than 1035 kPa 150 psi working pressure unless otherwise shown or specified. Fittings shall have flanged ends in accordance with AWWA C110/A21.10. Specials and fittings shall be cement mortar lined in accordance with AWWA C104/A21.4. Linings

shall be standard thickness.

2.1.4.3 Fittings for Screw-Joint Pipe

Malleable-iron, galvanized, 1035 kPa 150 psi, ASTM A197/A197M, threaded ends, ASME B16.3.

2.1.4.4 Joints Inside Valve Chamber

All joints inside the valve chamber shall be flanged.

2.1.5 Valves

2.1.5.1 Gate Valves

Gate valves shall be opened by turning counterclockwise. Valves 80 mm 3 inches and larger shall be iron body, brass mounted, conforming to AWWA C500. Valves smaller than 80 mm 3 inches shall be all bronze and shall conform to MSS SP-80, Type 1, class 150. Valves 80 mm 3 inches or larger located in valve chambers shall be equipped with hand-operating wheels and shall be flanged.

2.1.5.2 Butterfly Valves

Butterfly valves shall be opened by turning counterclockwise. Valves shall conform to AWWA C504. Body and disc shall be cast iron, conforming to ASTM A48/A48M. Shaft shall be 18-8 stainless steel. Resilient seat shall be bonded to the valve body. Butterfly valves shall be stainless steel to rubber seated, tight closing type.

2.1.5.3 Check Valves

****
NOTE: Check valves as specified in AWWA C508 do not include cushioning devices such as springs or weighted arms.
****

Check valves shall be of the horizontal swing-check type, suitable for the purpose and the operating conditions. The body shall be iron and shall have a removable gate assembly and a cover removable for inspection. The gate, gate seat, shaft, gate studs, and nuts shall be bronze or other suitable alloy. Valves shall conform to AWWA C508.

2.1.5.4 Altitude Valve

****
NOTE: Altitude valves should be used only where required in a system with differential pressures and should be installed in a valve vault with appropriate shut-off valves and check valve. The size of the altitude valve will be inserted. In general, for a pipe connection larger than 200 mm (8 inches) in diameter, the altitude valve may be one or two sizes smaller.
****

The supply to the [elevated tank] [standpipe] [reservoir] shall be controlled by a [_____] mm inch altitude valve, automatic in operation and

accurately set to prevent overflow of the [elevated tank] [standpipe] [reservoir]. The 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. The valve shall be cushioned when opening and closing to prevent water hammer or shock. Valves shall be provided with a travel indicator.

2.1.6 Pressure Gauge

Pressure gauge 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. Gauges shall have 150 mm 6 inch dials, shall be stem mounted, and shall conform to ASME B40.100. Accuracy of gauges shall be Grade A or better. Gauges shall be calibrated in kPa and psi psi in not more than10 kPa and psi 2 psi increments from 0 to 350 kPa and 0 to 50 psi 0 to 50 psi in excess of the normal operating pressure at the tank.

2.2 ASSEMBLIES

2.2.1 Tank Accessories

Section 7 of AWWA D100 or Section 5 of AWWA D103 and as specified. Additional requirements for accessories are as follows:

2.2.1.1 Manholes and Pipe Connections

Section 7 of AWWA D100 and Section 5 of AWWA D103 represent the minimum requirements. Number, type, location, and size of manholes and pipe connections shall be as shown on the drawings. Inlet pipe connections to extend [_____] mm inches above tank bottom and shall be provided with deflectors as shown on the drawings. Outlet pipe connections to extend [_____] mm inches above tank bottom and shall be provided with vortex breakers as shown on the drawings.

2.2.1.2 Overflow

The overflow for the tank shall consist of an overflow weir and [stub overflow] [outside drop pipe, adequately supported and] capable of discharging at a rate of [_____] L/second gpm with [_____] mm inches of head [, without the water level exceeding [_____]]. [The top of the weir shall be [_____] mm inches below [_____].] [The weir shall be located as indicated.] The [stub overflow shall be steel, ASTM A53/A53M or equal, and shall be fitted with a screen] [overflow pipe shall be steel, ASTM A53/A53M or equal, and shall terminate 300 to 600 mm 1 to 2 feet above grade and shall be fitted with a flapper valve or screen to prevent ingress of animals and insects].

2.2.1.3 Vent

Vent shall be welded to the cover plate of the center manhole on the roof. Vent will be tank manufacturer's standard type mushroom vent with aluminum bird screen. The free area of the vent shall be sized 50 percent in excess of the [_____] L/second gpm pump-in rate and [_____] L/second gpm pump-out rate. Screening for vent shall conform to Section 5.7.2 of AWWA D100 or Section 5.7.2 of AWWA D103which ensures fail-safe operation in the event that screen frosts over and the bottom of the screen shall be sufficiently elevated for snow consideration in the area.

2.2.1.4 Ladders and Safety Devices

Ladders and safety devices shall be provided in accordance with Sections 7.4 and 7.5 of AWWA D100 or Sections 5.4 and 5.5 of AWWA D103. Location of ladders shall be as shown on the drawings. Sections 7.4 and 7.5 of AWWA D100 and Sections 5.4 and 5.5 of AWWA D103 represent the minimum requirement. In addition, safety cage, rest platforms, roof ladder handrails, and other safety devices shall be provided as required by federal or local laws or regulations.

2.2.1.5 Scaffold Cable Support

Provision shall be made for the attachment of a scaffold cable support at the top of the roof on welded tanks.

2.2.1.6 Balconies

Provide a balcony a minimum of 600 mm 2 feet wide with a standard guard railing. Provide a structural steel railing with a top rail 1050 mm 42 inches above balcony platform with an intermediate rail halfway between. Guard rail shall be capable of withstanding a force of 888 N 200 pounds applied in any direction. Install a steel toe board with minimum height of 100 mm 4 inches. Bottom of toe board shall be a maximum 6 mm 1/4 inch from platform top. Extend guard rail and toe board entire length of balcony except where access openings are required. For balcony floors use diamond plates a minimum of 6 mm 1/4 inch thick, punched or drilled for drainage. [Equip access openings in guard rail with a gate which closes automatically.] Hatches through balcony floor shall be counterbalanced or otherwise arranged to open from below.

2.2.1.7 Coating for Welded Tanks

Provide exterior coating systems conforming to Section 09 97 13.27, "Exterior Coating of Steel Structures," and interior coating systems conforming to Section 09 97 13.16, "Interior Coating of Welded Steel Water Tanks."

2.2.1.8 Coating for Bolted Tanks

****
NOTE: Bolted tanks are factory coated, interior and exterior. No field painting is needed other than repair to damaged areas. Where cathodic protection will be installed, electrical continuity must be established across the bolted joints to ensure proper cathodic protection system operation.
****

As supplied by the manufacturer.

2.2.2 Valve Chamber

Valve chamber shall be sufficiently large to house all control valves and fittings. Pipes, valves, and fittings shall be supported on concrete blocks where necessary. The valve chamber shall be constructed to provide not less than [_____] mm feet of cover over the pipes. The valves and fittings shall extend from the [standpipe] [reservoir] [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] [standpipe] [reservoir]; the

drain line will be carried to an outlet as indicated on the drawings. The access manhole shall be not less than 760 mm 30 inches in diameter.

2.2.3 Anchors for [Standpipe] [Reservoirs]

The following requirements shall be met:

a. An adequate number of anchors designed to prevent overturning of the [standpipe] [reservoir] when empty shall be installed. If anchor bolts are used, the nominal diameter shall not be less than 25 mm one inch, plus a corrosion allowance of at least 6 mm 1/4 inch on the diameter. If anchor straps are used, they shall be pre-tensioned before welding to the tank shell.

b. The anchor bolts shall be a right angle bend, hook, or plate washer, while anchor straps shall have only a plate welded to the bottom. The anchors shall be inserted into the foundation to resist the computed uplift.

c. Attachment of anchors to the shell shall not add significant localized stresses to the shell. The method of attachment shall consider the effects of deflection and rotation of the tank shell. Anchors shall not be attached to the tank bottom. Attachment of the anchor bolts to the shell shall be through stiffened chair-type assemblies or anchor rings of adequate size and height.

2.3 CONCRETE WORK

Concrete work shall conform to Section [03 30 00.00 10 CAST-IN-PLACE CONCRETE][03 30 00 CAST-IN-PLACE CONCRETE].

2.4 CHLORINE

AWWA B300 for hypochlorites or AWWA B301 for liquid chlorine, mixed with water to give the solutions required in AWWA C652.

PART 3 EXECUTION

3.1 FOUNDATIONS

Foundations for the [standpipe] [reservoir] [tank columns and riser] and for the valve chamber shall be constructed of concrete, reinforced where necessary, and designed in accordance with Section 12 of AWWA D100 or Sections 11 and 8.5 of AWWA D103 for earth with a bearing value of [_____] MPa psf, at elevation [_____], and constructed in conformance with the applicable requirements of Section [03 30 00.00 10 CAST-IN-PLACE CONCRETE][03 30 00 CAST-IN-PLACE CONCRETE], except as shown or specified herein. An AWWA D100 Type 1 or an AWWA D103 Type 1 or Type 2 foundation shall be provided for the [standpipe] [reservoir]. Factor of safety on overturning of [elevated tanks] [standpipe] [reservoir] under design wind load shall be 1.33 minimum. When a footing is required, an inverted truncated pyramid of earth with 2 on 1 side slopes above top of footing may be used in determining overturning stability.

3.2 EXCAVATING, FILLING, AND GRADING

Excavating, filling, and grading shall conform to the applicable requirements of Section 31 00 00 EARTHWORK.

3.3 CATHODIC PROTECTION

****
NOTE: Evaluate need for cathodic protection on an individual project basis.
****

Cathodic protection shall be provided, conforming to Section 26 42 15.00 10 CATHODIC PROTECTION SYSTEM (STEEL WATER TANKS).

3.4 OBSTRUCTION LIGHTING

****
NOTE: Obstruction lighting will be included in the contract specifications only when required and will be detailed on the drawings, in accordance with UFC 3-260-05A or AFM 88-14 and AFR 88-16. The Contracting Officer will determine the type of control to be used, based on local requirements. Automatic control of the obstruction lights will be by either a time switch with an astronomic dial or a light sensitive device. Where it is known that the obstruction lights will be operated from the control tower, an automatic control will not be provided.
****

Obstruction lighting shall be provided and installed as shown, and shall conform to Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM or FAA AC 150/5345-43.

3.5 BEACON

****
NOTE: The beacon and beacon platform should be included in the specifications only when required by AFM 88-14 and AFR 88-16, or by the Base Commander.
****

Beacon shall be provided and installed as shown, and shall conform to Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

3.6 TANK INSTALLATION

Submit detail and erection drawings, before proceeding with any fabrication. Complete drawings with details of steel, pipe, and concrete work, and of the assembling of items required for the total installation. Use standard welding symbols as recommended by the American Welding Society. Details of welded joints referenced on the drawings shall be included. Tank installation shall be in accordance with the following requirements:

3.6.1 Welding

Section 8 of AWWA D100 or Section 6 of AWWA D103.

3.6.2 Erection

Section 10 of AWWA D100 or Section 8 of AWWA D103.

3.6.3 Inspections and Testing

Tank inspection and testing shall be in accordance with Section 11 of AWWA D100 or Section 9 of AWWA D103. Mill and shop inspections [are not required] [are required and shall be performed by an approved commercial inspection agency]. Perform the radiographic inspections of the welded tank shell, the hydrostatic test and the vacuum box leak test of the tank bottom. Final hydrostatic and leak tests shall be performed before painting of welded tanks.

3.7 PIPING INSTALLATION (EXCEPT FOR OVERFLOW PIPING)

3.7.1 General Guidelines

Where details of fabrication or installation are not shown on the drawings, installation shall conform to Section 1 and 3 of AWWA C600.

3.7.2 Testing of Valves and Piping

After the [elevated tank] [standpipe] [reservoir] has been erected and the valves and piping installed, and before field painting is begun, the valves and piping shall be hydrostatically tested in accordance with Section 4 of AWWA C600. Submit each coating manufacturer's technical data, application instructions, Material Safety Data Sheets (MSDS), and certificate for compliance for VOC content. Submit copies of the following test results:

a. Manufacturer's mill test reports for plate material.

b. Mill and shop inspections by a commercial inspection agency.

c. After acceptance of the structure, the radiographic film and test segments.

d. At the conclusion of the work, a written report prepared by the Contractor covering the hydrostatic test and certifying that the work was inspected in accordance with Section 11.2.1 of AWWA D100.

Replace with sound material any defective material disclosed by the pressure test; the test shall be repeated until the test results are satisfactory.

3.7.3 Polyethylene Encasement of Underground Ductile-Iron Piping

****
NOTE: Appendix A of AWWA C105/A21.5 will be utilized in determining whether polyethylene encasement should be used.
****

Polyethylene encasement of underground ductile-iron piping shall be provided in addition to asphaltic coating in accordance with AWWA C105/A21.5.

3.7.4 Plugging Ends

Pipe ends left for future connections shall be capped or plugged as directed.

3.8 PAINTING AND COATING OF TANK

****

NOTE: Some state and local health agencies have listings of acceptable paint materials to be used for the interior of potable water tanks and to be used on the exterior of structures. As an example, the State of California will not allow vinyl paints to be applied due to air emission restrictions. The designer must contact the appropriate state and local authorities to determine if the paint systems are acceptable. If these systems are not acceptable, the designer must determine the best acceptable system and revise this specification accordingly. However, any deviation from this specification and AWWA Standards must be submitted with justification to CEMP-ET for approval.

****

Each coating manufacturer's technical data, application instructions, Material Safety Data Sheets (MSDS), and certificate for compliance for VOC content shall be submitted to the Contracting Officer. Application, curing time, mixing and thinning of the coating materials shall be in strict accordance with the manufacturers instructions. The use of thinners shall not alter the required minimum dry thickness or adversely affect the VOC content.

3.8.1 Exterior Surfaces (Welded Tanks)

****

NOTE: For rural areas, mild to fairly heavy industrial atmospheres, and mild marine atmospheres, use the first bracketed paragraph. For moderately severe to the most severe atmospheres, such as seacoasts and in corrosive industrial areas, use the second bracketed paragraph. The vinyl system is fast drying and best in congested areas where there is danger of property damage due to overspray but should be used only in white or light gray colors because it fades and chalks easily. The epoxy polyurethane system retains its color and gloss well and is highly abrasion resistant and graffiti is easily removed. If the tank is or will be an obstruction to air navigation, use the checkerboard pattern.

****

[A prime coat, minimum of 0.051 mm 2.0 mil thick followed by two coats of alkyd enamel, each a minimum of 0.038 mm 1.5 mil thick shall be applied. The prime coat shall be rust inhibitive red iron oxide, zinc oxide, oil and alkyd primer without lead or chromate pigments, in accordance with SSPC Paint 25. The finish coats shall be [white alkyd enamel in accordance with Type I of SSPC Paint 104] [[_____] gloss alkyd enamel in accordance with SSPC Paint 21] [alternating panels (checkerboard) of white alkyd enamel in accordance with Type I of SSPC Paint 104 and international orange gloss alkyd enamel in accordance with SSPC Paint 21 color 12197].]

[[A gray vinyl prime coat a minimum of 0.038 mm 1.5 mil thick followed by two coats of [white] [light gray] vinyl paint, each a minimum of 0.038 mm

1.5 mil thick shall be applied. The primer and paint shall be VR-3 in accordance with SSPC PS 4.04] [A two-component catalyzed epoxy prime and intermediate coat, each a minimum of 0.076 mm 3.0 mil thick, followed by a two-component catalyzed aliphatic polyurethane finish coat, a minimum of 0.038 mm 1.5 mil thick, conforming to Type V of SSPC PS Guide 17.00 shall be applied. The prime coat shall be a green primer, Formula 150 in accordance with MIL-DTL-24441. The intermediate coat shall be white Formula 152 in accordance with MIL-DTL-24441 and may be tinted with pigment color. The finish coat shall be [white] [_____] [alternating panels (checkerboard) of international orange and white]].]

3.8.2 Interior Surfaces (Welded Tanks)

****
NOTE: Where surface and ambient temperatures of 10 degrees C (50 degrees F) and higher will be maintained during curing, the epoxy system shall be specified. When this is not the case and heating is not practical but ambient temperatures will be greater than 1 degree C (34 degrees F), specify the vinyl system.
****

[A prime coat at least 0.076 mm 3.0 mil thick and a [white] [_____] final coat at least 0.127 mm 5.0 mil thick shall be applied. Each coat shall be a two-component catalyzed epoxy in accordance with MIL-PRF-23236. The primer shall contrast with the color of the finish coat.] [Four coats, each at least 0.038 mm 1.5 mil thick, of VR-3 vinyl resin paint in accordance with SSPC PS 4.04 shall be applied. The second, third, and fourth coats shall be of contrasting colors.]

3.8.3 Bolted Tanks

****
NOTE: If the tank constitutes an obstruction to air navigation, the paint system applied to the outside of the tank will be an international orange and white checkerboard pattern. Galvanized coatings shall be disallowed when the stored water is corrosive.
****

The tanks shall have a coating applied to both the interior and exterior surfaces in accordance with Section 10 of AWWA D103. Color shall be [as indicated on the drawings] [as approved] [_____].

3.9 DISINFECTION

The [elevated tank] [standpipe] [reservoir] and connecting lines thereto shall be disinfected with chlorine before being placed in operation.

3.9.1 Tank

****
NOTE: In areas subject to regulations which are more stringent than requirements contained in AWWA C652, the local requirement will apply and will be specified.

AWWA C652 covers three methods for disinfection. Typically, only one method will be used for a given storage facility disinfection, but combinations of the methods may be used. The three methods are:

1. Chlorination of the full storage facility such that the end of the appropriate retention period the water will have a free chlorine residual of not less than 10 mg/L.

2. Spraying or painting of all storage facility water contact surfaces with a solution of 200 mg/L available chlorine.

3. Chlorination of full storage facility with water having a free chlorine residual of 2 mg/L after 24 hr.

This paragraph is mandatory for all NAVFAC PAC projects. All other agencies may use it after checking applicability.

****

The [elevated tank] [standpipe] [reservoir] shall be disinfected in accordance with [AWWA C652] [_____]. After the chlorination procedure is completed and before the storage facility is placed in service, the Contracting Officer will collect samples of water in properly sterilized containers for bacteriological testing from the full facility in accordance with Section 7 of AWWA C652. The tank will not be accepted until satisfactory bacteriological results have been obtained.[After coating system has been inspected, approved, and cured, rinse tank with potable water. Disinfect tank and connecting lines in accordance with AWWA C652, [Method 1] [Method 2] [or] [Method 3].]

3.9.2 Piping

The valves and piping shall be disinfected in accordance with Section 33 11 00 WATER DISTRIBUTION.

3.10 INSPECTION AND REPAIR

Prior to tank repair job, perform a detailed inspection of the structure and submit report by a certified inspector.

-- End of Section --