

**SECTION 22 67 21
WATER DEALKALIZING SYSTEM**

SPEC WRITER NOTES:

- 1. Delete between //----// if not applicable to project. Also delete any other item or paragraph not applicable in the section and renumber the paragraphs.
- 2. Consider utilizing a reverse osmosis system (RO) instead of a softener and dealkalyzer. A major advantage of RO is reducing the dissolved solids and thus the boiler blowdown. Refer to Section 22 67 19.16, REVERSE-OSMOSIS WATER EQUIPMENT.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide a chloride anion, pressure type, water dealkalizing system, complete, ready for operation, including electrical connections, services, controls, and all required accessories and equipment.
- B. A complete listing of all acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.2 RELATED WORK

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.
- //D. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.//
- //E. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.//
- F. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- G. Section 22 07 11, PLUMBING INSULATION: Pipe Insulation.
- //H. SECTION 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS: Requirements for commissioning, systems readiness checklist, and training.//

1.3 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by their basic designation only.
- B. American Society of Mechanical Engineers (ASME):
B16.1-2010.....Gray Iron Pipe Flanges and Flanged Fittings:
Classes 25, 125, and 250

B16.3-2011.....Malleable Iron Threaded Fittings: Classes 150
and 300

B40.100-2013.....Pressure Gauges and Gauge Attachments

C. ASTM International Standards (ASTM):

A53/A53M-2012.....Standard Specification for Pipe, Steel, Black
and Hot-Dipped, Zinc-Coated, Welded and
Seamless

E1229-2008.....Standard Specification for Calcium Hypochlorite

E1120-2008.....Standard Specification for Liquid Chlorine

D. American Water Works Association (AWWA):

C651-2005Disinfecting Water Mains

SPEC WRITER NOTE: Make material requirements agree with applicable requirements specified in the referenced Applicable Publications. Update and specify only that which applies to the project.

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 67 21, WATER DEALKALIZING SYSTEM", with applicable paragraph identification.

C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

- 1. Piping
- 2. Valves
- 3. Dealkalizing System
- 4. Controls
- 5. Pressure Gages
- 6. Backflow Preventer
- 7. Water meter
- 8. Caustic pump
- 9. Water Testing Equipment

D. Completely detailed layout, setting, arrangement, and installation drawings including electrical/hydraulic controls. Drawings shall also

show all parts of the apparatus including relative positions, dimensions, sizes, required clearances for unobstructed operation and general arrangement of connecting piping.

E. Certification of performance requirements.

F. ASME U-form tank construction form.

G. Field performance test results.

//H. Completed System Readiness Checklist provided by the CxA and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.//

//I. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.//

1.5 QUALITY ASSURANCE

A. Water Analysis: Water to be treated is reported to have an alkalinity as CaCO₃ of // // mg/L (// // ppm) and a pH of // //. // This analysis is for assistance only. Obtain and verify the analysis.//

B. Performance Requirements: Provide written certification that the following performance requirements shall be met by equipment under actual operating conditions:

1. Exchanger material shall not wash out of the apparatus during any dealkalizing run regardless of rate of flow.
2. Turbidity and color of treated water shall not be increased above same of sodium cycle treated water by reason of passing through the exchanger equipment.
3. Strainer system, gravel bed, and exchange material shall not become fouled by dirt, rust, or scale from pipe lines to the extent to render backwash ineffective.

C. System Requirements:

1. Unit shall be capable of delivering water having a maximum alkalinity of 20 mg/L (20 ppm), as CaCO₃, up to maximum demand of // // L/min (// // gpm).
2. Total loss of head through unit, and assembly, between the gages, including dealkalizer, valves, piping, etc., shall not exceed 103 kPa (15 psig).
3. Regeneration shall be accomplished within a period of 75 minutes. Regeneration period shall be that part of cycle of operation from the time unit has delivered its dealkalizing capacity until it is

- ready to deliver dealkalized water again, including all backwashing, brining and brine washout, etc., complete. Quantity of caustic soda shall be approximately one tenth of salt employed.
- D. Required Technical Services: Provide services of a qualified manufacturer's representative to check complete installation for conformance to manufacturer's recommendation, put system into service, make adjustments required for full conformance to design and specified requirements, and test per Part 3 of this specification.
- E. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit <http://www.biopREFERRED.gov>.

1.6 AS-BUILT DOCUMENTATION

SPEC WRITER NOTE: Coordinate O&M Manual requirements with Section 01 00 00, GENERAL REQUIREMENTS. O&M manuals shall be submitted for content review as part of the close-out documents.

- A. Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.
- B. Submit operation and maintenance data updated to include submittal review comments, substitutions and construction revisions shall be // in electronic version on compact disc or DVD // inserted into a three ring binder. All aspects of system operation and maintenance procedures, including piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices such as damper and door closure interlocks shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.
- C. The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. As-built drawings

are to be provided, and a copy of them in AutoCAD version //____// provided on compact disk or DVD. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement.

- D. Certification documentation shall be provided to COR 10 working days prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and certification that all results of tests were within limits specified.

PART 2 - PRODUCTS

2.1 EXTERNAL DEALKALIZER PIPING

- A. Pipe: ASTM A53/A53M, galvanized, Schedule 40. Flanges, ASME B16.1, Class 125.
- B. Fittings: Malleable iron, ASME B16.3 or coated iron, ASME B16.1, Class 125.
- C. Threaded Joints: Shall be made with ends reamed out. Apply bituminous base lubricant or fluorocarbon resin tape to threads only. Bio-based materials shall be utilized when possible.

2.2 VALVES

- A. Manual Valves: Ball, bronze body, stainless steel trim, reinforced Teflon seat and seal, full port.
- B. Multiport or Valve Nest: water-pressure-operated assembly of non-sticking, non-leaking, hard-anodized polymer-coated aluminum alloy or cast iron multi-port diaphragm valves. Guided-perimeter diaphragms. All valve parts accessible for service. Design shall permit slow opening and closing automatic operation of various steps of operating service, opening and closing ports in correct sequence. Provide sample cocks. Provide inlet and outlet pressure gages at all valve ports.

2.3 DEALKALIZING SYSTEM

- A. Vertical, down-flow, pressure type with water-meter-actuated automatic controls, operating on the chloride-anion cycle, designed to remove more than 90 percent of the bicarbonate alkalinity from softened water.
- B. Performance Requirements: Refer to paragraph "Quality Assurance".
- C. Dealkalizer Tank: ASME Construction, welded carbon steel, designed for 861 kPa (125 psig) working pressure. Sidewall height shall be adequate to allow 50 percent of the mineral bed depth for expansion. Tank shall

have easy access to entire interior. Tanks 1000 mm diameter (39.4 inches) and greater shall have 300 mm x 400 mm (12 inch x 16 inch) manway in top head. Reinforced pipe nozzles. Epoxy interior lining, 0.2 to 0.25 mm (8 to 10 mils) dry film thickness; exterior rust-resistant primer coated. Bio-based materials shall be utilized when possible. // Provide steel floor supports welded to lower head suitable for applicable Seismic Zone. //

- D. Distributor Pipes: Upper internal pipes stainless steel, lower distribution pipes CPVC.
- E. Exchange Material: High capacity, strongly basic, styrene base, resinous synthetic material. Exchange capacity as CaCO₃ shall be considered to be a minimum of 280 grains per cubic meter (8 grains per cubic foot) with salt consumption of 64 kg per cubic meter (4 pounds per cubic foot) and caustic soda consumption of 6.4 kg per cubic meter (0.4 pound per cubic foot). Resin furnished shall be such type which shall not require dosing or addition of any chemical, mixture, or solution to the water to be treated, or the water used for backwashing, other than common salt (NaCl) and caustic soda (NaOH) regeneration.
- F. Brine Measuring Tank:
 - 1. Construction:
 - a. Filament wound fiber glass, minimum 10 mm (3/8 inch) thick, reinforced at top with a minimum 1.6 mm (1/16 inch) resin coating on the internal wall. Bio-based materials shall be utilized when possible.
 - b. Polyethylene.
 - c. Salt capacity sufficient for six regenerations.
 - 2. Controls: Float-operated angle valve with float, float rod and stops:
 - a. Angle Valve: Not less than 25 mm (1 inch), double seated sliding stem, snap action closing and manual opening type. Constructed of all bronze containing not less than 85 percent copper. Equip valve with nonmetallic float of sufficient size to operate valve.
 - b. Float Rod and Stops: Shall be material and design for use in fully saturated salt brine and be provided with necessary lever and supports. Set float stops on rod to close valve at predetermined low level in tank.

G. Caustic System:

1. Provide pumping system to pump from VA-furnished drums or carboys of 50 percent liquid caustic soda.
2. System shall include: Metering pump, diaphragm-type; movable pump stand, pressure switch, 30 minute automatic reset timer in protective box, blend valve for adjustment of concentration.

H. System Controls: Electronic field-programmable microprocessor control, all solid state components, digital display showing system status at any time and continuous display of flow rate and flow totalization, moisture-resistant keypad. Volume-based automatic regeneration. Motor-driven pilot valve initiates regeneration. Manual override. Automatic start feature. Mount controls in NEMA 4X panel adjacent to the unit.

I. Automatic reset register water meter which automatically operates the system to provide backwashing, brining, rinsing and service along with opening the soft water bypass valve while the unit is regenerating. Meter turndown at least 70/1 with maximum flow rating approximately 10 percent above maximum flow rating required for the unit.

2.4 PRESSURE GAGES

A. ASME B40.100, 1 percent accuracy, 115 mm (4-1/2 inches) in diameter, all metal case, bottom connected. Dials either dead black or white lacquered throughout, graduated from 0 to 690 kPa (0 to 100 psig) and identity labeled. Isolating gage cocks on all gages.

2.5 WATER TESTING EQUIPMENT

A. Furnish methylorange titration-type water testing equipment in a portable cabinet. Equipment shall be such to permit conducting tests as recommended by manufacturer of equipment.

PART 3 - EXECUTION

3.1 INSTALLATION

A. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no cost or additional time to the Government.

3.2 FLUSHING AND DISINFECTING

A. Flush and disinfect new water lines and dealkalizer interior in accordance with AWWA C651.

B. Material:

1. Liquid Chlorine: ASTM E1120.
2. Hypochlorite: ASTM E1229.

3.3 STARTUP AND TESTING

A. Operating: Tests shall be performed in the presence of COR. Contractor shall provide a minimum of 10 working days prior to startup and testing. It is prohibited, for testing purposes, to add to or subtract from exchange material used in apparatus, neither shall any regenerating agent, other than the solution specified, be permitted.

SPEC WRITER NOTE: See Article, Quality Assurance, for test flow rate.

B. Procedure:

1. Operate dealkalizer at a constant flow rate of ___ L/s (___ gpm) for ten minutes after dealkalized water is produced. If necessary, waste treated water to sewer to maintain above flow rate. Dealkalized water production shall begin when a sample of 40 cc does not indicate more than 20 mg/L (20 ppm) of alkalinity.
2. Regenerate system to demonstrate operation of multiport valve and control system.

//C. The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the COR and CxA. Contractor shall provide a minimum of 10 working days prior to startup and testing.//

//3.4 COMMISSIONING

- A. Provide commissioning documentation in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.
- B. Components provided under this section of the specification will be tested as part of a larger system.//

3.5 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer's technical representative for //four// // // hours to instruct VA Personnel in operation and maintenance of units.

//B. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.//

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