

## SECTION 232513 - WATER TREATMENT FOR CLOSED-LOOP HYDRONIC SYSTEMS

**TIPS:**

To view non-printing **Editor's Notes** that provide guidance for editing, click on Masterworks/Single-File Formatting/Toggle/Editor's Notes.

To read **detailed research, technical information about products and materials, and coordination checklists**, click on Masterworks/Supporting Information.

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. Section includes the following water treatment for closed-loop hydronic systems:
  - 1. **[Manual] [Automatic]** chemical-feed equipment.
  - 2. Chemicals.
- B. Related Requirements:
  - 1. Section 232533 "HVAC Makeup-Water Filtration Equipment" for water softeners, RO equipment, and filtration equipment.

## 1.3 DEFINITIONS

- A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.
- B. RO: Reverse osmosis.
- C. TSS: Total suspended solids are solid materials, including organic and inorganic, that are suspended in the water. These solids may include silt, plankton, and industrial wastes.

## 1.4 ACTION SUBMITTALS

- A. Product Data: Include rated capacities, operating characteristics, and furnished specialties and accessories for the following products:
  - 1. Bypass feeders.

2. Water meters.
3. Inhibitor injection timers.
4. pH controllers.
5. TSS controllers.
6. Chemical solution tanks.
7. Injection pumps.
8. Chemical test equipment.
9. Chemical material safety data sheets.

B. Shop Drawings: Pretreatment and chemical treatment equipment showing tanks, maintenance space required, and piping connections to hydronic systems.

1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

## 1.5 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Water Analysis Provider Qualifications: Verification of experience and capability of HVAC water-treatment service provider.

C. Field quality-control reports.

D. Other Informational Submittals:

1. Water-Treatment Program: Written sequence of operation on an annual basis for the application equipment required to achieve water quality defined in "Performance Requirements" Article.
2. Water Analysis: Illustrate water quality available at Project site.

## 1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For sensors, injection pumps, and controllers to include in emergency, operation, and maintenance manuals.

## 1.7 QUALITY ASSURANCE

A. HVAC Water-Treatment Service Provider Qualifications: An experienced HVAC water-treatment service provider capable of analyzing water qualities, installing water-treatment equipment, and applying water treatment as specified in this Section.

## 1.8 MAINTENANCE SERVICE

- A. Scope of Maintenance Service: Provide chemicals and service program to maintain water conditions required above to inhibit corrosion and scale formation for hydronic piping and equipment. Services and chemicals shall be provided for a period of one year from date of Substantial Completion and shall include the following:
1. Initial water analysis and HVAC water-treatment recommendations.
  2. Startup assistance for Contractor to flush the systems, clean with detergents, and initially fill systems with required chemical treatment prior to operation.
  3. Periodic field service and consultation.
  4. Customer report charts and log sheets.
  5. Laboratory technical analysis.
  6. Analyses and reports of all chemical items concerning safety and compliance with government regulations.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)

### 2.2 PERFORMANCE REQUIREMENTS

- A. Water quality for hydronic systems shall minimize corrosion, scale buildup, and biological growth for optimum efficiency of hydronic equipment without creating a hazard to operating personnel or the environment.
- B. Base HVAC water treatment on quality of water available at Project site, hydronic system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.
- C. Closed hydronic systems, including **[hot-water heating]** **[chilled water]** **[dual-temperature water]** **[and]** **[glycol cooling]**, shall have the following water qualities:
1. pH: Maintain a value within **[9.0 to 10.5]** **<Insert range>**.
  2. "P" Alkalinity: Maintain a value within **[100 to 500]** **<Insert range>** ppm.
  3. Boron: Maintain a value within **[100 to 200]** **<Insert range>** ppm.
  4. Chemical Oxygen Demand: Maintain a maximum value of **[100]** **<Insert number>** ppm.
  5. Soluble Copper: Maintain a maximum value of **[0.20]** **<Insert number>** ppm.
  6. TSS: Maintain a maximum value of **[10]** **<Insert number>** ppm.
  7. Ammonia: Maintain a maximum value of **[20]** **<Insert number>** ppm.
  8. Free Caustic Alkalinity: Maintain a maximum value of **[20]** **<Insert number>** ppm.
  9. Microbiological Limits:
    - a. Total Aerobic Plate Count: Maintain a maximum value of **[1000]** **<Insert number>** organisms/mL.

- b. Total Anaerobic Plate Count: Maintain a maximum value of [100] <Insert number> organisms/mL.
- c. Nitrate Reducers: Maintain a maximum value of [100] <Insert number> organisms/mL.
- d. Sulfate Reducers: Maintain a maximum value of [zero] <Insert number> organisms/mL.
- e. Iron Bacteria: Maintain a maximum value of [zero] <Insert number> organisms/mL.

10. <Insert other requirements if necessary>.

## 2.3 MANUAL CHEMICAL-FEED EQUIPMENT

- A. Bypass Feeders: Steel, with corrosion-resistant exterior coating, minimum 3-1/2-inch (89-mm) fill opening in the top, and NPS 3/4 (DN 20) bottom inlet and top side outlet. Quarter turn or threaded fill cap with gasket seal and diaphragm to lock the top on the feeder when exposed to system pressure in the vessel.
  - 1. Capacity: [2 gal. (7.6 L)] [5 gal. (19 L)] <Insert value>.
  - 2. Minimum Working Pressure: [125 psig (860 kPa)] [175 psig (1210 kPa)] <Insert value>.

## 2.4 AUTOMATIC CHEMICAL-FEED EQUIPMENT

- A. Water Meter:
  - 1. AWWA C700, oscillating-piston, magnetic-drive, totalization meter.
  - 2. Body: Bronze.
  - 3. Minimum Working-Pressure Rating: 150 psig (1035 kPa).
  - 4. Maximum Pressure Loss at Design Flow: 3 psig (20 kPa).
  - 5. Registration: Gallons (Liters) or cubic feet (cubic meters).
  - 6. End Connections: Threaded.
  - 7. Controls: Flow-control switch with normally open contacts; rated for maximum 10 A, 250-V ac; and that will close at adjustable increments of total flow.
  - 8. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Water Meter:
  - 1. AWWA C701, turbine-type, totalization meter.
  - 2. Body: Bronze.
  - 3. Minimum Working-Pressure Rating: 100 psig (690 kPa).
  - 4. Maximum Pressure Loss at Design Flow: 3 psig (20 kPa).
  - 5. Registration: Gallons (Liters) or cubic feet (cubic meters).
  - 6. End Connections: Threaded.
  - 7. Control: Low-voltage signal capable of transmitting 1000 feet (305 m).

8. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Water Meter:
1. AWWA C701, turbine-type, totalization meter.
  2. Body: **[Bronze]** **[Epoxy-coated cast iron]**.
  3. Minimum Working-Pressure Rating: **150 psig (1035 kPa)**.
  4. Maximum Pressure Loss at Design Flow: **3 psig (20 kPa)**.
  5. Registration: **Gallons (Liters)** or **cubic feet (cubic meters)**.
  6. End Connections: Flanged.
  7. Controls: Flow-control switch with normally open contacts; rated for maximum 10 A, 250-V ac; and that will close at adjustable increments of total flow.
  8. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Chemical Solution Tanks:
1. Chemical-resistant reservoirs fabricated from high-density opaque polyethylene with minimum 110 percent containment vessel.
  2. Molded cover with recess for mounting pump.
  3. Capacity: **[30 gal. (114 L)] [50 gal. (189 L)] [120 gal. (454 L)]** **<Insert value>**.
- E. Chemical Solution Injection Pumps:
1. Self-priming, positive displacement; rated for intended chemical with minimum 25 percent safety factor for design pressure and temperature.
  2. Adjustable flow rate.
  3. Metal and thermoplastic construction.
  4. Built-in relief valve.
  5. Fully enclosed, continuous-duty, single-phase motor. Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."
  6. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- F. Chemical Solution Tubing: Polyethylene tubing with compression fittings and joints except ASTM A 269, Type 304, stainless steel for steam boiler injection assemblies.
- G. Injection Assembly:
1. Quill: Minimum **NPS 1/2 (DN 15)** with insertion length sufficient to discharge into at least 25 percent of pipe diameter.
  2. Ball Valve: **[Three]** **[Two]**-piece, stainless steel; selected to fit quill.
  3. Packing Gland: Mechanical seal on quill of sufficient length to allow quill removal during system operation.
  4. Assembly Pressure/Temperature Rating: Minimum **600 psig (4137 kPa)** at **200 deg F (93 deg C)**.

## 2.5 CHEMICALS

- A. Chemicals shall be as recommended by water-treatment system manufacturer that are compatible with piping system components and connected equipment and that can attain water quality specified in "Performance Requirements" Article.

## PART 3 - EXECUTION

### 3.1 WATER ANALYSIS

- A. Perform an analysis of supply water to determine quality of water available at Project site.

### 3.2 INSTALLATION

- A. Install chemical application equipment on concrete bases, level and plumb. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible. Anchor chemical tanks and floor-mounting accessories to substrate.
- B. Install seismic restraints for equipment and floor-mounting accessories and anchor to building structure. Comply with requirements in Section 230548 "Vibration and Seismic Controls for HVAC" for seismic restraints.
- C. Install water testing equipment on wall near water chemical application equipment.
- D. Install interconnecting control wiring for chemical treatment controls and sensors.
- E. Mount sensors and injectors in piping circuits.
- F. Bypass Feeders: Install in closed hydronic systems, including **[hot-water heating]** **[chilled water]** **[dual-temperature water]** **[and]** **[glycol cooling]**, and equipped with the following:
  - 1. Install bypass feeder in a bypass circuit around circulating pumps unless otherwise indicated on Drawings.
  - 2. Install water meter in makeup-water supply.
  - 3. Install test-coupon assembly in bypass circuit around circulating pumps unless otherwise indicated on Drawings.
  - 4. Install a gate or full-port ball isolation valves on inlet, outlet, and drain below the feeder inlet.
  - 5. Install a swing check on the inlet after the isolation valve.

### 3.3 CONNECTIONS

- A. Where installing piping adjacent to equipment, allow space for service and maintenance.
- B. Make piping connections between HVAC water-treatment equipment and dissimilar-metal piping with dielectric fittings. Comply with requirements in Section 232116 "Hydronic Piping Specialties."

- C. Install shutoff valves on HVAC water-treatment equipment inlet and outlet. Metal general-duty valves are specified in Section 230523.11 "Globe Valves for HVAC Piping," Section 230523.12 "Ball Valves for HVAC Piping," Section 230523.13 "Butterfly Valves for HVAC Piping," and Section 230523.15 "Gate Valves for HVAC Piping."
- D. Comply with requirements in Section 221119 "Domestic Water Piping Specialties" for backflow preventers required in makeup-water connections to potable-water systems.
- E. Confirm applicable electrical requirements in electrical Sections for connecting electrical equipment.
- F. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- G. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

### 3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform the following tests and inspections[ **with the assistance of a factory-authorized service representative**]:
  - 1. Inspect field-assembled components and equipment installation, including piping and electrical connections.
  - 2. Inspect piping and equipment to determine that systems and equipment have been cleaned, flushed, and filled with water, and are fully operational before introducing chemicals for water-treatment system.
  - 3. Place HVAC water-treatment system into operation and calibrate controls during the preliminary phase of hydronic systems' startup procedures.
  - 4. Do not enclose, cover, or put piping into operation until it is tested and satisfactory test results are achieved.
  - 5. Test for leaks and defects. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  - 6. Leave uncovered and unconcealed new, altered, extended, and replaced water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
  - 7. Cap and subject piping to static water pressure of **50 psig (345 kPa)** above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow test pressure to stand for four hours. Leaks and loss in test pressure constitute defects.
  - 8. Repair leaks and defects with new materials and retest piping until no leaks exist.
- C. Equipment will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

- E. At **[four] [six] [eight]** <Insert number>-week intervals following Substantial Completion, perform separate water analyses on hydronic systems to show that automatic chemical-feed systems are maintaining water quality within performance requirements specified in this Section. Submit written reports of water analysis advising Owner of changes necessary to adhere to "Performance Requirements" Article.
- F. Comply with ASTM D 3370 and with the following standards:
  - 1. Silica: ASTM D 859.
  - 2. Acidity and Alkalinity: ASTM D 1067.
  - 3. Iron: ASTM D 1068.
  - 4. Water Hardness: ASTM D 1126.

### 3.5 DEMONSTRATION

- A. **[Engage a factory-authorized service representative to train] [Train]** Owner's maintenance personnel to adjust, operate, and maintain HVAC water-treatment systems and equipment.
- B. Training: Provide a "how-to-use" self-contained breathing apparatus video that details exact operating procedures of equipment.

END OF SECTION 232513