

SECTION 232500 HVAC WATER TREATMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract apply to this Section.
- B. Section 232113 Hydronic Piping for additional equipment and requirements.

1.2 SUMMARY

- A. This Section includes the following HVAC water-treatment systems:
 - 1. Chemical-feed equipment and controls.
 - a. Manual – Bypass Feeder as specified in Section 232113 Hydronic Piping.
 - 2. Chemical treatment test equipment.
 - 3. HVAC water-treatment chemicals.
- B. The basic scope of work is to provide analysis and chemicals for the hydronic systems as indicated on the contract drawings. The chemicals will be introduced into the respective hydronic systems via a chemical bypass feeder for the closed systems (hot water). The resultant PH-levels must be maintained to meet the equipment manufacturer's requirements. Basic bypass feeders are specified in the "Hydronic Piping" specification section.

1.3 DEFINITIONS

- A. EEPROM: Electrically erasable, programmable read-only memory.
- B. 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.
- C. RO: Reverse osmosis.
- D. TDS: Total dissolved solids.
- E. UV: Ultraviolet.

1.4 PERFORMANCE REQUIREMENTS

- A. Water quality for HVAC systems shall minimize corrosion, scale buildup, and biological growth for optimum efficiency of HVAC equipment without creating a hazard to operating personnel or the environment.

- B. Base HVAC water treatment on quality of water available at Project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.
- C. Closed hydronic systems, shall have the following water qualities:
 - 1. pH: Maintain a value within 9.5 to 10.5 for chilled water and 7 to 8.5 for hot water system.
 - 2. "P" Alkalinity: Maintain a maximum value of 100 ppm.
 - 3. Chemical Oxygen Demand: Maintain a maximum value of 100 ppm.
 - 4. Soluble Copper: Maintain a maximum value of 0.20 ppm.
 - 5. TDS: Maintain a maximum value of 10 ppm.
 - 6. Ammonia: Maintain a maximum value of 20 ppm.
 - 7. Free "OH" Alkalinity: Maintain a maximum value of 20 ppm.
 - 8. Microbiological Limits:
 - a. Total Aerobic Plate Count: Maintain a maximum value of 10,000 organisms/ml.
 - b. Total Anaerobic Plate Count: Maintain a maximum value of 1000 organisms/ml.
 - c. Nitrate Reducers: Maintain a maximum value of 100 organisms/ml.
 - d. Sulfate Reducers: Maintain a maximum value of 0 organisms/ml.
 - e. Iron Bacteria: Maintain a maximum value of 0 organisms/ml.
 - 9. Polymer Testable: Maintain a minimum value within 10 to 40.

1.5 ACTION SUBMITTALS

- A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for the following products:
 - 1. Water meters.
 - 2. Inhibitor injection timers.
 - 3. pH controllers.
 - 4. TDS controllers.
 - 5. Biocide feeder timers.
 - 6. Chemical solution tanks.
 - 7. Injection pumps.
 - 8. Chemical test equipment.
 - 9. Chemical material safety data sheets.
 - 10. Filtration System and System components
- B. Shop Drawings: Pretreatment and chemical treatment equipment showing tanks, maintenance space required, and piping connections to HVAC systems. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Wiring Diagrams: Power and control wiring.

1.6 INFORMATIONAL SUBMITTALS

- A. Field quality-control test reports.

B. 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 the "Performance Requirements" Article above.
2. Water Analysis: Illustrate water quality available at Project site.

1.7 LEED Submittals:

- A. Provide manufacturer's data and related documents for LEED requirements.

1.8 CLOSEOUT SUBMITTALS

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

1.9 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.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.10 MAINTENANCE SERVICE

- A. Scope of Maintenance Service: Provide chemicals and service program to maintain water conditions required above to inhibit corrosion, scale formation, and biological growth for condenser-water piping and equipment. Services and chemicals shall be provided for a period of one year from date of Substantial Completion or acceptance of system by Owner, testing shall be completed monthly 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 (minimum of monthly visits).
 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following water treatment manufacturers:
 - 1. Aqua-Treat.
 - 2. Cascade Water Systems.
 - 3. Scientific Water Conditioning Co.
 - 4. Nalco Company.
 - 5. Or approved equivalent.
- B. Manufacturer's representatives noted above shall utilize suitable manufacturer's products to meet the performance specifications of the equipment noted below.

2.2 CHEMICAL TREATMENT TEST EQUIPMENT

- A. Test Kit: Manufacturer-recommended equipment and chemicals in a wall-mounting cabinet for testing pH, TDS, inhibitor, chloride, alkalinity, and hardness; sulfite and testable polymer tests for high-pressure boilers, and oxidizing biocide test for open cooling systems.
- B. Corrosion Test-Coupon Assembly: Constructed of corrosive-resistant schedule 40 steel material, complete with piping, valves, and mild steel and copper coupons. Locate copper coupon downstream from mild steel coupon in the test-coupon assembly.
 - 1. Four-station rack for open systems.

2.3 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 Part 1 "Performance Requirements" Article.
- B. Minimum requirements for chemical products are as follows:
 - 1. Closed Loop Systems: Inhibitor product shall be a multifunctional blend of corrosion and scale inhibitors designed to obtain the stated treatment parameters. The treatment shall include an alternating biocide program to eliminate any and all bacteria from developing in the system. For high efficiency condensing boiler system, Sentinel X100 or approved equivalent shall be utilized per the manufacturer's recommendations.
- C. Water Softener Chemicals:
 - 1. Mineral: High-capacity, sulfonated-polystyrene ion-exchange resin that is stable over entire pH range with good resistance to bead fracture from attrition or shock. Resin

- exchange capacity minimum 30,000 grains/cu. ft. of calcium carbonate of resin when regenerated with 15 lb of salt.
2. Salt for Brine Tanks: High-purity sodium chloride, free of dirt and foreign material. Rock and granulated forms are not acceptable.
- D. Products supplied shall comply with all regulations pertaining to chemicals. This will include DOT, OSHA, NIOSH and local and state regulatory agencies. MSDS Sheets shall be displayed for all products on site at point of application. Boiler water additives shall meet FDA compliance requirements.

PART 3 - EXECUTION

3.1 CONSTRUCTION WASTE MANAGEMENT (LEED)

- A. The contractor, subcontractors, and their personnel shall follow the procedures and practices for waste separation, collection and transport as defined in the contractor's "Waste Management Plan."

3.2 WATER ANALYSIS

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

3.3 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. Refer to Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment" 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.

3.4 CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

- C. Make piping connections between HVAC water-treatment equipment and dissimilar-metal piping with dielectric fittings. Dielectric fittings are specified in Section 232113 "Hydronic Piping."
- D. Install shutoff valves on HVAC water-treatment equipment inlet and outlet. Metal general-duty valves are specified in Section 230523 "General-Duty Valves for HVAC Piping."
- E. Refer to Section 221119 "Domestic Water Piping Specialties" for backflow preventers required in makeup water connections to potable-water systems.
- F. Confirm applicable electrical requirements in electrical Sections for connecting electrical equipment.
- G. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- H. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.5 GLYCOL MIXTURE AUTOMATIC FEED UNIT SPECIFIC REQUIREMENTS

- A. Installation shall be completed in accordance with the manufacturer's installation instructions.
- B. Support and level unit base and lubricate lubrication points as identified by manufacturer.
- C. Confirm / verify all electrical connections are completed per manufacturer's wiring diagram.
- D. Confirm all valves are in correct position for operation.
- E. Adjust pressure switch, triple-duty valve and expansion tank settings as required for the project.
- F. Exercise the low water cut off switch to confirm operation.
- G. Confirm the system is purged of debris and air.

3.6 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Perform tests and inspections and prepare test reports.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 - 2. Biological testing on cooling towers and closed loops shall be conducted as required in the event of an indication that biological fouling is occurring. Testing and treatment shall be continued until control is established.

C. Tests and Inspections:

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 HVAC 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 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.

D. Remove and replace malfunctioning units and retest as specified above.

E. At monthly 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 Part 1 "Performance Requirements" Article.

1. Submit cooling water particle analysis reports showing count and volume of particles within the following micron size ranges: 0.5 to 1, 1 to 2, 2 to 5, 5 to 10, 10 to 20 and 20 and larger at time of startup.
2. Submit cooling water particle analysis reports showing count and volume of particles within the following micron size ranges: 0.5 to 1, 1 to 2, 2 to 5, 5 to 10, 10 to 20 and 20 and larger 30 days after startup.

F. Comply with ASTM D 3370 and with the following standards:

1. Silica: ASTM D 859.
2. Steam System: ASTM D 1066.
3. Acidity and Alkalinity: ASTM D 1067.
4. Iron: ASTM D 1068.
5. Water Hardness: ASTM D 1126.

3.7 SPECIAL INSTRUCTIONS FOR CHEMICAL APPLICATION

- A. Closed System Cleaning Procedure: Tri-sodium phosphate (TSP) used for the removal of all oils, minerals and dirt in the closed loop chilling and heating systems. This chemical is to be injected at a rate of 300 PPM and should be recirculated for a period of 48 hours for complete**

exposure to the pipe. Once the exposure period is met, then a bleed and make up water feed is set up until the system is completely flushed. Once it is determined that the piping is cleaned, the required amount of corrosion and scale inhibitor will be injected. MSDS are to be submitted for approval for all chemicals.

B. Condensing Boiler Pipe and Boiler Cleaning Procedure:

1. Sentinel X300 has been formulated as a cleansing chemical for new hydronic pipe and heating systems along with condensing boilers. It will effectively remove all excess flux, grease, oily contaminants and sludge.
2. Sentinel X300 will be used to passivate the metal surfaces in the system during the cleaning process. Dosages should be at a rate 5 to 8 % of the total system volume, the solution should circulate for a period of at least 24 hours but not longer than one week.
3. Once contact time has been met, the system should be flushed clean until the system water is identical to the city water, at that time the recommended amount of Sentinel X100 must be added.

3.8 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service. If deficiencies are noted, the Contractor shall make necessary corrections and the unit shall be re-tested.
- B. Provide written reports demonstrating startup testing and actual performance noted during operation.

3.9 DEMONSTRATION

- A. Engage a factory-authorized service representative to 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 232500