

SECTION 23 25 00

HVAC WATER TREATMENT

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. This Section includes the following HVAC water-treatment systems:
 - 1. Chemical treatment test equipment.
 - 2. HVAC water-treatment chemicals.

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 GENERAL REQUIREMENTS

- A. A single water treatment company shall provide all products and serviced for undivided responsibility throughout the warranty period.
- B. The water treatment company shall be a recognized specialist in the field of industrial water treatment for a minimum of ten (10) years.
- C. The water treatment company shall have knowledgeable and experienced personnel on staff who are chemical engineers or chemists and have been in the field of industrial water treatment for over ten (10) years.

- D. The water treatment company shall have a technical service representative within two (2) hours drive of the job site for the duration of the warranty period.
- E. The water treatment company shall have a well-equipped laboratory managed by qualified personnel.
- F. All products furnished shall be proven reliable and have good proven performances.

1.5 DESCRIPTION OF WATER TREATMENT SERVICE.

- A. Furnish the following as base bid
 - 1. Retain qualified water treatment firm for the following:
 - 2. Supervision of installation of chemical feeding and treatment control equipment, and of initial application of water treatment.
 - a. Supply release title to chemicals for initial cleaning, chemicals for required water treatment, equipment for feeding water treatment chemicals, equipment for control water treatment written instructions for application and control of initial. Cleaning and have water treatment, material Safety Data Sheets for each cleaning and treatment chemical and test equipment and reagents.
 - b. Corrosion test coupons and 4 pass carbon steel apparatus in accordance with ASTM D2688 Method B for all water systems.

1.6 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, including chilled water and hot-water heating, shall have the following water qualities:
 - 1. pH: Maintain a value within 8.0 to 10.3.
 - 2. Soluble Copper: Maintain a maximum value of 0.10 ppm.
 - 3. TDS: Do not exceed 4,000 mmhs.
 - 4. Ammonia: Maintain a maximum value of less than 2.0 ppm.
 - 5. Microbiological Limits:
 - a. Total Aerobic Plate Count: Maintain a maximum value of 1000 cells/ml.
 - b. Total Anaerobic Plate Count: Maintain a maximum value of 50 cells/ml.
 - c. Nitrate Reducers: Maintain a maximum value of 50 cells/ml.
 - d. Sulfate Reducers: Maintain a maximum value of 50 cells/ml.

- e. Iron Bacteria: Maintain a maximum value of 50 cells/ml.

1.7 SUBMITTALS

- A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for the following products:
 - 1. Chemical test equipment.
 - 2. Chemical material safety data sheets.
- B. Shop Drawings: Pretreatment and chemical treatment equipment showing maintenance space required, and piping connections to HVAC systems. Retain subparagraph below if equipment includes wiring.
- C. Field quality-control test 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 the "Performance Requirements" Article above.
 - 2. Water Analysis: Illustrate water quality available at Project site.

1.8 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.

1.9 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 [heating, hot-water 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Ampion Corp.
 2. Anderson Chemical Co, Inc.
 3. Aqua-Chem, Inc.; Cleaver-Brooks Div.
 4. Barclay Chemical Co.; Water Management, Inc.
 5. Boland Trane Services
 6. GE Betz.
 7. GE Osmonics.
 8. H-O-H Chemicals, Inc.
 9. Metro Group. Inc. (The); Metropolitan Refining Div.
 10. ONDEO Nalco Company.
 11. Watcon, Inc.

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 TREATMENT

- A. Provide Treatment for systems as follows:
 1. Chilled water and hot water systems, treatment shall be as follows:
 - a. For pH range, refer to Treatment Schedule at end of this section.
 - b. Mixture of Molybdate, Silicate, Polymeric dispersant and Tolytriazole or equivalent non-ferrous inhibitor, maintaining minimum concentration as noted in Treatment schedule at end of this section. The inhibitor shall maintain corrosion of steel and copper below 2 mils per year and 0.2 mils per year respectively.
 - c. Non-oxidizing, non-acidic and non-cationic biocide, glutaraldehyde or approved equal, to control total bacteria count below 1000 colonies per ml.

- d. Preliminary work required, but is not limited to:
- 1) Refer to the drawing for additional information and clarification
 - 2) Provide a training manual to include operating and maintenance procedures on equipment, chemical control limits, material safety data sheets, lay-up and start-up procedures.
 - 3) All steps in the following cleaning and treatment procedures must be accomplished in immediate succession with no delay. Provide overtime manpower to accomplish same.
 - 4) Leave all valve trains in place and open for cleaning and treatment procedures and hydrostatic testing.
 - 5) Install drain outlets at deadends, low points and heat exchangers.
 - 6) Insert temporary wire screens of 140 microns or 9/64 inch perforations at chiller inlets. Use a 50 micron bag in the sidestream bag filter.
- e. Preliminary cleaning procedures:
- 1) Remove all extraneous loose debris, construction material, trash and dirt from piping, filters and all equipment. Remove as much dry material as possible, for this material prevents protective coating transfer to hard to reach portions of the system.
 - 2) Flush water fill line separately to drain. If a new water line has been installed, be sure that rust and debris from it is not washed into the system.
 - 3) Fill the system piping and equipment with water and recirculate for one with the temporary bypasses at open positions.
 - 4) Turn on direct make-up and begin blowing down deadends, low points and y-strainers until water runs "city-water clean" as fast as make-up will allow.
 - 5) Remove all screens and strainers, clean and replace. Flush all temporary bypasses.
 - 6) Add alkaline, non-foaming, non-chlorinated detergent disinfectant plus non-foaming wetting agent to remove cutting oil, excess pipe joint compound, fine solids and other materials at a dosage of 5 lbs per 100 gallons of system water.
 - 7) Recirculate for 4 to 8 hours.
 - 8) Turn on direct make-up and begin flushing all drain outlets, y-strainers, deadends and bypasses until water meets the following

parameters: Iron levels within 1 ppm, conductivity within 10 mmhs, orthophosphate within 1 ppm and turbidity within 1 FTU.

- 9) Isolate tower basins to carry out vacuuming and power spray washing of tower interior. Immediately begin the "pretreatment procedure".
- f. Pretreatment procedure:
- 1) Fill the system piping and equipment with water while adding non-foaming, water- based lay-up inhibitors to protect the piping as per chemical manufacturer's recommended dosage.
 - 2) Recirculate for 2 hours. All heat exchangers and condensers must be off-line and with no heat load.
 - 3) Stop the pumps and secure the system for hydrostatic tests.
 - 4) If the hydrostatic test fails, refill the system and begin pretreatment procedures again from step "g".
 - 5) After successful completion of the hydrostatic test, disconnect all apparatus and secure the system for the resumption of the pretreatment procedure.
 - 6) Begin flushing systems as fast as make-up will allow. Continue until water is "city water clean".
 - 7) Remove all screens, strainers and temporary bypasses. Clean and replace screens and strainers immediately and begin the "passivation procedure".
- g. Passivation Procedure
- 1) Fill the system piping and equipment with water while adding TWICE the regular amount of the maintenance corrosion inhibitor into the water.
 - 2) Recirculate for 24-72 hours.
 - 3) Change the filter bag to a 10 micron high efficiency bag.
 - 4) Keep pressure differential across the bag filter less than 15 psig by washing or replacing the filter bag.
- h. Initial chilled water and hot water system treatment:
- 1) Install corrosion coupons and 5 micron, high-efficiency filter bag in the sidestream filter.
 - 2) Test water for corrosion inhibitor level. Add corrosion inhibitor if necessary to restore the regular control range.

- 3) Add biocide per water treatment contractor's recommended dosage.
- 4) Record make-up water meter reading.
- i. Chilled water and hot water maintenance:
 - 1) Dose system with corrosion inhibitor based on test results and water meter readings.
 - 2) Remove corrosion coupons on a quarterly basis.
 - 3) Change the filter bags on pressure differential and flow meter readings.
 - 4) Test water monthly for pH, alkalinity, ammonia, hardness, molybdates, silicates, iron, copper, conductivity, total bacteria, turbidity, iron bacteria and sulfur reducing bacteria.
2. Steam and steam condensate systems.
 - a. Preliminary work required includes, but is not limited to:
 - 1) All steps in the following treatment procedures must be accomplished in immediate succession with no delay. Provide overtime manpower to accomplish same.
 - 2) Install shut off ball valves at the horizontal headers for a temporary connection with hoses, recirculating pumps and tanks.
 - 3) Install vent and drain outlets at the temporary piping.
 - 4) Clean the piping with aqueous cleaning solutions first, followed with steam blowout.
 - b. Cleaning procedure:
 - 1) Remove all loose mill scale with circulation of plain city water at 3 ft per second or higher (300 gpm in the riser) for 15 minutes.
 - 2) Add a liquid alkaline inhibited chelate cleaner into the piping to create a 5% cleaning solution to remove old mill scale and rust.
 - 3) Cleaner shall contain erythorbate as a corrosion inhibitor, sodium gluconate and EDTA as chelates, non-foaming wetting agent and low molecular weight polymeric dispersant.
 - 4) Circulate cleaner for 4 to 8 hours. Test for residual chelate and corrosion inhibitor levels during circulation. Add additional cleaner if necessary to maintain the strength of the cleaner AT 5% and 200 ppm of erythorbate.

- 5) Drain and flush the loop with city water until it meets the following parameters: Iron levels within 1 ppm, conductivity within 10 mmhs, orthophosphate within 1 ppm and turbidity within 1 FTU.
3. Passivation procedure:
 - a. Fill the temporary piping with water while adding alkaline silicate based passivator at an amount of half a gallon to 100 gallons.
 - b. Recirculate the piping for 24 to 48 hours.
 - c. Drain piping and begin cleaning new pipes with steam

3.3 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.
 4. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
 1. 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.
 2. Place HVAC water-treatment system into operation and calibrate controls during the preliminary phase of HVAC systems' startup procedures.
 3. Do not enclose, cover, or put piping into operation until it is tested and satisfactory test results are achieved.
 4. 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.
 5. 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.
 6. 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.
 7. 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. 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.

3.6 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. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION