

**SECTION 23 25 00
HVAC WATER TREATMENT**

PART 1 – GENERAL

1.01 WORK INCLUDED

A. The work of this Section shall include, but is not limited to, the following:

1. Heating hot water piping
2. Chilled water piping
3. Open condenser water piping and cooling towers
4. Closed condenser water piping
5. Steam and condensate return piping
6. Steam boilers
7. Heat recovery piping
8. Evaporative condenser
9. Chemical treatment equipment, chemicals and service
10. Glycol

1.02 RELATED DOCUMENTS

- A. Section 23 05 01 – HVAC General Provisions
- B. Section 23 21 13 – Hydronic Piping
- C. Section 23 21 16 – Hydronic Piping Specialties
- D. Section 23 21 23 – Hydronic Pumps
- E. Section 23 52 16 – Condensing Boilers

1.03 REFERENCE STANDARDS

Published specifications standards, tests or recommended methods of trade, industry or governmental organizations apply to work in this Section where cited below:

- A. NEMA National Electrical Manufacturing Association
- B. ASHRAE American Society of Heating Refrigeration and Air Conditioning Engineers
- C. UL Underwriters Laboratories Inc.
- D. OSHA Occupational Safety and Health Act
- E. EPA Environmental Protection Agency

1.04 QUALITY ASSURANCE

- A. Retain a national water treatment chemical company to provide water treatment chemical feed equipment and chemicals for circulating water systems, steam systems and equipment as defined herein and as may be required to maintain the integrity of the

pipng systems and mechanical equipment.

- B. The water treatment chemical and service supplier shall be a recognized specialist, active in the field of industrial water treatment, whose business is in the field of water treatment, and who has full time personnel within the trading area of the job site. Supplier shall have completed five existing chemical treatment systems of equal or greater size as this project and these projects shall have been operating for a minimum of two years.
- C. Furnish and install all equipment and material on this project in accordance with the requirements of the Authority Having Jurisdiction, suitable for its intended use on this project, approved by the Environmental Protection Agency (EPA), and so certified by the manufacturer.
- D. Analyze water from the local water company to be used on the project before establishing treatment procedures.
- E. Provide dual containment tanks for all liquid chemicals.
- F. Treatment Standards Control levels are listed in ppm (parts per million) or as noted:
 - 1. Closed Recirculating Water Systems:
 - a. Multi-metal closed loop corrosion inhibitor
 - b. Molybdate: Control Level – 30 to 50 ppm as MoO_4
 - c. Nitrite: Control Level – 500 to 700 ppm as NaNO_2 Hot, and 300 to 500 ppm as NaNO_2 Chill
 - d. Tolytriazole: Control Level – 5.0 to 10.0 ppm where copper is present
 - e. pH: 9.0 to 10.3
 - f. Reserve Alkalinity: Control Level – 15 to 20 ppm Glycol only

1.05 SUBMITTALS

- A. Submit the following for review:
 - 1. Make-up water analysis
 - 2. Layouts of feeding equipment
 - 3. Details of testing equipment
 - 4. Description of treatment program including calculations, list of chemicals and quantities of chemicals to be used on a daily, weekly and monthly basis.
 - 5. Provide system schematics showing the following:
 - a. Chilled Water and Hot Water Systems:
 - 1) Volume
 - 2) Circulation rates
 - 3) Pressures
 - 4) Temperature differentials
 - 6. Provide written report witnessed by Contractor containing log and procedure of system cleaning, giving times, dates problems encountered and condition of water.
 - 7. Manufacturer's installation instructions.
 - 8. Manufacturer's descriptive literature, operating instructions, and maintenance

and repair data.

9. Properties and product datasheets for all chemicals [and glycols].
10. Product datasheets for Glycol Feed Systems.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Chemical Water Treatment Service:

1. International Chemtex
2. Nalco
3. Garratt Callahan
4. Pro Chem Tech International, Inc.

2.02 PRE-STARTUP FLUSHING, CLEANING AND TREATMENT

A. Closed Loop Piping System (Chilled Water and Hydronic Hot Water):

1. The following processes are based on strategically installed devices (i.e. flush valves, crossover connections, recirculation barrel, recirculation pump, separate fresh water source, etc.) allowing for the procedure to be followed and expected results to be achieved. The bypass pipe should be sized at a minimum of 20 percent capacity of building service pipe capacity. Location of bypass line shall be immediately adjacent to the isolation valves, on the house side. Flushing pump must have capability to meet flow demands to adequately flush new system piping. Any impacts to the water chemistry of the closed loop existing conditions due to lack of adequate execution of the following directions shall become the liability of the Contractor.
This process shall immediately follow the successful pressure testing of newly installed piping.
2. Flushing: Provide all equipment (temporary and permanent) as necessary to:
 - a. Flush building service pipes and coil branch pipes. Confirm adequate flow with pressure gauges at coil branch pipes. RFI engineer to establish referenced pressures. Record and acquire attest signatures.
 - b. Flushing may be feed and bleed or fill and drain until the system pH is no greater than 0.5 units above current measured city water pH.
Example: City water pH 7.5, final flush pH 8.0 or less. Initial flushing times and readings are to be documented and signed.
 - c. Once initial flushing has been completed, remove the Rock wool/startup strainer element from the strainer, replace with operating strainer element.
3. Cleaning and Second Flushing:
 - a. It takes a minimum of 48 hours (and possibly 72 hours or more if substantial fouling exists) of water circulation to clean new piping. New Piping must be cleaned with an alkaline cleaner containing iron polymeric dispersants, and surfactants. The cleaning agent must be added until Total Alkalinity equals 3,000 ppm or greater monitored at the drain or recirculation barrel. Cleaning times and readings are to be

- documented and signed.
- b. System is to be flushed a second time. Flushing may be feed and bleed or fill and drain until the system pH is no greater than 0.5 units above current measured city water as monitored at the drain or recirculation barrel. pH.
Example: City water pH 7.5, final flush pH 8.0 or less. Second flushing times and readings are to be documented and signed.
4. Treatment:
- a. A complete corrosion inhibitor package added. Treatment is 30.0 ppm as MoO_4 , 5 ppm as TTZ (tolytriazole), 100 ppm of iron deposition polymer, and a pH of 9.5 to 10.2. Conditions are measured and recorded, times and readings are to be documented and signed.
 - b. If the site desires nitrite chemistry, the spec is 200 to 400 ppm NaNO_2 and 20.0 ppm as MoO_4 . The system TTZ, polymer and pH are the same. Conditions are measured and recorded, times and readings are to be documented and signed as attested to by MCCD personnel or third-party commissioning agent.
5. Acceptance:
- a. At the time this project is turned over to the Owner, this level of treatment is desired and the system should be sterile.

2.03 WATER TREATMENT CHEMICALS

- A. Provide a one-year's supply of necessary water treatment chemicals including the following:
- 1. Open Condenser Water Systems: Agent to inhibit scaling, acid or alkali to treat alkalinity and pH, corrosion inhibitor and biocides. Biocides shall be alternated periodically to prevent algae from developing immunity. Materials shall not contain any chromates, mercury, tin, arsenic or any toxic substances. Recommended biocides of an oxidizing and a non-oxidizing composition shall be registered with the U.S. Environmental Protection Agency and EPA registration numbers are to be clearly shown on all product literature and drum labels.
 - a. All Organic Scale and Corrosion Inhibitor
 - b. UV Digestion Organo Phosphate
 - c. Use EPA-Registered Dual Biocides for feed minimum weekly. Control is absence of algae, and Total Colony Count Aerobic bacteria at 10^3 or less
 - 2. Closed Recirculating Water Systems: Agent to reduce scale deposits, to adjust pH and to inhibit corrosion. Treatment shall not contain any chromates or other toxic substances.
 - a. Multi-metal closed loop corrosion inhibitor
 - b. Molybdate
 - c. Nitrite
 - d. Tolytriazole
 - e. Reserve Alkalinity, Glycol only

3. Steam Systems: Agents shall scavenge oxygen, control hardness and alkalinity and inhibit corrosion. Use neutralizing amines as approved by USDA, USPHS, FDA and OSHA.
 - a. Organic Polymer Phosphate-based Scale and Sludge Conditioner
 - b. Sodium Sulfite-based oxygen scavenger
 - c. Filming Amine-based Condensate Treatment
4. Open Systems (Humidifier/Dehumidifier): Agents shall inhibit scaling and corrosion; provide alternating biocides.
 - a. Biocide program shall consist of an oxidizing and non-oxidizing treatment.
5. Ethylene Glycol:
 - a. Provide a glycol solution where indicated or specified, which provides freeze protection to minus 20 degrees F.
 - b. Provide a glycol feed system to maintain a consistent pressure in closed loop systems.
 - c. The fluid shall be industrially inhibited ethylene glycol (phosphate based). Specifically excluded are automotive antifreezes or any formulations containing silicates.
 - d. The fluid shall be easily analyzed for glycol concentration and inhibitor level, and easily recharged using replacement inhibitor readily available from the fluid manufacturer.
 - e. For systems containing more than 250 gallons of fluid, annual analysis shall be provided free of charge by the fluid manufacturer. Manufacturer shall also provide convenient analytical test aids for use by the operator of a smaller system.
 - f. The fluid shall pass ASTM D1384 (less than 0.5 mils penetration per year for all system metals).

2.04 CONTROL TESTING EQUIPMENT

- A. One year's supply of all reagents and meters for digital testing of control parameters.
- B. Myron L Ultrameter II 6PFCE or Myron L TechPro II TPH1 digital pH and conductivity meter with storage case and one quart of NIST pH buffer and conductivity solutions for calibration, and one quart of pH sensor storage solution.
- C. One year's supply of log sheets on which to record the test results, and bound copy of full test instructions.

2.05 CHEMICAL FEED EQUIPMENT FOR CLOSED WATER SYSTEMS

- A. Provide bypass pot feeders with 5-gallon capacity, ¾-inch brass drain valve furnished with slotted lexan inlet and outlet strainers and sight flow indicator and able to withstand the maximum system working pressure. Wingert, Neptune, or approved equal.
- B. Provide glycol feeder system in closed loop systems for consistent pressure control.

2.06 BOILER FEED

- A. The preferred method of boiler treatment is to apply the chemicals in neat (undiluted form) with a separate pump to a separate feed point. Sodium Sulfite Oxygen scavenger is fed into the Feedwater or Deaerator Tank. A Polymer Phosphate, phosphonates blend is fed into the boiler supply downstream from the feedwater tank. Amines are then fed into the steam header to control condensate pH.
- B. A microprocessor-based boiler conductivity controller with four (4) relays, timed sampling, is desirable. A steam throttling and solenoid valve is to be installed as a surface (skimmer) blow-down to a blow-down cooler to city drain. A sample cooler is to be provided for boiler testing on the blow-down.

2.07 BOILER WATER TREATMENT

- A. Applicable to steam boilers up to 50 boiler horsepower and 100 pounds per square inch operating pressure.
- B. System equipment, as previously specified:
 - 1. Low pressure chemical metering pump
 - 2. Liquid level switch
 - 3. Automatic blow-down valve assembly
 - 4. Solution tank
 - 5. Agitator
 - 6. Sample cooler
- C. Test kits as previously specified:
 - 1. Ortho phosphate or organic test if using polymer treatment
 - 2. Sulfite
 - 3. Alkalinity
 - 4. Hardness
 - 5. pH
 - 6. Conductivity meter
- D. Chemicals:
 - 1. Alkaline boil-out compound
 - 2. Alkalinity builder compound
 - 3. Orthophosphate or polymer
 - 4. Sulfite compound
 - 5. Neutralizing amines

2.08 CLOSED SYSTEM WATER TREATMENT

- A. Typical for:
 - 1. Heating hot water piping
 - 2. Chilled water piping
 - 3. Glycol solution piping
- B. Provide bypass feeder: five-gallon capacity.

C. Test kits as previously specified: Nitrite.

D. Chemicals:

1. Alkaline boil-out compound
2. Nitrite corrosion inhibitor

2.09 OPEN SYSTEMS (SPRAY SYSTEMS)

A. Provide an automatic drip feeder with coil of capillary tubing with probe, weight, charging syringe and clip to feed treatment chemicals. Provide solenoid valve on drip feed to close when spray pump is off.

PART 3 – EXECUTION

3.01 TECHNICAL SERVICE AND CONTROL

- A. Water treatment equipment shall be located in mechanical equipment rooms or spaces when feasible to do so.
- B. Supervise the installation of water treatment equipment.
- C. Supervise the cleaning of open and closed systems and provide a written certification of cleanliness at completion of cleaning procedure.
- D. Provide a four-hour training program to the Owner's operating personnel instructing them clearly and fully on the installation, care, maintenance, testing, and operation of the water treatment system. The training course shall be arranged by the mechanical contractor at the start-up of the system.
- E. For a period of one year after completion of system commissioning, provide the services of a fully qualified field engineer for one year at no additional cost to the Owner. This field engineer must be a graduate chemist or chemical engineer or have five years of experience as a service technician in the water treatment field in this locale. The water treatment company shall also provide laboratory and technical assistance from a fully qualified engineering staff to support the following tasks:
1. Make monthly technical service visits to the installation to perform field inspections and to make water analysis on site, with sufficient complexity as to evaluate the water systems operations. Discuss findings with the Owner's personnel in writing advising on proper practices, chemical requirements and any corrective actions needed to protect the water systems from scale, corrosion, and fouling. Copies of the field service report must be forwarded each month to the Owner, Architect and Engineer.
 2. Make on-site inspections of equipment during scheduled or emergency outages in order to properly evaluate the success of the water treatment program and to make recommendations in writing based upon these inspections.

3.02 INSTALLATION

A. Chemical Feeders:

1. Chemical pumps shall be mounted at height suitable for pumping chemical

2. treatment solutions directly from supply drums to condenser water system.
Top of reservoir tank maximum 4 feet above floor. Provide drip pan of same material as tank with drain under tank and pumps.

B. Piping:

1. Proportioning pump piping shall include pressure gauge and relief valve on discharge line.
 2. Install by-pass feeders:
 - a. Install feeder in location convenient for filling.
 3. Drain connections at low points of piping.
- C. System connections and feeder locations shall be approved in the field by water treatment firm before installation of treatment equipment begins.

3.03 INITIAL CLEANING OF SYSTEMS

- A. Prior to operation, clean system as specified.
- B. Upon completion of cleaning, dose system with chemicals to obtain specified treatment conditions.

END OF SECTION 23 25 00