SECTION 15189 – CHEMICAL WATER TREATMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 WORK INCLUDED

A. Furnish and install all equipment, controls, chemicals, labor and accessories to make a complete system for chemically treating the HVAC hydronic systems specified herein.

B. All chemicals shall be environmentally safe and compatible.

C. The Mechanical Contractor shall engage the services of a nationally recognized water treatment manufacturer with local representative of such manufacturer to provide a complete water treatment service, designed to minimize corrosion and scale formation in all water systems. This service shall include providing the equipment, controls, chemical feed pumps, shot feeders, all chemicals and consulting analysis service for the initial start-up of each system.

D. The Mechanical Contractor shall provide complete electrical control interlocking wiring for all chemical feeding and control equipment, for a complete system. All electrically driven equipment, such as pumps, shall be provided with starters and disconnect switches under this Contract.

1.3 RELATED SECTIONS

A. Examine all drawings and criteria sheets and all other Sections of the Specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.

1.4 REFERENCES

A. EPA Regulation.

B. FDA Requirements.

C. ASTM: American Society for Testing and Materials.

1. D596-83 - Standard methods of reporting results of analysis of water.

D. NEMA: National Electric Manufacturers Association.

E. NFPA: National Fire Protection Association.

F. UL: Underwriters Laboratory Inc.

1.5 SUBMITTALS

A. See Section 15050 and General Conditions for additional requirements.

B. Shall be in accordance with all other specified requirements as well as those following.

C. Product Data: Submit manufacturer's technical product data, indicating chemical treatment materials, chemicals and equipment. This shall include MSDS and technical data sheets as well as all EPA, FDA, and or other environmental approvals.

D. Shop Drawings: Submit the initial manufacturer of all components and drawings indicating system schematics, equipment locations, and control schematics. In addition a clear concise written sequence of operation shall be provided.

E. Water analysis.

F. A complete scale drawing of the equipment installation

G. Submit manufacturer's installation instructions.

H. Submit reports indicating pre-cleaning completed and submit analysis of system water after cleaning and after treatment.

I. Submit reports indicating start-up of system is completed and is operating properly.

J. Submit an Operations Manual providing equipment manuals, product MSDS and technical data sheets, treatment log sheets, testing program, and description of operating parameters.

K. Product Data: Provide chemical treatment materials, chemicals and equipment including electrical characteristics and connection requirements.

L. Shop Drawings: Indicate system schematic, equipment locations, control schematics, electrical characteristics and connection requirements.

M. Manufacturer's Installation Instructions: Indicate placement of equipment in systems, piping configuration and connection requirements.

N. Manufacturer's Field Reports: Indicate start-up of treatment systems when completed and operating properly. Indicate analysis of system water after cleaning and after treatment.

O. Certificate: Submit certificate of compliance for authority have jurisdiction indicating approval of chemicals and their proposed disposal.

P. Project Record Documents: Record actual locations of equipment and piping, including sampling points and location of chemical injectors.

Q. Operations and Maintenance Data: Include data on chemical feed pumps, agitators and other equipment including spare parts lists, procedures and treatment programs. Include step-by-step instructions on test procedures including target concentrations.

1.6 QUALITY ASSURANCE

A. The water treatment company shall have at least (5) years experience in the treating and servicing of systems as outlined above. All service must be supervised by a chemist or a chemical engineer. The water treatment company shall have full time service located within the trading area of the job site. Manufacturers shall be insured for not less than $10,000,000.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section with minimum five (5) years of documented experience and approved by manufacturer.

1.7 REGULATORY REQUIREMENTS

A. Conform to applicable code for addition of non-potable chemicals to building mechanical systems and to public sewage systems.

B. Products Requiring Electrical Connection: Listed and classified by UL testing firm and acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.8 MAINTENANCE SERVICE

A. Service Period: Provide chemicals and service program for a period of one (1) year from start-up date of condensing equipment, including the following:

1. Initial water analysis of water supply and recommendations.
2. Systems start-up assistance.
3. Training of operating personnel.
4. Periodic field service and consultation.
5. Customer reports and log sheets.
6. Laboratory technical assistance.

B. Provide monthly technical service visits to perform field inspections and make water analysis on site. Detail findings in writing on proper practices, chemical treating requirements and corrective actions needed. Submit two copies of field service report after each visit.

C. Provide laboratory and technical assistance services during this maintenance period.

D. Include two (2) hour training course for operating personnel, instructing them on installation, care, maintenance, testing and operation of water treatment systems. Arrange course at start up of systems.

E. Provide on site inspections of equipment during scheduled or emergency shutdown to properly evaluate success of water treatment program and make recommendations in writing based upon these inspections.

1.9 MAINTENANCE MATERIALS

A. Supply sufficient chemicals for treatment and testing during warranty period.

PART 2 - PRODUCTS

2.1 GENERAL

A. Acceptable manufacturers contingent upon compliance with the specifications.

1. Diversey Corp.
2. Nalco Chemical Company
3. Betz Laboratory
4. Barclay Chemical, Inc.

B. Description of Work

1. The HVAC Contractor shall engage the services of a nationally recognized water treatment manufacturer or local representative of such manufacturer to provide a complete water treatment service, designed to minimize corrosion and scale formation in all water systems. This service shall include providing the equipment, controls, chemical feed pumps, bypass feeders, all chemicals and consulting analysis service for the initial clean out and start-up period of each system.

2. Service Period: Provide chemicals and service program for period of (1) year from start-up date of condensing equipment, including the following:

a. Initial water analysis of water supply and recommendations.
b. Systems start-up assistance.
c. Training of operating personnel.
d. Periodic field service and consultation.

e. Customer reports and log sheets.
f. Laboratory technical assistance.

3. Refer to Division 16 for the following work:

a. Power supply wiring from power source to power connection on water treatment equipment. Include starters, disconnects, and required electrical devices, except as specified as furnished, or factory installed, by manufacturer.
b. Interlock wiring between electrically operated equipment units; and between equipment and field installed control devices.

1) Interlock wiring specified as factory installed is work of this section.

4. Provide the following electrical work as work of this section, complying with requirements of Division 16.

a. Control wiring between field installed controls, indicating devices, and unit control panels.

C. Quality Assurance

1. The water treatment company shall have at least (5) years experience in the treating and servicing of systems as outlined above. All service must be supervised by a chemist or a chemical engineer. The water treatment company shall have full time service located within the trading area of the job site. Manufacturers shall be insured for not less than $10,000,000.
2. Codes and Standards

a. UL and NEMA Compliance: Provide electrical components required as part of condenser water treatment equipment, which are UL listed and labeled and comply with NEMA standards..
b. NEC Compliance: Comply with National Electrical Code as applicable to installation, electrical connections, and ancillary electrical components of condenser water treatment equipment.
c. Chemical Standards: Provide only chemical products which are acceptable under state and local pollution control regulations.
d. Provide any and all necessary safety and government approval literature on recommended products and assure compliance with federal, state and local regulations.

2.2 PRE-CLEANING

A. The HVAC Contractor shall closely coordinate with the water treatment company to insure that each piping system is properly cleaned prior to placing in use and that no system is filled with water without proper water treatment chemicals being added.

1. Pre-cleaning chemical shall be TSP based and shall contain a flash rusting protection package. Disposal shall be to an approved waste treatment system.
2. Procedures

a. Flush all systems and then install precleaning chemicals to remove construction deposits such as pipe dope, oils, loose mill scale, and other extraneous materials.
b. Add recommended dosages and circulate for 6 to 8 hours.
c. Drain and flush until total alkalinity of rinse water is equal to make-up water.
d. Remove, clean, and replace strainer screens.
e. Refill with clean water to start treatment procedures.

2.3 HOT WATER AND CHILLED WATER SYSTEMS (CLOSED LOOP)

A. Equipment

1. Provide a 5 gallon capacity, bypass feeder with the wide mouth opening and quick disconnect cap for each hot water and chilled water system. Pressure rating of shot feeders shall be at least 125 psi. Provide all piping, valves, and accessories as detailed on the drawings.

a. Feeder shall be steel
b. ASME rated for 125 psig

B. Chemicals

1. Hot Water (for loops operating at temperatures exceeding 120°F)

a. Provide a nitrite based program designed to provide metal corrosion and scale protection. Program must be designed to provide corrosion rates of not more than 5 mpy for mild steel and 1 mpy for copper.

2. Chilled Water (for loops operating at temperatures below 120°F)

a. Provide a molybdenum based program designed to provide multi-metal corrosion and scale protection. Program must be designed to provide corrosion rates of not more than 5 mpy for mild steel and 1 mpy for copper.

2.4 CONDENSER WATER (COOLING TOWERS)

A. Equipment

1. Provide an automatic prefabricated analyzing control and chemical feed system consisting of continuous monitoring of system water with the following features.

   a. Programmable temperature compensated bleed control for TDS with Hi-Lo and bleed time alarm.
   b. Programmable inhibitor feed with water meter control.
   c. Programmable multi-event dual biocide control with pre-bleed and lock-out functions.
   d. Low Chemical and no flow alarms.
   e. Keypad selectable controls and digital readouts.
   f. Flow Sensor - Manifold Assembly: Conductivity

      1) Maximum Sampling Pressure: 100 psi.
      2) Integrally mounted within control panel.
      3) Components made of ABS plastics.

2. Automatic Solenoid Bleed Valve

   a. Provide a solenoid bleed valve (sized for system), that is initiated by the conductivity control module. Valve shall be rated for 120V.

3. Water Meters

   a. Provide (1) electric contacting water meter (sized for system) for make up, similar to Carlon, Badger or equal. Meter shall be flanged connection, bronzed bodied turbine type.

      1) Meter shall be of a type approved by the local water authority.

   b. Provide (1) water meter (sized for system) for bleed, similar to Carlon, Badger or equal. Meter shall be flanged connection, bronzed bodied turbine type.

      1) Meter shall be of a type approved by the local water authority.

4. Chemical Feed Pumps

   a. Provide (3) chemical feed pumps for inhibitor feed and biocide feed ([2] pumps for biocide, [1] for inhibitor).
   b. Pumps shall be diaphragm type having adjustable stroke length and frequency controls. Liquid handling trim shall be polypropylene with teflon seals and diaphragm. Output shall be at least 30 gallons/day, rated 100 psi at 120 volts. Pumps shall be installed including all wiring and a shelf assembly mounted integrally with the control panel.

c. Discharge shall be separately connected to header, as shown on the drawings.
d. Pumps shall be manufactured by LMI, Pulsatron or approved equal.

5. Corrosion Coupon Test Rack

a. The Contractor shall provide ASTM corrosion coupon test racks in accordance with the chemical treatment service organization requirements. Test coupons shall be mild steel and copper and shall be provided by the Water Treatment Contractor and removed every (90) days for laboratory evaluation. A report of corrosion rates shall be submitted to the Owner with subsequent recommendations for corrective action to obtain corrosion rates of less than 5 mpy for mild steel and 1 mpy for copper.
b. Constructed of schedule 40; 316 stainless steel.

B. Chemicals

1. Provide an organic sequestrant, polymer scale and corrosion inhibitor as determined by make-up water and system conditions. Maintain control limits of product as specified by manufacturer and pH of not less than 7.5.
2. Provide (2) EPA registered non-oxidizing brocades for algae, slime and bacteria control.
3. Provide pH correction chemical (if necessary) as determined by water analysis.

2.5 STEAM BOILER WATER

A. Equipment

1. Provide an automatic prefabricated analyzing control and chemical feed system consisting of monitoring of system water with the following features.

a. Programmable blow down control for TDS with Hi-Lo and bleed time alarm.
b. Programmable feed with water meter control.
c. Low chemical alarms.
d. Keypad selectable controls and digital readouts.
e. Conductivity Sensor - Manifold Assembly: Conductivity

1) Maximum Sampling Pressure: 250 psi.
2) Integrally mounted with flow regulator.
3) Components made of black iron and stainless steel.

f. Automatic Motorized Surface Blow Down Valve

1) Provide a stainless steel motorized blow down valve (sized for the system), that is initiated by the conductivity control module. Valve shall be rated for 120 volts.

g. Sample Cooler

1) Provide one for each boiler.
2) Suitable for service at 750°F
3) Coil Inconel 600 with a pressure rating of 4,500 psi and a pressure drop not to exceed 55 psig at a flow rate of 250 lbs per hr.
4) Shell 316 stainless steel with a pressure rating of 250 psi and a pressure drop not to exceed 3 psig at a flow rate of 3 gpm.
5) Similar to Neptune SC 600

h. Water Meter

1) Provide (1) contacting water meter (sized for system), as manufactured by Carlon, Master Meter, or equal. Meter shall be flanged connection, bronzed bodied turbine type with sealed, tamperproof magnetic drive with impulse contact register.

i. Chemical Feed Pumps

1) Provide chemical feed pumps as necessary for scale and corrosion inhibitor, oxygen scavenger, and neutralizing amine.
2) Pumps shall be diaphragm type having adjustable stroke length and frequency controls. Liquid handling trim shall be polypropylene with teflon seals and diaphragm. Output shall be at least 30 gallons/day, rated at least 50 psi greater than boiler operating pressure at 120 volts. Pumps shall be installed including all wiring and a shelf assembly mounted integrally with the control panel.
3) Pumps shall be manufactured by LMI, Pulsatron or approved equal.

B. Chemicals

1. For all steam boiler systems the contractor shall employ the use of a metal passivator, a scale control agent, an oxygen scavenger, and a neutralizing amine for the condensate system. Those products should not contain hydrazide, phosphate, or chromates.
2. Provide a polymer based boiler treatment complete with appropriate corrosion and scale control agents along with sodium sulfite oxygen scavenger and amines for the protection of the condensate return piping. This treatment may be premixed or separate.
3. Maintain control limits as specified by manufacturer and dictated by make-up water quality.

a. Minimum boiler water parameters shall be:

1) P-Alkalinity: 300-500 ppm
2) Sulfite: 30-60 ppm
3) Condensate pH: 7.8-8.5

2.6 PROPYLENE GLYCOL SYSTEMS

A. Provide complete initial fill of 30% propylene glycol/70% water for all glycol systems. Propylene glycol solution shall be Dowfrost as manufactured by Dow Chemical Co. or Union Carbide UCAR-17. Top off, test and adjust system solution after all piping systems have been tested and received. Refer to details on the drawings for automatic glycol fill system schematic.

B. Tanks shall be 50 gallon H.D., self-supporting natural polyethylene having vertical embossed graduations, stainless steel cover divided at midpoint with full diameter stainless steel piano hinge and drilled for pump mounting, suction line, fresh water fill, agitator and liquid level monitor. Tank shall be CCS, CB50 or equal.

C. Chemical injection pump shall be 110 volt, minimum 1/3 HP drive, 3/8" positive displacement, to be used for charging of glycol and future additional inhibitor. Pump is to have a bronze housing with stainless or bronze liquid drivers and internal, discharge pressure gauge, and adjustable internal relief valve set so as not to exceed normal system operating pressures. Output is to be at least 5.0 gallons per minute at 100 psi. The pump discharge line is to be fitted with a ball or swing check valve to prevent system backflow (zero flow leakage) when valves are open to main headers. Unless otherwise specified, pump operation shall be initiated by a switch controlled 110 volt circuit. Pumps shall be CCS P283A series. Provide an electric transfer pump system to transfer concentrated propylene glycol to the moving tank. Provide a pre-pressurized diaphragm tank, pressure tank at least 15 gallons in size to maintain pressure on the main fluid system.

D. Accessory Switch: Provide adjustable pressure switch to prevent operation of glycol chemical pump above system PRV settings, as manufactured by Mercoid DA-31, United or approved equal.

PART 3 - EXECUTION

3.1 EQUIPMENT START-UP,FOLLOW-UP AND TRAINING

A. The Water Treatment Contractor shall provide:

1. Recommendations in writing for all chemical types to be used in each system depending on local water quality and suitability. Chemicals shall be listed in generic terms.
2. Recommendation in writing on procedures, logs book entry and correct chemical applications.
3. Complete training of maintenance and operating personnel.
4. Start-up consisting of at least (3) days with weekly visits for the first month of operation.

5. After start-up, monthly visits at least every (30) days for a period of (1) year to analyze all water systems. Each analysis to be submitted in writing containing all results and recommendations to the Owner for corrective action.
6. A microbiological dip slide culture kit shall be provided and testing, including incubation, shall be performed.
7. Monthly Service

    a. Provide weekly service checks during initial start-up month and bi-weekly service during the 2nd month.
    b. Run control tests and submit a written service report covering all aspects of chemical treatment.
    c. Recommended changes in chemical feed rate or blowdown/bleed schedule as indicated by control tests.

3.2 OTHER SERVICE

A. Provide in-service training of operating engineers on product testing and chemical performance.

1. Operator Training: Train operating personnel in use, operation, and maintenance of all water treatment systems.
2. A program administration manual shall be furnished encompassing all systems covered in this Section.
3. Three days of training for operating personnel shall be priced including all expenses. Document in bid tabulation form.

B. Inspect boiler and condenser water surfaces at their regular inspection intervals.

C. Provide all laboratory reports on corrosion or deposit analysis as needed.

D. Make available all test kits and testing reagents to assure accurate test results.

E. Provide all log books for all equipment rooms so test results may be recorded. Log Books should contain:

1. Product technical data sheets
2. Product Material Safety Data Sheets
3. Equipment Literature
4. Program Operating & Testing Parameters
5. Chemical Testing and Blowdown/Bleed Log Sheets

F. System Testing and Follow Up

1. Chemical treatment representative shall visit the site once every month during the guarantee period. The representative shall check and adjust water treatment system operation during each visit, check efficiency of chemicals and chemical applications, and instruct and advise operating personnel.

2. At each inspection during the guarantee period, samples of the water systems shall be taken by the chemical treatment representative. The samples shall be analyzed by an independent testing laboratory and certified. The analysis made on the water shall be submitted to owner. The analysis report shall include recommendations as to any changes in the water treatment required.

G. Provide any and all necessary safety and government approval literature on recommended products to assure compliance with federal, state and local regulations.

3.3 INSTALLATION

A. Install chemical feeders per manufacturer's instructions. Chemical treatment equipment manufacturer shall supervise installation to ensure proper installation.

B. Install chemical feeders and equipment per manufactures recommendations.

C. Provide 316 stainless steel drip pan under chemical tanks and pumps. Pan shall be a minimum of 10 gauge.

D. Provide relief valve in the discharge of each pump.

E. Provide hose end drain valves at low points in piping.

3.4 PIPING SYSTEMS PREPARATION

A. General: After piping systems are erected and proven free of leaks provide services for piping systems flushing, cleaning, disinfecting, purging, rinsing and treating in accordance with specification.

3.5 CLEANING

A. Each new water system shall have an industrial strength cleaner added and circulated for a minimum of 24 hours when the system is initially filled with water. Cleaner shall be equal to Barclay Flushout.

B. After a complete flushing, each system shall be chemically treated with an inhibitor. The Water Treatment Contractor shall provide the proper amount of cleaner and inhibitor for each system, supervise the cleaning procedure and issue a written report to the Owner and Architect that each system has been properly cleaned, chemically treated and tested. The Mechanical Contractor shall perform the cleaning and flushing procedure under the supervision of the Water Treatment Contractor. The result of the initial tests shall be included in the report. All test apparatus, equipment and labor shall be provided by the Mechanical Contractor under this Section.

Tests and cleaning will be witnessed by the Architect and Owner's representatives. Notify all parties 48 hours in advance of commencement of work.

END OF SECTION