

## SECTION 15548

### WATER TREATMENT

#### PART 1 - GENERAL

##### 1.01 SUMMARY

###### A. Section Includes:

1. Pre-Start Cleaning of HVAC Piping Systems
2. Chemical Feeders
3. Treatment for Closed Systems
4. Treatment for Open Systems
5. Corrosion Coupons

###### B. Related Sections:

1. Section 15010 - Basic Mechanical Requirements
2. Section 15050 - Basic Mechanical Materials and Methods
3. Section 15511 - Hydronic Piping and Specialties

##### 1.02 SYSTEM DESCRIPTION

###### A. Design Requirements:

1. Spill containment requirement for each chemical treatment station will be determined by University of Colorado at Boulder's Facilities Management, Refrigeration Shop water treatment technician. Chemical containers will vary from 5 gallons to 55 gallons. Containments of concrete or polyethylene, holding drums 30 gallons or larger, must have a ramp to the platform level.

###### B. Specify the following procedures.

###### 1. Pre-Cleaning

###### a. Closed Systems

Hot and chilled water systems must be cleaned in the same manner prior to being ready for operation. The chemical cleaning must be alkaline material containing Dispersants, Detergent and Organic Corrosion inhibitors. Required system cleaner is Drew Flushout 624L or Drew equivalent. Once system is properly dosed with chemical, circulate for 24 hours and, if possible, heating system water up to 140-180F. Following circulation, drain down and flush. Fill, circulate 30 minutes and flush system until the water is clear and TDS of system water is +/- 50  $\mu$ mhos that of city water. Once system has been properly flushed, add closed-system inhibitor (Nitrate based) to boost chilled water levels to 400-600 ppm as NO<sub>2</sub>. Hot systems should be dosed with inhibitor to boost nitrite levels to 600-800 ppm. Required closed-system inhibitor is Drewgard 2808.

Note: If glycol is specified in the system, and it is not pre-inhibited, (such as Dowtherm & Dowfrost as required in Section 15511) proper glycol levels are added to the system prior to adding inhibitor. Report system volume and glycol/water mixture added.

b. Open Recirculating System (Cooling-Tower Water)

With system circulating, add a phosphate-based cleaner/passivation chemical. Liquid chemical should be a blend of inorganic phosphate, organic corrosion inhibitor, dispersant and an oil emulsifier. Drew L.A.C. or Drew equivalent is the required product. In order for optimum passivation and cleaning system, pH must be maintained in The 6.5-7.5 range. Sulfuric acid may be gradually added to adjust pH if it increases above 7.5. Soda ash may be added if pH drops below 6.5. Sufficient Drew 2255 should be added to raise total inorganic phosphate levels to 500 ppm minimum. Circulate for a minimum of 48 hours. Circulate and flush the system until TDS is +/- 50  $\mu$ mhos that of city water. Verify all pump strainers are clean and functioning. Lay up the system dry until ready for use or begin recommended treatment program.

c. Steam Boiler

Fill the boiler and add an alkaline cleaner containing detergents, emulsifiers and organic inhibitors. Drew L.A.C. or Drew equivalent is the required cleaner in sufficient amount to boost system pH to 11.0 - 12.0. Fire the boiler at normal operating levels and allow system pressure to build to 1/3 normal operating pressure. Fire for 4 - 6 hours then drain to 1/2 normal operating level in site glass. Add sufficient water to refill to normal operating level. Blowdown again to 1/2 normal operating level. Repeat this procedure at least 4 times allowing system pressure to drop during each flush. Allow the boiler to cool, then drain and flush. Begin normal treatment program or layup dry.

2. Chemical- Feed Equipment

a. Inhibitor Feed and TDS Control for Cooling Towers

Provide a proportional make-up chemical feed system where chemical feed is fed in proportion to the quantity of make-up water fed to the cooling tower. A certified contacting water meter shall be provided and installed in the make-up water line. The water meter will sense the quantity of make-up water in 10 gallon increments. Send an electrical signal to a cooling tower controller. The tower control device will accept and accumulate the electrical signals from the water meter. The correct contacting water meter may be specified by the chart below:

TOWER	CONDENSER	RECOMMENDED WATER METER	
TONNAGE	CIRC. RATE	SIZE	GALLON COUNT
0-200	0-6000	5/8"	10
300-400	900-1200	3/4"	10
500-800	1500-2400	1"	10
900-1600	2700-4800	1 1/2"	10
1600-3000	4800-9000	2"	10

The controller must have the capability to actuate a variable timer when a predetermined number of signals is accepted from the water meter. The controller will be capable of activating the timer when 1 to 99 pulse-signals are sent to the controller. The timer circuit will activate a 110V circuit to energize a chemical pump for feeding scale inhibitor.

Tower bleed will be controlled via a flow through TDS/conductivity sensor. The controller will read conductivity of the cooling water the 0-2000 microohms/cm range in a digital format on the front of the control device. The controller will be designed to energize a 110V circuit to open a solenoid bleed valve any time a preset conductivity is exceeded.

The controller will also include a 28-day programmable biocide time clock for feeding 2 (two) liquid biocides. The time clock shall be capable of energizing a 110V electrical outlet that can be used to energize a chemical feed pump for biocide, in 15-minute increments.

The controller will have a mounted flow assembly TDS sensor. Flow assembly will de-energize the controller when a loss of flow is sensed.

The required tower control unit is a LMI DC4500-111A or LMI equivalent

b. Inhibitor Feed and TDS Control for Cooling Towers 100 Tons and Smaller.

Provide a bleed-and-feed tower control system. Tower bleed will be controlled via a flow-through TDS/conductivity sensor. The control unit will read out in the 0-2000 micro mho/cm range in a digital format on the front of the control device. The controller will be designed to energize a 110V circuit to open a solenoid bleed valve any time preset conductivity is exceeded. While the solenoid bleed valve is open, and additional 110V circuit will energize to provide power to a chemical feed pump.

Although the system will be designed to operate in the bleed-and-feed mode, the system should have the capability of accepting pulses from a contacting water meter. The control unit should be capable of energizing a 110V circuit for 0-300 seconds following receipt of a pulse from a contacting water meter. The controller will have a mounted flow assembly/TDS sensor. Flow assembly will de-energize the controller when a loss of flow is sensed. The required tower controller is a LMI DC4500-111A controller. See attached parts list for required controller options for each tower configuration.

c. Inhibitor Feed Pumps

An electronically-actuated diaphragm pump will be provided. The pump must be a 110V, rated at 0.24-24 GPD. Discharge pressure must be capable of overcoming the maximum pressure rating of the condenser-water pump. Materials of construction are Polypropylene/Teflon/Ceramic. An LMI Model A151-392SI series pump is required. The inhibitor will be fed using the injector supplied with LMI pump.

d. Biocide Feeders for Towers

An electronically-actuated diaphragm pump will be provided. The pump must be for 110V, rated at 0.24-24 GPD. Materials of construction are Polypropylene/Teflon/ceramic. An LMI model A151-392SI is required. The pump shall be activated by the Tower control unit.

Injection quills of 304 Stainless Steel will only be used on injection points with 4" or greater pipe diameter, all others will use injection check valve supplied with LMI A151-392SI pumps.

e. Steam Boilers

1) TDS

Provide a TDS control unit that periodically samples boiler water by opening the blowdown line for a short sampling period. If TDS is below the trip point, the blowdown valve closes after the timed sample. If TDS exceeds preset limits, the controller overrides the timer, allowing the blowdown valve to remain open until the system returns to the desired TDS.

The control device shall provide a 0-10,000 micro-ohm or 0-6,500 ppm TDS analog readout. Trip point can be adjusted on the front panel of the control unit. An LMI DC4500 250 psi valve package is the required Boiler Control Unit.

2) Feed of Oxygen Scavenger

Sulfite based oxygen scavenger must be fed on a continuous basis. The chemical is fed using an injection quill that is positioned in the deaerator storage tank or the feed-water tank (if no deaerator exists). The injection quill should be constructed of 304 stainless steel. An electronically - actuated diaphragm pump rated at 0.24-24 gallons per day must be provided. Materials of construction are Polypropylene/Teflon/Ceramic. An LMI model A151-392SI or LMI equivalent a pump is required.

3) Inhibitor Feed

Scale inhibitors are fed into the suction side of the feed water pumps using a 304 stainless steel injection quill. An electronically-actuated diaphragm pump rated at 0.24-24 GPD must be provided. Materials of construction are Polypropylene/Teflon/ceramic. A LMI model A151-392SI pump is required. The inhibitor pump should be wired such that it will energize when the feed pump runs or when make-up water is supplied to the boiler system. Operators must have the option of either control mode by providing a dual-receptacle plug. One plug will energize based on the feed pump the other will energize when make-up

water is called for.

#### 4) Water Softener

A water softener must be provided for all boilers. It shall be capable of producing a consistent supply of make-up water containing <0.5 ppm total hardness. The softener must be equipped with a salt tank and provisions for automatic regeneration based on total gallons supplied by the unit.

If the boiler is an intermittent-operating unit that shuts down at least 4 hours per day, a single softener vessel system must be provided. If the boiler runs on a continuous basis, a dual-vessel system must be provided. The dual-vessel system will regenerate the exhausted vessel as soon as the new vessel is put into service. See attached schematic WT-7A and parts list WT-7B.

#### f. Closed Systems

- 1) All hot-water or chilled-water closed-loop systems under 1,000 gallons shall have a 2 gallon bypass (pot) filter feeder installed.
- 2) All hot-water or chilled-water closed-loop systems over 1,000 gallons shall have a 5 gallon by-pass filter feeder installed.

A Neptune by-pass filter feeder will be provided. The vessel will be constructed of mild steel and be capable of operating up to 200 psig. A filter bag kit should be provided to fit inside the feeder. The bag filter will remove scale, rust, chips, etc. from the system. This bag filter shall be marked "bag inside."

The contractor installing the bypass filter feeder will be required to provide piping and valves for installation of this feeder. See attached schematic WT-D and parts list WT-D.

#### g. Corrosion Coupon Racks

Corrosion coupon racks shall be supplied on all process-cooling, chilled-water and water systems served by open cooling towers, such as condensers and indirect evaporating coils. All racks shall be constructed of 1" Sch 80 PVC Pipe with the exception of Hot Water systems which should be Sch 80 mild steel pipe. Coupon racks should be capable of accepting two corrosion test specimens. A orifice-valve must be supplied in each rack which provides a 3.0-4.0 ft/sec flow throughout the rack. A flowmeter shall be installed near the coupon rack, after orifice-valve. Flowmeter shall be within 1 foot of union.

When installing a rack in the condenser water system, the warmest water in the system should be the supply water to the coupon rack. Usually, the water exiting the condenser would be considered supply to the coupon rack.

### 3. Special Procedures

- a. Domestic-Water Sterilization  
see 601 IPC SHANNON

10% bleach will be used to perform the sterilization. Bleach will be fed by injecting it

into the main water supply header feeding the facility. An LMI Model A151-392SI chemical feed pump is recommended for injection of bleach. Below is the sterilization procedure.

- (1) Run all domestic water supply faucets at 1/2-1/4 gallon per minute.
- (2) Begin pumping bleach and adjust bleach injection rate such that a 1.0-2.0 ppm free Cl<sub>2</sub> residual is attained at all faucets.
- (3) Maintain above flow rates and free chlorine residuals for a 4-6 hour period.
- (4) Cease bleach injection. Monitor free Cl<sub>2</sub> residuals at faucets and observe when free Cl<sub>2</sub> residual drops below 0.2 ppm. Run all faucets for an additional two hours at a 1/2-1/4 gallon per minute rate.

System is now considered sterile and ready for operation.

### 1.03 QUALITY ASSURANCE

- A. The Water Treatment, Chemical and Service Company shall be recognized specialist, active in the field of industrial water treatment for at least ten years, whose major business is in the field of water treatment, and shall have regional water analysis laboratories, development facilities and service department, plus full-time service personnel within the locale of the job site.
- B. All products shall be provided by a single subcontractor to ensure there is a single source of responsibility. Sub-contractor shall be on State approved list.
- C. Firms must submit a list of satisfied customer service references and evidence of qualifications and experience for acceptance to execute the work on the project.

### 1.04 MAINTENANCE

- A. Provide the services of a fully-qualified Field Engineer and laboratory and technical assistance from a fully-qualified laboratory staff for one year warranty period. Services and assistance shall include the following:
  1. A training course for the University's operating personnel, instructing them clearly and fully on the installation care, maintenance, testing, and operation of the water treatment systems length of training shall be given as needed, per system size and complexity.
  2. A periodic technical service visit to the job site to perform field inspections and to make water analysis on site, in order to evaluate the condition of the treated systems.
  3. The Field Engineer shall report findings to the University's operating personnel in writing on proper practices, chemical treating requirements, and any corrective actions needed to protect the water systems from scale, corrosion, and fouling.

## PART 2 - PRODUCTS

### 2.01 WATER TREATMENT CHEMICALS

- A. Supplier:

## 2.02 CHEMICAL FEED PUMPS

### A. Manufacturer:

LMI

## 2.03 WATER METERS/ CERTIFIED

### A. Manufacturer:

LMI, Badger or Seametrics

## 2.04 CONDUCTIVITY METERS

### A. Manufacturer:

LMI, DC4500-111A or approved equivalent

## 2.05 WYE STRAINERS

Threaded wye strainers shall have screens of 20 mesh maximum and 40 mesh minimum.

## 2.06 SPILL CONTAINMENT

Spill containment made of polypropylene (or equivalent) or concrete shall be provided. Total volume of containment shall exceed total volume of chemical containers by 50%.

## PART 3 - EXECUTION

### 3.01 INSTALLATION/APPLICATION

#### A. Specify the following:

1. Emergency eye wash/shower (potable water) shall be located at or in close proximity (within 10') to chemical treatment station with no obstruction or tripping hazards in between chemical containers, filter-feeders, chemical pumps and conductivity controller are considered chemical treatment station.
2. Chemical treatment station shall be located at or in close proximity to sanitary sewer floor drain or be constrained in a basin piped to sanitary drain.
3. All chemical pumps shall be mounted no higher than 5 foot above floor elevation, with 4 foot being the optimal height.
4. All chemical pumps shall be located within 5 feet of conductivity controller.

5. Wye strainers must be installed before (upstream) of all controller sensors, bleed solenoids before controller sensor can be used for both controller and coupon rack.  
On systems 1,500 gallons or less, wye strainer located before controller sensor can be used for both controller and coupon rack. Systems over 1,500 gallons shall have wye strainers upstream of coupon rack, upstream of controller and one upstream of bleed solenoid.
6. Conductivity controller must be mounted on fixed walls or stands free of vibration. Controller shall not be mounted on cooling towers, duct work or air handlers. Controller must be insulated from extreme cold and heat if installed on building exterior wall. All controllers shall be mounted between 5' & 5' 6" above floor (eye level).
7. All chemical pumps must be secured to shelf or support to prevent any movement due to pump action or normal contact.
8. All chemical pumps and conductivity controllers must be 110 volt, 60 Hz.

END OF SECTION

