

SECTION 23 25 00

HVAC WATER TREATMENT

PART 1 GENERAL

1.01 GENERAL GUIDELINES

- A. Open Cooling Towers: a treatment system utilizing chemicals and biocides that contain no heavy metals and are non-carcinogenic to prevent corrosion, scaling and biological growth.
 - 1. Cooling tower chemicals are **NOT** supplied by Denver Public Schools.
- B. Closed Loop Systems include the following and shall utilize Nitrite based water treatment.
 - 1. Closed Circuit Cooling Towers (also known as Fluid Cooler or Evaporative Condensing Tower).
 - 2. Hot and chilled water systems.
 - 3. Hot and chilled systems shall use propylene glycol to lower system water freezing point. Propylene glycol is **NOT** supplied by Denver Public Schools .
- C. Steam Systems are designed for 100% condensate return and use a sodium sulfite-based internal boiler treatment.
- D. Direct evaporative cooling systems shall utilize biocide with weekly drain down. Biocide used shall be approved for contact with humans.
 - 1. Evaporative cooling chemicals are **NOT** supplied by Denver Public Schools.
- E. Indirect evaporative cooling systems shall utilize biocide with weekly drain down. Biocide used shall be approved for contact with humans.
 - 1. Evaporative cooling chemicals are **NOT** supplied by Denver Public Schools.

1.02 QUALITY ASSURANCE

- A. System cleaning and initial treatment will be documented by the General Contractor and Project Manager or a representative of the Maintenance Department, needs to be given to QA/QC representative.
- B. This documentation shall become a part of the Operation and Maintenance Manual and shall include the cleaning procedure for each system, personnel involved, results of chemical analyses, amount of Propylene Glycol used for heating or cooling systems and volume for closed loop systems.
 - 1. System cleaning includes piping and equipment.

1.03 SUBMITTALS

- A. Project Record Documents:
 - 1. As-built shop drawings:
 - a) Certified elevation and outline drawings with dimensions.
 - b) Certified plan view drawings with dimensions.
 - c) Wiring and termination drawings.

1.04 MAINTENANCE

- A. Closed loop and steam systems:
 - 1. For consistency/liability of treatment during warranty period contractor to provide water treatment service contract for duration of the 24 month warranty period
 - 2. Approved vendors
 - a). TRS, INC.

b) G2 Solutions

3. Following start up and cleaning Denver Public Schools Maintenance will perform water treatment in house.

B. Open Cooling Towers, replacement cooling towers, and new cooling towers associated with new chillers.

1. Following the project completion the contractor will provide a water treatment service contract for the duration of the 24 month warentee period.

- a) Service contract will include monthly maintenance checks and all chemicals needed
- b) Records of service performed will be kept on site in a contractor provided maintenance log book.
- c) Cooling tower conductivity shall be maintained between 1200 and 1500 micromhos. Actual Set point to be based on individual laboratory analysis.
- d) Scaling inhibitor addition shall be sufficient to curtail scale formation.
- e) Biocide injections will alternate weekly

2. All chemicals shall be provided by the Water Treatment Contractor for the duration of the warranty period.

C. Closed loop system shall use a nitrate based treatment. Chemicals to be provided by the contractor.

1.05 SYSTEM DESCRIPTION

A. Design Requirements: specify the following procedures.

1. Pre-start Cleaning of closed loop HVAC Piping Systems

- a) Notify the DPS five working days in advance of the start of cleaning. Cleaning and flushing of all systems shall take place in the presence of the DPS and or a representative from Maintenance. The “Certification of Work Certificate” documents the cleaning procedure and personnel involved. The designated Maintenance Personnel observing the cleaning process shall sign the certification. School personnel or custodial staff are not authorized to certify the procedure.
- b) Closed loop systems, hot and chilled water shall be cleaned using a cold alkaline cleaning solution at normal system pumping pressures. Use commercially available chemicals furnished by the contractor (at no additional cost to the Owner)
 - i) If the contractor furnishes system cleaning chemicals; use the following formula or a functionally equivalent mixture.

<u>Chemical</u>	<u>Ounces per gallons of system volume</u>
trisodium phosphate	<u>16 per 1000</u>
sodium hydroxide	<u>1 per 100</u>
dishwashing detergent (liquid surfactant)	<u>1 per 100</u>
nitrite	<u>Per manufacture recommendation</u>

ii) The cleaning solution must begin with a minimum pH of 10.0

iii) Procedure to clean an entire hydronic system:

1	Isolate the expansion tank from all cleaning solutions.
2	Fill the system with water and add the alkaline cleaning solutions.
3	Circulate the alkaline cleaning solution in any hot or chilled water system for 48 hours.
4	Drain the alkaline cleaning solution and fill the system with domestic cold water. Circulate and flush as necessary until the circulated water reaches a pH of 8.5 or less at all end points of the hydronic system.
5	When the rinse water reaches 8.5 pH or less, remove and clean all piping strainers through out the system. Do not drain the rinse water from the piping system until the propylene

	glycol is ready to be installed (if applicable). The designated Denver Public Schools Maintenance person must verify and approve the cleanliness of the system. A minimum of three samples will be taken of each hydronic system. The contractor and the owner will each retain one sample and one will be sent for chemical analysis.
6	Drain and partially fill the hydronic system with clean domestic cold water. Install the uninhibited propylene glycol to a concentration of 30%. The owner will sample and install the water treatment chemicals into the system – pH buffer, oxygen scavenger, and corrosion inhibiting surfactant.
7	Before using the glycol feeder, thoroughly clean the tank of oil, grease and solids. Fill the tank completely with domestic cold water and one gallon of chlorine bleach. Allow to stand over night. Rinse tank free of chlorine.
8	Fill the specified propylene glycol mixture

- iv) In no case shall the system being cleaned be left in an untreated condition for more than eight hours.
- v) The water treatment contractor shall certify in writing that the system was cleaned and treated in conformance with the specification.
- vi) If freeze protection is specified in the system, it must Pure Virgin Inhibited Propylene Glycol. Report system volume and glycol/water mixture added.
 - Initial (start-up) concentration of propylene glycol shall be 30% for heating water and 30% for chilled water.
 - At the end of the 24 month warrantee glycol concentrations should be at 30%.

2. Boilers (Steam and Heating Water):

- a) Boilers shall be cleaned as per manufacturers instructions
- b) Notify the DPS five working days in advance of the start of cleaning. Cleaning and flushing of all systems shall take place in the presence of the DPS and or a representative from Maintenance. "Certification of Work Certificate" documents the cleaning procedure and personnel involved. The designated Maintenance Personnel observing the cleaning shall sign the certification. School personnel or custodial staff are not authorized to certify the procedure.

3. Chemical Feed Equipment:

- a) Chemical Pot Feeder
 - i) Provide bypass type pot feeder with 3/4" NPT connections and a 3-1/2" quick opening cap with "O" ring seat. Capacity as specified herein rated for 200 psig working pressure at temperatures up to 240°F.
 - ii) Feeders shall be two gallon capacity.

4. Glycol Feeder System

- a) Provide a glycol feeder system as shown on the drawings. The glycol feeder shall have a 50-gallon polyethylene tank, with capacity indicator and removable cover. Four legs shall support the tank with footpads. 3/4" under tank drain with hose bib shall be provided for draining the tank.
- b) Manufactures
- c) Advantage Controls
- d) Neptune Glycol Feed Systems
 - a) Provide a separate glycol feed tank for both water systems

- e) The pump shall be a positive displacement rotary gear pump with 3/4" suction side ball valve. Rotary gear pump shall be all bronze construction, 1.8 gpm @ 100 psi, 1725 rpm. Electrical characteristics: 1/3 hp, 120/60/1, 20 amp.
 - f) Pump discharge shall consist of a 3/4" check valve, 3/4" "T" for connecting the Glycol Feeder system to the system piping, and a 30-psig relief valve for discharge back into the storage drum.
 - g) The Control Cabinet shall be mounted on the tank and contain the following functions:
 - i) One liquid level switch with horn alarm, low-level light, and horn silencer switch. When the storage tank level is below safe level, the horn alarm and light will activate.
 - ii) A silencer switch, mounted on the control cabinet, will disconnect the horn, but the low-level light will remain on until the tank level has reached a safe working level.
 - iii) A momentary spring-loaded pushbutton switch for testing the operation of the pump.
 - iv) System Pressure gauge.
 - v) Pressure switch for pump control. Set at the required system pressure of (as indicated on the drawings by the designer) psig.
 - h) Provide one hand-operated rotary gear transfer pump with eight foot of 1" hose and a 3/4" nozzle. The pump shall have a 1" telescoping suction pipe and bung adapter with 2" thread. The above is for the operator to transfer glycol from the drum into the glycol feed tank.
5. Cooling Tower Chemical Controller
- a) Recommended controller brands
 - i) Advantage Controls
 - ii) LMI, Inc.
 - b) Provide a prefabricated, pre-wired, and pre-piped automatic tower water control system to bleed solids by conductivity or TDS and feed inhibitor in direct proportion to the makeup water rate of the cooling tower water system. Automatic alternating control of dual biocides used to eliminate biofouling shall also be part of this controller.
 - c) All of the electronic equipment shall be mounted in a NEMA 12 gasket enclosure hereinafter referred to as the controller.
 - i) The enclosure shall incorporate side brackets for mounting and shall have locking hasps. The enclosure door shall be hinged and shall contain a large LEXAN viewing window.
 - ii) Manual override switches and LED pilot lamps for the following functions shall be mounted on the inside panel.
 - Power "On-Off"
 - Flow "On-Off"
 - Bleed Valve "On-Auto-Off"
 - Inhibitor Pump "On-Off"
 - Biocide A "On-Auto-Off"
 - Biocide B "On-Auto-Off"
 - d) Provide a prefabricated pump/piping rack for wall mounting adjacent to or beneath the controller.
 - i) The rack shall be board mounted and shall include:
 - Bypass piping and flow control and isolation valves
 - TDS sensor/flow switch assembly
 - Bleed solenoid valve, strainer, and flow control valve. Strainer shall be placed as to protect the bleed solenoid valve.

- Inhibitor and biocide pumps
 - Chemical injection valves installed in bypass piping and pre-piped to respective pumps
 - Cord plugs, and receptacles as necessary to connect all pre-mounted devices to the controller.
6. Steam Boilers:
- a) Provide a water meter to measure make-up water into the steam boiler system. The water meter shall be installed just upstream (before) of the makeup water solenoid to the condensate receiver tank.
 - i) Provide a multi-jet turbine type water meter for installation in the make-up water line. Meter selection size shall be the responsibility of the water treatment contractor. (See drawings for pipe size).
 - ii) Meter body shall be cast bronze, class 150 with NPT couplings.
 - iii) Meter shall be magnetic drive type with sealed direct reading, five digit register and sweep second hand for low flow indication.
 - b) Provide bypass type pot feeder with 3/4" NPT connections and a 3-1/2" quick opening cap with "O" ring seat for each boiler. Capacity as specified herein rated for 200 psig working pressure at temperatures up to 240 degree F.
 - i) Feeders shall be two gallon capacity, located as indicated on the drawings, parallel to the condensate feed line, and mounted with the top no higher than 36" from the floor.

PART 2 PRODUCTS

2.01 CHEMICAL FEED PUMPS

A. Acceptable Manufacturers:

1. Advantage – MEGA TRON

B. DDC control connection, coordinate points with controls contractor.

2.02 WATER METERS

A. Acceptable Manufacturers

1. Carlon
2. LMI
3. Pulsafeeder
4. Neptune
5. Hersey

2.03 CONDUCTIVITY METERS

A. Acceptable Manufacturers

1. LMI
2. Pulsafeeder
3. Advantage

2.04 CHEMICAL FEED EQUIPMENT

A. Acceptable Manufacturers

1. Vector Industries
2. Neptune
3. Claypool

4. J. L. Wingert

- B. Solenoid Valves: Forged-brass body, globe pattern, and general-purpose solenoid enclosure with 120-V, continuous-duty coil
- C. Electronic Timers: 150-second and 5-minute ranges, with infinite adjustment over full range, and mounted in cabinet with hand-off-auto switches and status lights
- D. Chemical Tubing: Schedule 80, PVC with solvent-cement joints; or polypropylene tubing with heat fusion
- E. Plastic Ball Valves: Rigid PVC or CPVC body, integral union ends, and polytetrafluoroethylene seats and seals
- F. Plastic-Body Strainer: Rigid PVC or CPVC with cleanable stainless-steel strainer element
- G. Recommended Chemical Service Providers. TRS, INC. G2 Solutions

PART EXECUTION

2.05 INSTALLATION

- A. Report system volume to DPS HVAC/Water Treatment
- B. Install treatment equipment level and plumb.
- C. Add cleaning chemicals as recommended by manufacturer.
- D. Coordinate sub-metering of water at the following locations: cooling tower makeup water, cooling tower bleed water.
- E. All cleaning and disinfecting of piping shall be witnessed by the engineer and the DPS.
- F. Provide a minimum of 4 hours of training for DPS maintenance personnel. The training shall take place in four 4-hour sessions and shall include step by step instructions for testing and administering the water treatment systems.
 - 1. The training shall include job logs for each school/facility where water treatment has been installed. Job logs shall contain reproducible log pages for maintenance staff use. Log shall also be provided in electronic format utilizing the latest version of Word or Excel software.
 - 2. Open side of systems: Provide one (1) report per month during operating period.
- G. The mechanical contractor shall determine the system volume by the use of a flow meter or volumetric dye testing. The volume of each system shall be recorded in the O & M Manual. System volume will be used to determine the amount of chemical quantities for the systems.

END OF SECTION 23 25 00