

**SECTION 23 25 00  
HVAC WATER TREATMENT**

SPEC WRITER NOTES:

1. Delete between // // if not applicable to project. Also delete any other item or paragraph not applicable in the Section and renumber the paragraphs.
2. References to pressure in this section are gauge pressure unless otherwise noted.
3. Provide the year of latest edition to each publication given in paragraph APPLICABLE PUBLICATIONS.
4. All cooling tower water treatment shall be coordinated with the facilities Cooling Tower Policy.

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- B. This section specifies cleaning and treatment of circulating HVAC water systems, including the following.
  1. Cleaning compounds.
  2. Chemical treatment for closed loop heat transfer systems.
  3. Chemical treatment for open loop systems.
  4. Glycol-water heat transfer systems.

**1.2 RELATED WORK**

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.
- D. //Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.//
- E. //Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.//
- F. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.
- G. //Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.//
- H. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.
- I. Section 23 21 13, HYDRONIC PIPING.
- J. Section 23 22 13, STEAM and CONDENSATE HEATING PIPING.

**1.3 APPLICABLE PUBLICATIONS**

SPEC WRITER NOTES:

1. Make material requirements agree with requirements specified in the

referenced Applicable Publications. Verify and update the publication list to that which applies to the project unless the reference applies to all HVAC systems. Publications that apply to all HVAC systems may not be specifically referenced in the body of the specification but shall form a part of this specification.

2. Insert the year of approved latest edition of the publications between the brackets // // and delete the brackets if applicable to this project.
- A. The publication listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standards will govern.
  - B. American Society of Mechanical Engineers (ASME):  
ASME Boiler and Pressure Vessel Code (BPVC):  
BPVC Section VIII-//2021// Rules for Construction of Pressure Vessels, Division 1
  - C. American Society for Testing and Materials (ASTM):  
A666-//2015//.....Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar  
F441/F441M-//2020//.....Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80
  - D. National Fire Protection Association (NFPA):  
70-//2020//.....National Electric Code (NEC)
  - E. Department of Veterans Affairs (VA):  
ES-2019-01.....Cooling Tower Water Systems Policy

#### **1.4 SUBMITTALS**

- A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION XX XX XX, SECTION TITLE", with applicable paragraph identification.
- C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights,

materials, applications, standard compliance, model numbers, size, and capacity.

1. Cleaning compounds and recommended procedures for their use.
2. Chemical treatment for closed systems, including installation and operating instructions.
3. Chemical treatment for open loop systems, including installation and operating instructions.
4. Glycol-water system materials, equipment, and installation.

D. Water analysis verification.

E. Materials Safety Data Sheet for all proposed chemical compounds, based on U.S. Department of Labor Form No. L5B-005-4.

SPEC WRITER NOTE: Coordinate O&M Manual and commissioning requirements with Section 01 00 00, GENERAL REQUIREMENTS and Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS. O&M Manuals shall be submitted for content review as part of closeout documents.

F. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replaceable parts, and troubleshooting guide:

1. Include complete list indicating all components of the systems.
2. Include complete diagrams of the internal wiring for each item of equipment.
3. Diagrams shall have their terminals identified to facilitate installation, operation, and maintenance.

G. //Completed System Readiness Checklist provided by the CxA and completed by the contractor, signed by a qualified technician, and dated on the date of completion, in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.//

H. //Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING of HVAC SYSTEMS.//

### **1.5 QUALITY ASSURANCE**

SPEC WRITER NOTE: The designer shall consult with local water treatment specialists to determine the appropriate water treatment strategy for the HVAC systems included in the project.

A. Refer to paragraph QUALITY ASSURANCE in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

SPEC WRITER NOTE: Evaluate the extent of technical services on a case by case basis.

B. Technical Services: Provide the services of an experienced water treatment chemical engineer or technical representative to direct flushing, cleaning, pre-treatment, training, debugging, and acceptance testing operations; direct and perform chemical limit control during construction period and monitor systems for a period of 12 months after acceptance, including not less than 6 service calls and written status reports. Emergency calls are not included. //During this period perform monthly tests of the cooling tower for Legionella pneumophila and Heterotrophic Plate Count (HPC). Submit reports stating Legionella bacteria count per millimeter. These tests shall be conducted in a certified laboratory and not by a technician in the field.// Minimum service during construction/startup shall be 6 hours.

SPEC WRITER NOTE: Delete following paragraphs C and D when no cooling tower water treatment is required.

C. //Field Quality Control and Certified Laboratory Reports: During the 1-year guarantee period, the water treatment laboratory shall provide not less than 12 reports based on onsite periodic visits, as stated in above paragraph Technical Services, sample taking and testing, and review with VA personnel, of water treatment control for the previous period. In addition to field tests, the water treatment laboratory shall provide certified laboratory test reports. These monitoring reports shall assess chemical treatment accuracy, scale formation, fouling and corrosion control, and shall contain instructions for the correction of any out-of-control condition.//

D. //Log Forms: Provide 1-year supply of preprinted water treatment test log forms.//

E. Chemicals: Chemicals shall be non-toxic approved by local authorities and meeting applicable EPA requirements.

F. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specification section. For more information regarding the product categories covered by the Bio-Preferred Program, visit <http://www.biopreferred.gov>.

- G. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

#### **1.6 AS-BUILT DOCUMENTATION**

- A. Comply with requirements in paragraph AS-BUILT DOCUMENTATION of Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

### **PART 2 - PRODUCTS**

#### **2.1 CLEANING COMPOUNDS**

- A. Alkaline phosphate or non-phosphate detergent/surfactant/specific to remove organic soil, hydrocarbons, flux, pipe mill varnish, pipe compounds, iron oxide, and like deleterious substances, with or without inhibitor, suitable for system wetted metals without deleterious effects.
- B. All chemicals to be acceptable for discharge to sanitary sewer.
- C. Refer to Section 23 21 13, HYDRONIC PIPING and Section 23 22 13, STEAM and CONDENSATE HEATING PIPING, PART 3, for flushing and cleaning procedures.

#### **2.2 CHEMICAL TREATMENT FOR CLOSED LOOP SYSTEMS**

- A. Inhibitor: Provide sodium nitrite/borate, molybdate-based inhibitor or other approved compound suitable for make-up quality and make-up rate and which will cause or enhance bacteria/corrosion problems or mechanical seal failure due to excessive total dissolved solids. Shot feed manually. Maintain inhibitor residual as determined by water treatment laboratory, taking into consideration residual and temperature effect on pump mechanical seals.
- B. pH Control: Inhibitor formulation shall include adequate buffer to maintain pH range of 8.0 to 10.5.
- C. Performance: Protect various wetted, coupled, materials of construction including ferrous, red and yellow metals. Maintain system essentially free of scale, corrosion, and fouling. Corrosion rate of following metals shall not exceed specified mills per year penetration; ferrous, 0-2; brass, 0-1; copper, 0-1. Inhibitor shall be stable at equipment skin surface temperatures and bulk water temperatures of not less than 121 degrees C (250-degrees F) and 52-degrees C (125-degrees F) respectively. Heat exchanger fouling and capacity reduction shall not exceed that allowed by fouling factor 0.0005.
- D. Pot Feeder: Bypass type, complete with necessary shutoff valves, drain and air release valves, and system connections, for introducing chemicals into system, cast-iron or steel tank with funnel or large

opening on top for easy chemical addition. Feeders shall be 18.9 L (5 gallon) minimum capacity at 860 kPa (125 psig) minimum working pressure.

SPEC WRITER NOTE: The designer shall increase the pump capacity by 5 percent while selecting the pump.

- E. Side Stream Water Filter for Closed Loop Systems: Stainless-steel housing, and polypropylene filter media with //polypropylene// //stainless-steel// core. Filter media shall be compatible with antifreeze and water treatment chemicals used in the system. Replaceable filter cartridges for sediment removal service with minimum 20 micrometer particulate at 98 percent efficiency for approximately 5 percent of system design flow rate. Filter cartridge shall have a maximum pressure drop of 13.8 kPa (2 psig) at design flow rate when clean, and maximum pressure drop of 172 kPa (25 psig) when dirty. A constant flow rate valve shall be provided in the piping to the filter. Inlet and outlet pressure gauges shall be provided to monitor filter condition.

SPEC WRITER NOTES:

1. Provide water treatment for all condenser water systems. The type and configuration of the system shall be based on actual water samples obtained by the local VA facility. Coordinate with facilities Cooling Tower Management Plan.
2. All water treatment shall be based on measured levels of biocides. Dosing based on water flow is prohibited.

### **2.3 CHEMICAL TREATMENT FOR OPEN LOOP SYSTEM(S)**

#### **A. General:**

1. A factory-fabricated and tested packaged, self-contained, chemical feed/blowdown monitoring, controlling, recording and alarming system, containing all except specified or indicated remote components, and requiring only terminal sample stream and chemical piping/tubing connections, remote component electrical connection and power supply.
2. System shall be suitable for a broad spectrum make-up water supply and chemical treatment program. Components, except those specified or indicated otherwise, shall be housed in one or more joined or divided steel enclosures.

3. System shall be integrated into the campus Direct-Digital Control System for HVAC for trending and alarms. Refer to Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

B. System Functions:

1. Automatically maintain a predetermined, selectable, total dissolved solids concentration through a continuously monitoring conductivity controller, maintain a predetermined, selectable, scale/corrosion inhibitor and dispersant residual, through a continuously make-up monitoring meter/counter/timer and inhibitor/dispersant ratio controller; achieve a predetermined, selectable, peak concentration of 1 or 2 microbiocides as needed on an alternating basis, through a programmable timer controller. De-energize controller or stagger feed chemicals that would degrade or could be incompatible if fed simultaneously.
2. Automatically maintain a predetermined, selectable, pH level through a continuously monitoring pH controller. For systems with make-up water alkalinity in excess of 125 PPM or hardness above 300 PPM, provide acid feed limit timer and audible/visual alarm actuated on low pH.
3. Monitoring and Data Collection:
  - a. The water treatment system shall monitor the following conditions and report to the building control system:
    - 1) Biocide levels.
    - 2) Water chemistry including pH and conductivity.
    - 3) Corrosion inhibitor levels.
  - b. All conditions shall be trended on an hourly basis.

C. Main Control Panel and Accessories:

1. Housed in a NEMA Type 4X enclosure:
  - a. Hinged key lock door with viewing window.
  - b. Hard wire connected to power source.
  - c. Provide minimum of 3 115V, 1 Ph, 60 Hz receptacles located on enclosure for electrical connection and control of chemical pumps.
  - d. Prewired for ease of installation.
2. Provide an external combination mounted flow switch with transparent sight tube.
  - a. Disable control outputs upon loss of water flow to prevent chemical feeding.

- b. Provide complete with 3/4 inch connections and combination conductivity and temperature electrode.
- 3. Keypad or Remote Control: Access all measurements and set points through chemical resistant keypad or remote.
  - a. Security code to prevent unauthorized access.
- 4. Utilize microprocessor technology.
- 5. Menu driver programs.
- 6. Liquid crystal display (LCD).
- 7. Provide temperature corrected measurements by reading water temperature and adjusting conductivity values according to known temperature curve.
  - a. Range: 0 - 100 degrees C (32 - 212 degrees F) with an adjustable high alarm.
- 8. Provide real-time clock.
- 9. Conductivity Monitor:
  - a. Provide linear measurements of full range.
  - b. Provide 2 scales for selection of high and low in field to assure accurate measurements.
  - c. Provide increments of 1 micro ohm/cm with adjustable hysteresis.
  - d. Provide bleed-off control in following manner:
    - 1) Standard operation-controller actuates a bleed-off solenoid valve when dissolved solids level is exceeded by trip point.
    - 2) Provide an adjustable bleed limit timer to prevent excessive bleed-off.
    - 3) An alarm contact shall close when timer has timed out.
- 10. Biocide Operation:
  - a. Provide a programmable 28-day biocide timer for accurate addition of algaecide.
  - b. Provide a secondary bleed-off timer to lower conductivity in system prior to biocide feed.
  - c. Lockout cooling water bleed-off during biocide feed period.
- 11. Chemical Feed Control: Provide 3 timers that are capable of operating in one of following field programmable modes.
  - a. Counter-timer-chemical feed proportioned to make-up water rate.
    - 1) Controller shall send low voltage signal to a contacting head water meter.
    - 2) Low voltage signal will ensure long contact life.
    - 3) Water meter shall read in gallons.



SPEC WRITER NOTE: Coordinate with facility to determine if UV equipment is a requirement.

12. //UV Biocide Equipment:
  - a. Target Irradiation: Minimum //5,000// // // micro Wxs/sq. cm.
  - b. Light Source Vessels:
    1. ASTM A666, Type 304 stainless-steel.
    2. Construct for minimum //1034 kPa (150 psig)// // // at //65 degrees C (150 degrees F)// // // in accordance with ASME BPVC Section VIII and equipped with pressure-relief valve.
    3. Light Source Sleeve: Quartz, with EPDM O-ring seals.
    4. Light Source: Replaceable UV lamp producing minimum target irradiation of 254-nm wavelength light.
  - c. Controls: Interlock with pumps to operate when water is circulating.//
13. Alarms: Provide alarm LEDs with silence button for high and low conductivity, 10 - 60 minute bleed-off, chemical feed limit timers, and chemical drum level. Provide remote output relay to indicate alarm condition to Building Control System specified under Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.
14. Controller Operating Data History:
  - a. Retain in memory all operating data for following parameters:
    - 1) Standard memory shall allow acquisition and storage of all analog inputs for a 1 week period.
    - 2) A 3-hour minimum, maximum average of all conditions shall be stored for a 1 week period.
    - 3) A minute-by-minute account of operating conditions shall be available for latest 3-hour period.
15. Electrode: Combination temperature and conductivity type.
  - a. Quick disconnect.
  - b. Supplied in flow switch assembly.
16. pH Monitor:
  - a. Sensor for monitoring purposes only.
  - b. Acid shall not be used to control pH.
17. //Remote Communication: Provide open protocol BACnet/IP interface to perform the following functions:
  - a. Access real-time system values.
  - b. Change operating parameters.

- c. Controller diagnostics.
  - d. Obtain history files.
  - e. Alarm condition notification.//
- D. Impulse Water Meter:
- 1. General:
    - a. Measure in gallons.
    - b. Sized to meter peak make-up rates.
    - c. Equipped with an electrical contacting register.
    - d. Totalize flow at main control panel.
  - 2. Provide at following locations:
    - a. Cooling tower make-up line.
    - b. //Cooling tower bleed-off-line.//
- E. Provide CPVC injection nozzles, ASTM F441/F441M with corporation stop to inject chemical into main circulating water line.
- 1. Pressure Rating: 689 kPa (100 psig).
  - 2. Size: DN19 (3/4 inch) NPT.
  - 3. Quantity: 3.
- F. Provide chemical feed pumps operated by a 115V, 60 cycle, single PH motor.
- 1. Provide separate stroke and stroke frequency setting capabilities.
  - 2. Positive Displacement Type Pump:
    - a. Provide with anti-siphon/pressure relief valve installed on pump head which provides anti-siphon protection and aids in priming under pressure.
    - b. Capacity: As determined by Water Treatment Vendor.
    - c. Complete with discharge check valves, foot valves, polyethylene suction and discharge tubing.
  - 3. Quantity: Provide 1 pump for each chemical provided.
- G. Bleed-off Piping Assembly:
- 1. Inlet shutoff valve.
  - 2. Wye strainer.
  - 3. Strainer blowdown valve.
  - 4. Throttling valve.
  - 5. Brass solenoid valve compatible with main control panel.
  - 6. Assembly shall be sized by water treatment vendor.

SPEC WRITER NOTE: Utilize the pallet dimensions below to determine floor space required for chemical treatment drums. 2 pallets are required. Maintain access in

front of pallets to allow replacement of drums and proper service.

- H. Secondary Containment Spill Pallets for Chemical Drums:
1. Material: Polyethylene.
  2. Capacity: 250 L (66 gallons) each.
  3. Dimensions Each: DN135 (53 inches) length X DN74 (29 inches) wide X DN43 (17 inches) high.
  4. Provide each pallet with grating and drain plug.
  5. Provide 1 portable loading ramp.
  6. Quantity: 2.
- I. Provide liquid level switch assemblies with a CPVC bung hole adapter, ASTM F441/F441M, to mount directly into 200 L (53 gallons) chemical drum bung hole.
1. Interface with main control panel.
  2. Quantity: 3.
- J. Corrosion Monitor Rack:
1. Materials: Corrosion resistant.
  2. Construction: ASME standards.
  3. Number of coupons: 4.
  4. Coupon Holders: quick disconnect type.
- K. Provide test kits for monitoring inhibitor levels, total dissolved solids, chlorides, alkalinity and closed system inhibitors.

SPEC WRITER NOTE: For small systems (single towers/coolers, less than 50 tons), an erosion type chemical feeder may be desired instead of using liquid bromine or chlorine. Bromine and chlorine are popular types of biocide. Although bromine or chlorine tablets are more expensive than liquid, the labor and maintenance costs are less. Verify with Owner and Owner's Water Treatment Vendor if an erosion chemical feeder is desired. If used, only 2 of the 3 liquid chemical feed pumps will likely be used. The third pump can be delivered to the Owner as spare parts if not connected.

- L. //Erosion Chemical Feeder:
1. Completely enclosed.
  2. Materials: Corrosion resistant.
  3. External, non-clog inlet control valve.
  4. Bottom drain valve.
  5. Inlet and outlet connections to allow for recirculating water.

6. Suitable for use with chlorine or bromine tablets.//
- M. Provide 1 year's supply of chemical treatment including quantity of chemicals necessary to chemically treat system to control scale, and corrosion and biological fouling. Provide water treatment products that perform the following:
1. Inhibitor to protect against corrosion and scale formation.
  2. 2 liquid biocides for prevention of slime, bacteria, and algae.
  3. Chromate based chemicals are prohibited.
  4. Water treatment chemicals to remain stable throughout operating temperature range.
  5. Compatible with pump seals and other elements in the systems.
- SPEC WRITER NOTE: Although pH is monitored, chemical is typically not added to reduce pH. This requires the use of acids, which many Owners and chemical suppliers avoid due to safety concerns. As a result, cooling tower systems typically operate at a higher pH (8 - 9) than they have in the past. This is one of the reasons stainless-steel and fiberglass cooling towers have increased in popularity.
6. //Maintain required pH balance to prevent precipitation and/or breakdown of circulating fluid.//
  7. //Where analysis justifies addition of pH control, provide alteration of chemical formulation.//
- N. Chemicals: Except for acid, provide sufficient chemicals for startup and testing and 12 months operation from date of project acceptance.
1. Scale/corrosion Inhibitor: Provide a concentrated liquid organic corrosion/scale/fouling inhibiting formation without phosphates, chromates, zinc and other materials in excess of allowable, local, effluent limits. Feed automatically. Maintain residual as determined by water treatment laboratory.
  2. Dispersant: Provide a concentrated liquid organic/polyelectrolyte formulation. Feed automatically. Maintain residual as determined by water treatment laboratory.
  3. pH Control: Depending upon local water conditions, provide 60 or 66 degree Baume technical grade, concentrated sulfuric acid for acidic treatment or sodium hydroxide (NaOH) for basic treatment to maintain pH in the range of 7.0 to 8.0 automatically. Provide 1 initial 47 L

- (12.5 gallon) carboy of acid or base and one spare carboy of acid or base, if required.
4. Microbiocides: Provide 2 different, 1 oxidizing and 1 non-oxidizing, concentrated algaecide-biocide formations containing no heavy metals and which are effective at maximum encountered pH. Alternate solutions as needed to effectuate selective kill without buildup of immunity. Period treatment with a chlorine releasing agent is permissible within allowable, local, effluent limits. Feed automatically. Develop peak concentration and maintain for minimum period as determined by water treatment laboratory.
  5. All chemicals to be acceptable for discharge to sanitary sewer.
- O. Water Analysis: Confirm raw water analysis or provide analysis if none is furnished.
1. Description Year (Avg.) \_\_\_\_\_
  2. Silica (SiO<sub>2</sub>) \_\_\_\_\_
  3. Iron & Aluminum \_\_\_\_\_
  4. Calcium (Ca) \_\_\_\_\_
  5. Magnesium (Mg) \_\_\_\_\_
  6. Sodium (Na) & Potassium (K) \_\_\_\_\_
  7. Carbonate (CO<sub>3</sub>) \_\_\_\_\_
  8. Bicarbonate (HCO<sub>3</sub>) \_\_\_\_\_
  9. Sulfate (SO<sub>4</sub>) \_\_\_\_\_
  10. Chloride (Cl) \_\_\_\_\_
  11. Nitrate (NO<sub>3</sub>) \_\_\_\_\_
  12. Turbidity \_\_\_\_\_
  13. pH \_\_\_\_\_
  14. Residual Chlorine \_\_\_\_\_
  15. Total Alkalinity \_\_\_\_\_
  16. Non Carbonate Hardness \_\_\_\_\_
  17. Total Hardness \_\_\_\_\_
  18. Dissolved Solids \_\_\_\_\_
- P. Conduct performance test to prove capacity and performance of treatment system.
1. Raw water total hardness, PPM
  2. Concentration cycles
  3. Raw water, pH
  4. System water, pH
  5. Chemical solution used

6. Acid solution used
7. Quantity of chemical solution injected into system per cycle
8. Quantity of acid injected into system per cycle
9. Make-up water required
10. Waste to drain requirement

Q. Centrifugal Solid Separator:

1. Material: The separator shall be fabricated of carbon steel with shell material and head material of 3.4 mm (0.135 inch) wall or heavier. Maximum operating pressure shall be 10.3 bar (150 psi), unless specified otherwise.
2. Finish: Paint coating shall be acrylic urethane, sprayon, and royal blue.
3. Performance: The removal of solids from a pumped/pressurized liquid system shall be accomplished with a centrifugal-action vortex separator. Solids removal efficiency is principally predicated on the difference in specific gravity between the solids and the liquid. Single pass test performance shall be less than 95 percent removal of solids 74 microns and larger. Pressure loss shall be between 0.3 - 0.8 Bar (5 - 12 psi).
4. Purging: Evacuation of separated solids shall be accomplished automatically, employing a timer-activated motorized ball valve. Straight-through valve design, with bronze valve body and stainless-steel ball in a Teflon seat. NEMA 4 housing for indoor and outdoor installation. Valve size: 50 mm (2 inch).
5. //Provide a differential pressure sensor interface with DDC system.//

R. Chemical Treatment System Piping and Valves:

1. Schedule 80 CPVC and fittings. Pipe size shall be 25 mm (1 inch) unless otherwise shown.
2. Ball Valves: CPVC type.

**2.4 GLYCOL-WATER SYSTEM**

SPEC WRITER NOTE: Specify propylene glycol for all glycol systems.

- A. Propylene glycol shall be inhibited with 1.75 percent dipotassium phosphate. Do not use automotive antifreeze because the inhibitors used are not needed and can cause sludge precipitate that interferes with heat transfer.

- B. Provide required amount of glycol to obtain the percent by volume for glycol-water systems as follows and to provide 1/2 tank reserve supply:  
 //25// // // percent for //run-around coil systems// //chilled water system// //hydronic system//.

SPEC WRITER NOTE: For small glycol-water systems a pot feeder may be used for make-up rather than a tank/pump system.

- C. //Pot Feeder Make-up Unit: Bypass type for chemical treatment, schedule 3.5 mm (10 gauge) heads, 19 mm (3/4 inch) system connections and large neck opening for chemical addition. Feeders shall be 18.9 L (5 gallon) minimum size.//

D. Glycol-Water Make-up System:

1. Glycol-Water Storage Tank: Self-supporting polyethylene, minimum 90 mil thickness, with removable cover or black steel with 90 mil polyethylene insert. Capacity shall be 213 L (56 gallons), with approximate diameter of 584 mm (23 inches) and height of 914 mm (36 inches). Reinforced threaded pipe connections shall be provided for all connections. Provide identification for tank showing name of the contents.
2. Glycol-Water Make-up Pump: Bronze fitted, self-priming, high head type suitable for pumping a 33 percent to 50 percent glycol-water solution in intermittent service. The pump shall be provided with a mechanical shaft seal and be flange connected to a 1750 rpm NEMA Type C motor. The pump capacity shall be // 11 L/m (3 gpm)// // // //345 kPa (50 psig)// // // discharge pressure with a suction lift capability of 127 mm (5 inches) of mercury, with a //2.5 kW (1/3 horsepower)// // // drip-proof motor. The pump shall be a "gear-within-a-gear" positive displacement type with built-in relief valve set for //296 kPa (43 psig)// // //, or the pump shall be a regenerative turbine type providing self-priming with built-in or external relief valve set for design head of the pump.
3. Back Pressure Regulating Valve: Spring loaded, diaphragm actuated type with bronze or steel body, stainless-steel trim with capacity to relieve 100 percent of pump flow with an allowable rise in the regulated pressure of 69 kPa (10 psig) above the set point. Set point shall be 103 kPa (15 psig) above system PRV setting.
4. Low Water Level Control: Steel or plastic float housing, stainless-steel or plastic float, positive snap-acting SPST switch

mechanism, rated 10 amps-120 volt AC, in General Purpose (NEMA 1) enclosure. The control shall be rated for pressures to 1034 kPa (150 psig) and make alarm circuit on low water level. The alarm circuit shall be wired to an alarm light on the nearest local Temperature Control panel (LTCP). //Provide remote output relay to indicate alarm condition at the Building Control System specified under Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.//

## **2.5 EQUIPMENT AND MATERIALS IDENTIFICATION**

- A. Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

## **PART 3 - EXECUTION**

SPEC WRITER NOTE: Verify that electrical drawings show a circuit to the control panel and calls for wiring to blowdown valve and water meter.

### **3.1 INSTALLATION**

- A. If an installation is unsatisfactory to the COR, the contractor shall correct the installation at no additional cost or time to the Government.
- B. Delivery and Storage: Deliver all chemicals in manufacturer's sealed shipping containers. Store in designated space and protect from deleterious exposure and hazardous spills.
- C. Install equipment furnished by the chemical treatment supplier and charge systems according to the manufacturer's instructions and as directed by the Technical Representative.
- D. Refer to Section 23 21 13, HYDRONIC PIPING for chemical treatment piping, installed as follows:
1. Provide a bypass line around water meters and bleed off piping assembly. Provide ball valves to allow for bypassing, isolation, and servicing of components.
  2. Bleed off water piping with bleed off piping assembly shall be piped from pressure side of circulating water piping to a convenient drain. Bleed off connection to main circulating water piping shall be upstream of chemical injection nozzles.
  3. Provide piping for the flow assembly piping to the main control panel and accessories.
    - a. The inlet piping shall connect to the discharge side of the circulating water pump.
    - b. The outlet piping shall connect to the water piping serving the cooling tower downstream of the heat source.



- c. Provide inlet Y-strainer and ball valves to isolate and service main control panel and accessories.
- 4. Install injection nozzles with corporation stops in the water piping serving the cooling tower downstream of the heat source.
- 5. Provide piping for corrosion monitor rack per manufacturer's installation instructions. Provide ball valves to isolate and service rack.
- 6. //Provide piping for erosion chemical feeder per manufacturer's installation instructions. Provide ball valves to isolate and service feeder.//
- 7. Provide installation supervision, startup and operating instruction by manufacturer's technical representative.
- E. Before adding cleaning chemical to the closed system, all air handling coils and fan coil units shall be isolated by closing the inlet and outlet valves and opening the bypass valves. This is done to prevent dirt and solids from lodging the coils.
- F. UV-Irradiation Unit Installation: Install UV-Irradiation units on concrete bases level and plumb. Maintain manufacturer's recommended clearances. Arrange units, so controls and devices that require servicing are accessible. Anchor mineral and brine tanks and floor-mounting accessories to substrate.
- G. Do not valve in or operate system pumps until after system has been cleaned.
- H. After chemical cleaning is satisfactorily completed, open the inlet and outlet valves to each coil and close the bypass valves. Also, clean all strainers.
- I. Perform tests and report results in accordance with Section 01 00 00, GENERAL REQUIREMENTS.
- J. After cleaning is complete, and water pH is acceptable to manufacturer of water treatment chemical, add manufacturer recommended amount of chemicals to systems.

### **3.2 STARTUP AND TESTING**

- A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

- B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.
- C. //The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the COR and CxA. Provide a minimum notice of 10 working days prior to startup and testing.//

**3.3 //COMMISSIONING**

- A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.
- B. Components provided under this section of the specification will be tested as part of a larger system.//

**3.4 DEMONSTRATION AND TRAINING**

SPEC WRITER NOTE: Training requirements shall be coordinated with the total building commissioning effort.

- A. Provide services of manufacturer's technical representative for //4//  
// // hour//s// to instruct each VA personnel responsible in operation and maintenance of the system.
- B. //Submit training plans and instructor qualifications in accordance with the requirements of Section 23 08 00, COMMISSIONING OF HVAC SYSTEMS.//

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