SECTION 23 25 00 - HVAC WATER TREATMENT

PART 1 -GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. HVAC water-treatment systems.
2. Chemical treatment test equipment.
3. HVAC water-treatment chemicals.

1.2 PERFORMANCE REQUIREMENTS

A. Water quality for HVAC systems shall minimize corrosion, scale buildup, and biological growth for optimum efficiency of HVAC equipment without creating a hazard to operating personnel or the environment.

B. Base HVAC water treatment on quality of water available, HVAC system equipment material characteristics and functional performance characteristics.

C. Provide temporary water treatment for chilled, hot and condenser water until facility has final connections.

D. After connection to the Central Utilities Plant direct connected systems (chilled water and low temperature hot water), those systems will be treated from the Central Plant. Provide ongoing annual water treatment for the hot water heating system. Treatment shall consist of monthly site visits with analysis of water conditions and adjustment of chemical treatment to maintain specified levels. In glycol systems, glycol concentration, inhibitors and reserve alkalinity, as recommended by the glycol manufacturer.

E. Closed hydronic systems, including low temperature, hot-water heating, chilled water and glycol cooling and/or heating, shall have the following water qualities:

1. pH: Maintain a value within 8.8 to 9.5.
2. Turbidity: Maintain a value less than 15 NTU.
3. Boron: Maintain a value within 100 to 200 ppm. (Glycol system) and less than 10 ppm for the closed hydronic system.
4. Soluble Copper: Maintain a maximum value of 0.20 ppm.
5. TDS: Maintain a maximum value of 3000 ppm.
6. Ammonia: Maintain a maximum value of 5 ppm.
7. Free Caustic Alkalinity: Maintain a maximum value of 20 ppm.
8. Microbiological Limits:
    a. Total Aerobic Plate Count: Maintain a maximum value of 1000 organisms/ml.
    b. Total Anaerobic Plate Count: Maintain a maximum value of 100 organisms/ml.

c. Nitrate Reducers: Maintain a maximum value of 100 organisms/ml.

d. Sulfate Reducers: Maintain a maximum value of 0 organisms/ml.

e. Iron Bacteria: Maintain a maximum value of 0 organisms/ml.

9. Treatment:

a. Low temperature hot water, closed cooling and chilled water - Mixture of sodium nitrite, borax and molybdate with other copper alloy inhibitor. For the chilled water a non-nitrite program of phosphate, polymer borate and copper alloy inhibitors: non-oxidizing, non-cationic biocide.

b. Glycol low temperature – Ethylene glycol with buffered phosphate based corrosion inhibitor with copper alloy inhibitor in deionized water, if water chloride levels are 750 ppm and contains hard water ions.

F. Open hydronic systems, including condenser water, shall have the following water qualities:

1. pH: Maintain a value within 7.0 to 9.0.

2. Langelier Saturation Index: Maintain a maximum value of +2.5 ppm.

3. Soluble Copper: Maintain a maximum value of 0.20 ppm.

4. Conductivity: Maintain a minimum value of 2400 uhmos. The goal of the plant is to run the highest conductivity possible for water conservation.

5. Ammonia: Maintain a maximum value of 20 ppm.

6. Free "OH" Alkalinity: Maintain a maximum value of 0 ppm

7. Silica: Maintain a maximum value of 125 ppm

8. Microbiological Limits:

a. Total Aerobic Plate Count: Maintain a maximum value of 10,000 organisms/ml.

b. Total Anaerobic Plate Count: Maintain a maximum value of 1000 organisms/ml.

c. Nitrate Reducers: Maintain a maximum value of 100 organisms/ml.

d. Sulfate Reducers: Maintain a maximum value of 0 organisms/ml.

e. Iron Bacteria: Maintain a maximum value of 0 organisms/ml.

9. Polymer Testable: Maintain a minimum value within 10 to 40.

10. Treatment: organic phosphonate and polymeric dispersant with copper alloy inhibitor, or other chromate- free treatment in liquid form; suitable for pumping from containers directly to water system.

a. Alternate two biocides, one oxidizer and one non-oxidizer; increase dosage when significant amount of algae or slime are detected after system operations.

11. Bleed off:

a. Automatic control by condenser water conductivity and water meter signals.

b. To maintain maximum chloride concentration at the maximum level possible based on the incoming water quality up to 7 times concentration of make-up water to minimize corrosion and scale formation.

1.3 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for the following products:

1. Water meters.
2. Inhibitor injection timers.
3. pH controllers.
4. TDS controllers.
5. Chemical solution tanks.
6. Injection pumps.
7. Chemical test equipment.
8. Chemical material safety data sheets.

B. Shop Drawings: Pretreatment and chemical treatment equipment showing tanks, maintenance space required, and piping connections to HVAC systems. Include plans, elevations, sections, details, and attachments to other work.

1. Record actual locations of equipment and piping, including sampling points and locations of chemical injectors.
2. Wiring Diagrams: Power and control wiring.

C. Field quality-control test reports to indicate inhibitor levels, pH, conductivity, equipment conditions, chemical inventory and water usage data.

D. Operation and Maintenance Data: For sensors, injection pumps, and controllers to include in emergency, operation, and maintenance manuals.

E. Other Informational Submittals:

1. Water-Treatment Program: Written sequence of operation on an annual basis for the application equipment required to achieve water quality defined in the "Performance Requirements" Article above.
2. Water Analysis: Illustrate water quality available at Project site.
3. Certification of compliance: Submit certificate of compliance from authority having jurisdiction indicating approval of chemicals and their proposal disposal.

1.4 QUALITY ASSURANCE

A. HVAC Water-Treatment Service Provider Qualifications: An experienced HVAC water-treatment service provider with certified water technologists, capable of analyzing water qualities, installing water-treatment equipment.

1.5 MAINTENANCE SERVICE

A. Scope of Maintenance Service: Provide chemicals and service program to maintain water conditions required above to inhibit corrosion, scale formation, and biological growth for cooling, chilled-water piping, heating, hot-water piping, condenser-water piping and equipment. Services and chemicals shall be provided for a period of one year from date of Substantial Completion, and shall include the following:

1. Initial makeup and (and subsequent analysis of water quality changes) system water analysis with HVAC water-treatment recommendations.
2. Startup assistance for Contractor to flush the systems, clean with disinfectant detergents, and initially fill systems with required chemical treatment prior to operation.
3. Minimum 4 hours of on-site training of plant engineers to use water treatment equipment, to handle and administer treatment chemicals.
4. Weekly field service and consultation.
5. Customer report charts and log sheets.
6. Laboratory technical analysis.
7. Analyses and reports of all chemical items concerning safety and compliance with government regulations.
8. Summary review reports with graphs every six months.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following airport wide water treatment vendor:

1. Nalco Company / An Ecolab Company

2.2 AUTOMATIC CHEMICAL-FEED EQUIPMENT

A. Inhibitor Injection Timers:

1. Microprocessor-based controller with LCD display in NEMA 4X, Type 12 enclosure with gasketed and lockable door. Interface for start/stop and status indication at BAS.
2. Programmable timers with infinite adjustment over full range, and mounted in cabinet with hand-off-auto switches and status lights.
3. Test switch.
4. Hand-off-auto switch for chemical pump.
5. Illuminated legend to indicate feed when pump is activated.
6. Programmable lockout timer with indicator light. Lockout timer to deactivate the pump and activate alarm circuits.

7. LCD makeup totalizer to measure amount of makeup and bleed-off water from two water meter inputs.
8. Timer mode includes: Choice of percent timer, water meter timer, limit timer and 28-day programmable timer.

B. pH Integral Controller:

1. Microprocessor-based controller, 1 percent accuracy in a range from zero to 14 units. Incorporate solid-state integrated circuits and digital LCD display in NEMA 250, Type 12 enclosure with gasketed and lockable door. Interface for start/stop and status indication at BAS.
2. Digital display and touch pad for input.
3. Sensor probe adaptable to sample stream manifold.
4. High, low, and normal pH indication.
5. High or low pH alarm light, trip points field adjustable; with silence switch.
6. Hand-off-auto switch for acid pump.
7. Internal adjustable hysteresis or deadband.

C. Chemical Solution Tanks:

1. Chemical-resistant reservoirs fabricated from high-density opaque polyethylene or higher quality stainless steel, with minimum 110 percent containment vessel.
2. Molded cover with recess for mounting pump.
3. Capacity: Maintain inventory sufficient to meet the system demands

D. Chemical Solution Injection Pumps:

1. Self-priming, positive-displacement; rated for intended chemical with minimum 25 percent safety factor for design pressure and temperature.
2. Adjustable flow rate.
3. Metal and thermoplastic construction.
4. Built-in relief valve.
5. Fully enclosed, continuous-duty, single-phase motor.

E. Chemical Solution Tubing: Polyethylene tubing with compression fittings and joints except ASTM A 269, Type 304, stainless steel for steam boiler injection assemblies.

F. Injection Assembly:

1. Quill: Minimum NPS 1/2 (DN 15) with insertion length sufficient to discharge into at least 25 percent of pipe diameter.
2. Ball Valve: Two-piece, stainless steel.
3. Packing Gland: Mechanical seal on quill of sufficient length to allow quill removal during system operation.

4. Assembly Pressure/Temperature Rating: Minimum 600 psig (4137 kPa) at 200 deg F (93 deg C).
5. Materials of construction: Stainless steel 316, Nickel alloy, Carpenter 20, PVC.

G. Fail-Safes and Alarms

1. Corrosion safety interlock: Alarm indication, lock-out all chemical feed, open bleed-off valve to flush corrosive water from system.
2. PH interlock: Alarm indication, lock-out all chemical feed, open bleed-off valve to reduce total dissolved solids in cooling tower water.
3. Flow interlock (on loss of flow): Alarm indication, lock-out all control outputs and chemical feeds.

H. Low Level Alarms

1. Low level alarm system to monitor chemical solution level in inhibitor, pH modifier (acid or alkali), biocide, and dispersant drums.
2. Alarm probes, suitable current system capacity and connected with flexible cable.
3. Signal output suitable for remote alarm function in addition to local alarm.

2.3 CHEMICAL TREATMENT TEST EQUIPMENT

A. Test Kit: Manufacturer-recommended equipment and chemicals in a wall-mounting cabinet for testing pH, TDS, inhibitor, chloride, alkalinity, phosphate, silica and hardness; oxygen scavenger and testable polymer tests for high-pressure boilers, and oxidizing biocide test for open cooling systems.

B. Sample Cooler:

1. Shell: Cooling water.
   a. Material: ASTM A 666, Type 304 stainless steel.
   b. Pressure Rating: Minimum 250 psig (1725 kPa).
   c. Temperature Rating: Minimum 450 deg F (232 deg C).
2. Capacities and Characteristics:
   a. Tube: Sample.
      1) Flow Rate: 0.25 gpm (0.016 L/s).
      2) Entering Temperature: 400 deg F (204 deg C).
      3) Leaving Temperature: 88 deg F (31 deg C).
      4) Pressure Loss: 6.5 psig (44.8 kPa).
   b. Shell: Cooling water.
      1) Flow Rate: 3 gpm (0.19 L/s).
      2) Entering Temperature: 70 deg F (21 deg C).
      3) Pressure Loss: 1.0 psig (6.89 kPa).

C. Corrosion Test-Coupon Assembly: Constructed of corrosive-resistant material, complete with piping, valves, and mild steel and copper coupons in accordance with ASTM D2688. Locate copper coupon downstream from mild steel coupon in the test-coupon assembly.

1. Two-station rack for closed-loop systems.
2. Two station rack for open systems.

2.4 CHEMICALS

A. Chemicals shall be as recommended by water-treatment system manufacturer that are compatible with piping system components and connected equipment, and that can attain water quality specified herein.

2.5 GLYCOL SYSTEMS – HEATING AND COOLING

A. Use "Environmentally Friendly" glycol.

B. Coordinate compatibility of glycol with materials used in piping, valves, equipment and accessories.

C. Provide glycol feed system.

PART 3 - EXECUTION

3.1 WATER ANALYSIS

A. Perform an analysis of supply water to determine quality of water available at Project site.

3.2 INSTALLATION

A. Install chemical application equipment on concrete bases, level and plumb. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible. Anchor chemical tanks and floor-mounting accessories to substrate.

B. Install seismic restraints for equipment and floor-mounting accessories and anchor to building structure.

C. Install water testing equipment on wall near water chemical application equipment.

D. Install interconnecting control wiring for chemical treatment controls and sensors.

E. Mount sensors and injectors in piping circuits.

F. Install automatic chemical-feed equipment for condenser water and include the following:

1. Install inhibitor injection pumps and solution tanks with injection timer sensing contacts in water meter.

a. Pumps shall operate for timed interval on contact closure at water meter in makeup water supply connection for the heating and chilled water loops only. Pumps for the cooling towers and steam boilers shall operate base on the actual chemistry of the water.

2. Install test equipment and provide test-kit to LAWA. Install test-coupon assembly in bypass circuit around circulating pumps, unless otherwise indicated on Drawings.

3. Install TDS controller with sensor and bleed valves.

a. Bleed valves shall cycle to maintain maximum TDS concentration.

4. Install pH, conductivity and Oxidation-Reduction Potential (ORP) sensors with integral controller, injection pumps and solution tanks.

a. Injector pumps shall operate to maintain required pH and ORP.

5. Install biocide feeder alternating timer with two sets of injection pumps and solution tanks.

a. Injection pumps shall operate to feed biocide on an alternating basis.

G. Install corrosion resistant drip pan, a minimum of 3 in (75 mm) high, under tanks and pumps. Intent is to contain minor leaks.

3.3 CONNECTIONS

A. Install piping adjacent to equipment to allow service and maintenance.

B. Make piping connections between HVAC water-treatment equipment and dissimilar-metal piping with 6 inch long brass nipple for the pipes 1 ½ inch and smaller and dielectric flange for the pipes 2 inch and larger. Dielectric flanges are allowed in the pump and fan rooms only.

C. Install unions, shutoff valves on HVAC water-treatment equipment inlet and outlet.

D. Provide backflow preventers.

E. Provide appropriate equipment grounding.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Install and retrieve corrosion coupons every 90 days to generate quarterly reports on corrosion rates of steel and copper with photographic images of the coupons.

C. Tests and Inspections:

1. Inspect field-assembled components and equipment installation, including piping and electrical connections.
2. Inspect piping and equipment to determine that systems and equipment have been cleaned, flushed, and filled with water, and are fully operational before introducing chemicals for water-treatment system.
3. Place HVAC water-treatment system into operation and calibrate controls during the preliminary phase of HVAC systems' startup procedures.
4. Do not enclose, cover, or put piping into operation until it is tested and satisfactory test results are achieved.
5. Test for leaks and defects. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
6. Leave uncovered and unconcealed new, altered, extended, and replaced water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
7. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow test pressure to stand for four hours. Leaks and loss in test pressure constitute defects.
8. Repair leaks and defects with new materials and retest piping until no leaks exist.

D. Remove and replace malfunctioning units and retest as specified above.

E. At four-week intervals following Substantial Completion, perform separate water analyses on hydronic systems to show that automatic chemical-feed systems are maintaining water quality within performance requirements specified herein. Submit written reports of water analysis advising LAWA of changes necessary.

F. Comply with ASTM D 3370 and with the following standards:

1. Silica: ASTM D 859.
2. Acidity and Alkalinity: ASTM D 1067.
3. Iron: ASTM D 1068.
4. Water Hardness: ASTM D 1126.
5. Chloride: ASTM D4458
6. Copper: ASTM D1688
7. pH: ASTM D5464

3.5 TRAINING

A. Engage a factory-authorized service representative to train LAWA’s Maintenance personnel to adjust, operate, and maintain HVAC water-treatment systems and equipment.

B. Provide a minimum of 12 hours (3 shifts) of classroom and hands on training to LAWA Maintenance personnel on handling and testing of treatment chemicals with "how-to-use" video that details exact operating procedures of equipment.

3.6 FINAL CONNECTION TO SITE UTILITIES

A. Do not circulate any water from the site chilled and high temperature hot water mains until the CUP water treatment contractor has certified the water quality of both sides of the site utility isolation valves.

B. After connection to plant utilities are achieved remove temporary bypass pipes and cap.

END OF SECTION 23 25 00