UNIVERSITY OF MICHIGAN
ARCHITECTURE, ENGINEERING AND CONSTRUCTION

ARCHITECTURE & ENGINEERING
326 East Hoover, Mail Stop B
Ann Arbor, MI 48109-1002
Phone: 734-764-3414
Fax: 734-936-3334

BuildingName
The Description of the Project
P00000000 0000

SPECIFICATION DIVISION 23

NUMBER SECTION DESCRIPTION

DIVISION 23 HEATING, VENTILATING AND AIR CONDITIONING (HVAC)
SECTION 232513 – CHEMICAL WATER TREATMENT, CLOSED LOOP WATER SYSTEMS

END OF CONTENTS TABLE

REV 2026_FEB

DIVISION 23 HEATING, VENTILATING AND AIR CONDITIONING (HVAC)
SECTION 232513 – CHEMICAL WATER TREATMENT, CLOSED LOOP WATER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Related Sections:

1. Section 018113 - Sustainable Design Requirements
2. Section 019110/019100 - Facilities Commissioning
3. Section 220500 - Common Work Results for Mechanical
4. Section 221113 - Piping Materials and Methods
5. Section 220523 - Valves
6. Section 220519 – Thermometers, Pressure Gauges, and Accessories
7. Section 220553 - Mechanical Identification
8. Section 220719 - Mechanical Systems Insulation

1.2 SUMMARY

A. Products specified in this section include the following:

1. Chemical Inhibitors for Water
2. Chemicals for Inhibitors and cleaning
3. Shot Feeder
4. Corrosion Coupon Rack
5. Glycol Feed System
6. Ethylene Glycol

B. Provide a Chemical Services Provider (CSP) to perform the services described below.

C. Provide water treatment products and services including:

1. Chemicals for cleaning, passivation, and treatment of each system.
2. On-going treatment, chemicals, testing, certification, and reports to demonstrate effective water treatment is maintained at all times.
3. Start-up and operation of chemical treatment equipment.

D. Provide a complete chemical water treatment program during construction for all new and reused piping networks. This program shall begin from the point each system is filled during construction and extend until Substantial Completion or final Owner acceptance of each system, whichever occurs later. The program shall include water analysis, chemicals, testing, equipment, consulting and service for the following systems:

1. Heating Hot Water System
2. Chilled Water System
3. Dual Temperature Water System
4. Process Cooling System
5. Glycol System

6. All other closed loop systems

E. Attend project meetings as required to plan, schedule and coordinate above activities with other project contractors and the Owner.

F. Provide recommended testing procedures and chemical treatment schedule for Owner's personnel. This information shall be submitted to the owner in a Program Administration Manual.

1.3 SUBMITTALS

A. Product Data: Include rated capacities; water-pressure drops; shipping, installed, and operating weights; and complete data on furnished products listed below:

1. Shot Feeders
2. Coupon Racks
3. Glycol Feed System
4. Flow Indicators
5. Valves
6. Product specifications and MSDS's for each chemical used
7. Cleaning Procedures
8. Passivation Procedures
9. Chemical Treatment Procedures
10. Shop Drawings

B. Shop Drawings to include detailed equipment assemblies indicating dimensions, weights, loads, required clearances, method of field assembly, components, and the location and size of each field connection as necessary to assist the mechanical contractor with proper system installations

C. Submit resume of water treatment personnel and name of Chemical Services Provider.

D. Service Reports as indicated under Part 2 below.

1.4 QUALITY ASSURANCE

A. Manufacturers and Products: The products and manufacturers specified in this Section establish the standard of quality for the Work. Subject to compliance with all requirements, provide specified products from the manufacturers named in Part 2.

B. Products in this section shall be built, tested, and installed in compliance with the specified quality assurance standards; latest editions, unless noted otherwise.

1. American Society for Testing and Materials (ASTM)
   a. D859 – Test Method for Silica in Water
   b. D1067 – Test Methods for Acidity/Alkalinity in Water
   c. D1068 – Test Methods for Iron in Water
   d. D1126 – Test Method for Hardness in Water
   e. D3370 – Practices for Sampling Water from Closed Conduits
   f. D4012 - Test Method for Adenosine Triphosphate (ATP) Content of Microorganisms in Water
   g. D5465 - Practice for Determining Microbial Colony Counts from Waters Analyzed by Plating Methods

C. Conform to all applicable Codes, Regulations, and Municipal requirements for the use and disposal of chemicals (including cleaning compounds) and waste to public sewer systems.

1. Wastewater shall be discharged to the sanitary sewer only if it has a pH between 5.0 and 10.0 and meets the requirements of the City of Ann Arbor Sewer Use Ordinance. For wastewater not meeting such criteria, contact U-M Occupational Safety and Environmental Health (OSEH) Hazmat at 734-763-4568 for proper disposal instructions. City of Ann Arbor Sewer Use Limitations can be found at the following website: http://www.municode.com/resources/gateway.asp?pid=11782&sid=22 or by contacting U-M OSEH Environmental Protection & Permitting Program (EP3) at 734-936-1920
2. Glycols (of any type) shall not be discharged to the sanitary sewer. Contact U-M OSEH HazMat at 734-763-4568 for proper disposal instructions.

D. Wastewater containing any chemical or sediment is prohibited from discharge to the storm water system. No chemical shall contain Chromates or Inorganic Phosphates.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Package for delivery to best protect finished surfaces while using the least amount of single-use packaging as possible. Deliver equipment and components adequately packaged for lifting, skidding, or rolling into final position, according to manufacturer's instructions. If possible, package and ship products using reusable blankets and fabrics, or reusable cardboard and crate systems.

B. Store materials and equipment raised off the floor on pallets and protected with coverings to prevent damage due to weather and construction activities. Store in areas that prevent damage due to freezing and extreme temperatures or sunlight. Arrange coverings to provide air circulation to avoid damage from condensation or chemical build-up. Protect from damage, dirt and debris at all times.

C. Store chemicals in curb protected area. Such secondary containment areas must have the capacity to hold the volume of the largest container or 10% of the combined containers, whichever larger. If room has no floor drains, then the room itself may be considered sufficient secondary containment. If the room is considered the secondary containment ensure there is a lip at the door so no liquids can exit the room in the event of a leak. Verify field conditions before storing any chemicals

1. Provide temporary containment areas when permanent containment areas do not exist. Remove temporary containment at the end of construction.

1.6 WARRANTY

A. Provide a complete warranty for parts and labor for a minimum of one year from the date of Substantial Completion. This warranty does not include ongoing chemical treatment or monitoring.

1.7 ACCEPTABLE CHEMICAL SERVICE PROVIDERS (CSPS)

A. Approved CSPs

1. Chemtreat
2. Veolia Water
3. Kroff
4. Mitco
5. Nalco
6. Rochester Midland
7. U.S. Water Services

PART 2 - PRODUCTS

2.1 GENERAL

A. CSP Services:

1. The CSP shall provide all cleaning and treatment chemicals, basic services, testing, equipment and materials necessary for a complete water treatment program.
2. The CSP shall perform an analysis of the supply water to determine the type and quantities of chemical treatment needed to maintain the required water quality to prevent corrosion, scaling, and biological growth. The CSP will at minimum provide weekly site visits to verify proper water treatment for the first month after any system or part of a system is treated. Provide monthly visits thereafter, or more often if required to assure performance requirements are being met, to analyze water samples, inspect equipment, and add additional chemicals as required to maintain proper water treatment, until final written Owner acceptance of the respective system.
3. At each site visit CSP shall analyze each system for corrosion inhibitors, pH, total iron, total copper, bacteria levels (provide monthly analytical laboratory analysis), and conductivity; inspect loss from corrosion coupons (provide analytical laboratory analysis every three months), record make-up meter readings, and perform any other tests necessary to validate that corrosion, scale, and organic growth is being prevented.
4. Reports:
   a. Submit a written startup test report for each system placed into service.
   b. A service report shall be prepared on site by the CSP, submitted at the time of each service visit (with copies immediately provided to the Owner and Commissioner), which shall include all required test results and recommendations.
   c. Additionally, provide final reports for approval to the Owner and Commissioner regarding each site service visit, certified by an Officer of the CSP, within one week of any water treatment activity. Such reports shall include the results of any field or lab tests. Reports shall clearly state if the required water quality and maximum corrosion rates are being achieved.
   d. At a minimum, each report shall include the following information:

1) System Treated:
2) Date
3) Conductivity
4) pH
5) Total Iron
6) Total Copper
7) Bacteria(cfu) (monthly analytical laboratory analysis)
8) Coupon Corrosion Rates (three month analytical laboratory analysis)
9) Make-up Water Quantity since Last Visit
10) Corrosion Inhibitor level (ppm)
11) Silica level (ppm)

5. Conduct final on-site system turn over meeting with Owner and Commissioner. Present final validation report demonstrating that performance requirements have been achieved and that each system is currently properly treated.
6. When required by Part 3, train Owner's maintenance personnel in water treatment procedures.
7. Program Administration Manual:
   a. The CSP shall provide the Owner with two (2) Program Administration Manuals including sections covering program control, testing requirements, in plant logs, safety data and system information. Each section shall include the following:
      1) Program Control: Include a complete program outline with chemical descriptions, control ranges, and required action for "out of range" situations. Also include complete ordering instructions with applicable account numbers and phone numbers.
      2) Testing Requirements: This section will include basic testing practices as well as detailed test instructions for each test to be performed.
      3) In-Plant Logs: Include detailed testing log sheets for each system to be tested including room to record one (1) month's data on one (1) sheet and a section to log chemical inventory.
      4) Safety Data: Include the CSP's 24-hour toll free safety hotline number as well as MSDS sheets for each chemical used.
      5) System Information: Include any equipment manuals and related information.

2.2 TREATMENT PROGRAM – FLUSHING AND CLEANING

A. Cleaning chemicals shall be non-phosphate and non-acidic.

B. Flush and clean all new and reused piping.

C. Provide a flush/clean plan for approval. Provide and later remove all temporary bypasses, drains, vents, etc. required to flush and clean the system. Temporary components for flushing and cleaning are not indicated on the drawings.

D. Flush and clean systems per the general procedures specified in Related Sections; clean systems per the approved cleaning procedures submitted under this specification section. Provide and install all required cleaning chemicals.

E. Verify that adequate cleaning chemical was added, that cleaning was effective, and test that cleaning chemicals were properly rinsed from the system. Provide a report certifying that cleaning and rinsing, was properly executed.

F. Provide passivation and chemical treatment immediately after each system has been cleaned and flushed. Systems shall not stand filled with fluids for periods longer than 48 hours without beginning flushing and cleaning which shall immediately be followed by the passivation and chemical treatment procedures.

2.3 TREATMENT PROGRAM – CHEMICAL TREATMENT AND PASSIVATION

A. Provide passivation and chemical treatment per the approved chemical treatment procedures. Chemically treat new and reused piping networks using chemicals and treatment procedures compatible with the system being cleaned and the chemical treatment chemicals in existing piping systems being connected to. Test existing piping systems or otherwise determine chemical treatment in existing piping and validate compatibility. Note that existing systems may be silica based, adjust water treatment program accordingly.

B. When connecting into active existing systems, treat piping networks installed or reused by the project and verify by lab analysis that the treatment levels per the treatment plan have been attained prior to connecting into the existing active system. Submit validating report for approval.

1. Do not connect into existing active system until report is approved by Owner.
2. Provide temporary valves, piping, and accessories as required to treat the project’s piping prior to connection to the active system.

C. Provide passivation/chemical treatment at system startup or immediately upon operation of a system for temporary cooling and heating, whichever comes first.

D. Provide chemical treatment immediately after each system has been cleaned and flushed. Thereafter immediately begin the approved water treatment maintenance program to passivate and prevent corrosion, scale, and organic growth and to maintain treatment chemical levels. Note that systems or parts of systems will not typically be started at the same time; adjust treatment strategy accordingly.

E. Provide chemicals that comply with State and Federal regulations.

F. Chemical inhibitor shall be polymer based and contain azole in an amount appropriate for the percentage of internal copper surface area of the system piping. Provide products with PTSA (p-Toluenesulfonic acid) florescent tracer dyes.

G. Molybdenum is a chemical of concern for future waste water management and may preclude draining systems to the City sanitary sewer. Molybdenum should not be used at all for tracer, inhibitor or otherwise. If Molybdenum is proposed, the project must engage F & O mechanical systems and EHS to understand why it is needed, and to discuss if alternatives are available. Do not use any products that contain Molybdenum without prior approval. Optionally, for hot water heating systems only, nitrite/azole based inhibitors may be used.

H. No chemicals shall contain chromates or inorganic phosphates.

I. Utilize non-oxidizing biocides in the event sterilization is required.

J. Adjust chemical concentrations as required to achieve the required performance

2.4 PERFORMANCE REQUIREMENTS

A. The water treatment programs proposed by the CSP shall maintain corrosion rates below 0.5 mils per year for mild steel and 0.1 mils per year for copper. These rates shall be verified with corrosion coupons provided by the CSP Coupons shall be analyzed in the CSP's analytical laboratory every three months, more often if required, to assure these levels are not exceeded.

B. Microbiological growth levels shall be maintained below 10,000 cfu's aerobic bacteria and 10 cfu's anaerobic bacteria. The CSP shall perform detailed microbiological culturing at the CSP's company's analytical laboratory monthly, more often if required, to assure these levels are not exceeded

2.5 EQUIPMENT

A. Provide all components required for a fully operational water treatment system. Provide components that are not adversely affected by the treatment chemicals employed.

B. Chemical Shot Feeders:

1. Acceptable Manufacturers:
   a. Neptune
2. Provide shot feeders for each system. Provide steel 5-gallon minimum tank with interior and exterior epoxy coating, removable screwed and gasketed top (4" diam. minimum), pipe threaded inlet and outlet, dish bottom style with floor skirt, rated at 200 psi, 200°F.

C. Corrosion Coupon Rack:

1. Acceptable Manufacturers:
   a. Cannon Water Technology
   b. J.L. Wingert
   c. Advantage Controls
   d. Novatech
2. Supply for each corresponding shot feeder:

a. Chilled water: ¾" stainless steel coupon rack, with two coupon holders, inlet/outlet 316 stainless steel full port ball valves, and a ¼" sample valve. Include a 0-5 gpm nominal range variable area flow meter ("rotameter"), rated 150 psig at 70°F, with graduated polysulfone or acrylic cylinder, with an accuracy of +/-5%. Provide mild steel and copper coupons.
b. Heating hot water and dual temperature systems: ¾" stainless steel coupon rack, with two coupon holders, inlet/outlet 316 stainless steel full port ball valves, and a ¼" sample valve. Include a 0-5 gpm nominal range variable area flow meter("rotameter"), rated 100 psig at 250°F, graduated glass cylinder with stainless steel or brass connections, with an accuracy of +/-2%. Provide mild steel and copper coupons.

D. Glycol Feed System:

1. Acceptable Manufacturers:
   a. J.L. Wingert Co.
   b. Neptune Chemical Pump Co.
   c. Advantage Controls Inc.
   d. Wessels Co.
2. Provide a floor mounted packaged glycol feed system that is pre-wired and pre-plumbed, and includes a storage tank, control panel, controls, pump, piping, and valves, all supported on a steel frame.
3. Provide a 50-gallon minimum translucent polyethylene single wall tank with polyethylene cover. Minimum ¼ inch thick walls.
4. Provide a welded steel stand suitable for floor mounting and painted with two coat system consisting of oxide primer and alkyd enamel finish. Provide holes in the base for the installation of anchor bolts and leveling of equipment.
5. Provide a bronze gear pump, 120 V, single phase, and rated for a minimum of 1.5 gpm at 90 psig.
6. Valves and Piping: Pump suction shall include ball valve and Y-strainer. Pump discharge shall include silent check valve, pressure switch, pressure gauge, and 150 psi relief valve piped back to tank. All piping shall be Type L Copper. Connect pump suction and discharge with braided stainless steel or bronze flex connectors. All piping, valves and accessories shall conform to Related Sections.
7. Provide a NEMA 4X control panel with 8 foot, 120 V grounded power cord. Equip the panel with motor starter, 2-position main power switch with light, hand /off/ auto switch with light for gear pump, low level red light, low level audible alarm with push button silence switch, dry contacts for remote monitoring of alarm, and a 15 amp fuse.
8. Provide an adjustable pressure switch, selected with a range to match system operating pressure.
9. Provide electrical components that conform to Division 26 requirements. Provide all wiring in conduit. Loose, exposed or unprotected wire is not acceptable

2.6 PREMIXED INHIBITED ETHYLENE GLYCOL

A. Acceptable Manufacturer and Product:

1. Dow Chemical – Dowtherm SR-1

B. Provide for hydronic systems as indicated on the drawings.

C. Provide inhibited ethylene glycol, factory pre-mixed with water at a concentration of 30% by volume Dowtherm SR1.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Pre-Treatment Conference: Prior to treatment activities, meet with the Project Engineer, Commissioner and contractors to verify treatment procedures, discuss coordination with existing piping networks, and to coordinate treatment activities with construction schedule.

B. Flush and clean systems per Related Sections and Part 2 above.

3.2 INSTALLATION

A. Install all required components, and chemically passivate/treat and maintain the system as described in Part 2.

B. Use and dispose of chemicals and wastewater (including from existing piping networks) per the Quality Assurance section of this specification. All costs of disposal shall be borne by the contractor.

C. Provide and install all chemicals and all incidental components. Install equipment at locations shown on the Drawings. Follow the manufacturer’s installation and startup instructions.

D. Passivate and chemically treat each system immediately after it has been cleaned and flushed.

E. Install shot feeders with openings no higher than 4’ above finished floor. Pipe shot feeder drain to nearest floor drain. Install top coupon of corrosion coupon rack no higher than 6’ above finished floor.

F. The treatment program shall begin at system start-up or immediately upon first operation of the system by the contractor for temporary heating and cooling, whichever comes first. Continue the program until Substantial Completion.

3.3 INSTALLATION OF PREMIXED INHIBITED ETHYLENE GLYCOL SYSTEM

A. Following system flushing and cleaning, drain the entire piping system. Add premixed ethylene glycol/inhibitor solution into the system. Circulate system fluid, adding additional pre-mixed glycol/inhibitor as required until all air is purged from the system.

B. Sample fluid, measure concentration of glycol and inhibitor. Drain system fluid as required and add additional pre-mixed solution to achieve the design concentration of glycol and the manufacturer's recommended concentration of inhibitor. Submit report of activities, including volumes of all fluids used.

3.4 INSTALLATION OF GLYCOL FEED SYSTEM

A. Level and bolt Glycol Feed System to the floor within the containment area. Support all piping and conduits independent of the Glycol Feed Unit.

3.5 FIELD QUALITY CONTROL:

A. The CSP shall:

1. Verify that systems and equipment have been properly cleaned, flushed, and filled with water, and are fully operational before introducing operational chemicals for water-treatment systems.
2. Introduce and maintain chemical treatment to achieve the specified performance requirements.
3. Submit a written startup test report for each system placed into service.
4. Provide validation testing and required reports.
5. Attend final on-site system turn over meeting with Owner and Commissioner. Present final validation report demonstrating that performance requirements have been achieved and that each system is currently properly treated.

3.6 COMMISSIONING:

A. Perform Commissioning activities per Related Sections above.

3.7 OWNER TRAINING

A. CSP shall train Owner's maintenance personnel on equipment operation, adding and maintaining proper chemical levels, trouble-shooting, servicing and preventative maintenance procedures. Do not conduct training until after start up and commissioning is completed. Provide training using documents including the Program Administration Manual and the approved Operations and Maintenance manuals. Provide these documents to the Owner at least two weeks prior to the training to allow sufficient time for review.

1. Provide 2 hours training minimum.

B. Schedule training at least 7 days in advance, at date and time approved by Owner.

END OF SECTION 232513