

## **DIVISION 23 HEATING, VENTILATING AND AIR CONDITIONING**

### **SECTION 23 25 00 – HVAC WATER TREATMENT**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions, Division 01 Specifications, Component Special Conditions, and addenda.

##### **1.2 SUMMARY**

- A. Pre-Operational Cleaning, Passivation, Flushing and Discharge requirements.

#### **PART 2 - PRODUCTS**

##### **2.1 ACCEPTABLE PRODUCTS**

- A. An alkaline detergent, containing emulsifier, dispersant and polyphosphate mixture, is acceptable. Apollo CTW-2000, Apollo AWS-2005, Apollo CTW-7000
- B. Product must be non-nitrite and non-acidic.
- C. Products must be approved by a representative from Texas State University Environmental Health Safety and Risk Management (EHS&RM) office and the City of San Marcos (City). The product must clean the pipe without acid etching or causing a surface conversion or displacement of iron from the pipe.

#### **PART 3 –EXECUTION**

##### **3.1 PIPING CONNECTIONS**

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, valves, etc.

##### **3.2 CHILLED WATER PIPE PRE-OPERATIONAL CLEAN & FLUSH**

A.

###### **1. Flush Procedures**

Procedures for cleaning, passivating, and final treatment of new condenser or chilled/hot water piping for campus distribution piping. Campus distribution piping may include piping that is in the building up to and including heat exchangers and pumps. This procedure has been written assuming that the piping will be hydrotested prior to cleaning, and that there will be some time between hydrotesting and cleaning in which the lines will stay full and blocked. The cleaning/flushing procedures should be

performed as close to commissioning as possible to minimize corrosion. Any deviations to this scope shall be reviewed by the Owner and the Owner's water treatment supplier.

- a. The Mechanical Contractor shall meet with Owner and Owner's water treatment supplier prior to start of cleaning/passivating to review procedures and also circulation routing through the piping.
  - b. Ensure that water that meets water quality specifications for hydrotesting will be used to fill and flush the system. Ensure that backflow prevention is adequate.
  - c. Do not flush or clean the piping through heat exchangers, pumps, cooling coils, air handlers, or any other equipment. Heat exchangers must be bypassed and left dry until the piping has been cleaned and passivated.
  - d. Where permanent strainers are not already in-place, temporary strainers shall be installed in the system to protect chilled water pumps, and to prevent contamination of the existing system from the new chilled water lines. If the air handlers do not have permanent strainers, temporary strainers shall be installed to protect those as well.
  - e. Temporary strainers shall be installed for the flushing sequence that shall collect all debris in the flushing loop. The maximum mesh size for the start of flushing shall be as recommended by the pump manufacturer. Progressively smaller sizes shall be installed as the flushing is performed, with the end point being a 40 mesh screen size. During the flushing procedure, strainers shall be cleaned as often as necessary to remove debris, and, in any event, all strainers shall be cleaned by physically removing the strainer screen from the body of the strainer at the end of the flushing. Replace strainer and gasket after each cleaning of strainer.
  - f. Flush and drain loops to remove debris. Temporary pumps and piping will need to be furnished and installed by contractor to circulate through the new system. The new piping shall not be directly connected to the existing chilled water loop until it has been cleaned and passivated. System shall ultimately be circulated at 10 ft/s. Repeat until strainers are free of large particles. Owner's representatives will make the determination that the system is ready to proceed to the cleaning phase.
2. Cleaning & Passivation Procedures
- a. Ensure that strainers are cleaned prior to adding cleaning chemicals. Check with Owner to determine proper mesh size for strainers.
  - b. Once the system has been readied for the cleaning process, start the circulation pumps and add 2 gallons Apollo CTW-2000 and 2 gallons of Apollo AWS-2005 for every 1000 gallons of system volume.
  - c. Add 2 ounces of Apollo CTW-7000 antifoam per 1000 gallons of system volume.
  - d. Add chemicals using either a metering pump, temporary by-pass pot feeder, or by a vacuum into the suction side of the circulation pump.
  - e. Circulation rate shall be in the range of 3 – 5 ft/s.

- f. After adding chemicals, circulate for a minimum of 24 hours and sample. At this time the Owner's representatives will determine if additional circulation time is needed. Once circulation has started for cleaning, system shall circulate continuously (24 hours/day).
  - g. If necessary, add additional chemicals to meet desired concentration.
  - h. Circulate solution at 3 – 5 ft/s for 24-72 hours.
  - i. Sample cleaning solution. Results will be analyzed and reviewed by Owner's representatives. Circulation shall continue throughout this process.
  - j. When indicated, drain system, refill, sample, and repeat until system is clean. The methodology to determine the end point of the flushing is testing the conductivity, iron level, and phosphate level.
  - k. If intent is to drain to sanitary sewer, samples must be taken and approved by Texas State EHS&RM. It can take several days for this process to occur and circulation must continue throughout that time. The Contractor shall set up a meeting with the Owner and EHS&RM well in advance of cleaning to determine the likelihood of discharge to the sanitary sewer. If draining to sanitary sewer is not an option, then the Contractor shall arrange for temporary storage and disposal of the cleaning solution. See section 3.3 for Discharge process.
  - l. If acceptable to EH&S, an alternate flush method would be to flush continuously with fresh water until samples indicate that pipe has been cleaned. The flush must be conducted while circulating at 3-5 ft/s continuously.
  - m. Clean strainers at the completion of the cleaning cycle.
  - n. EHS&RM will perform final water chemistry test to determine if the water is safe to discharge to sanitary sewer or into storage tank to hold for off-site disposal.
  - o. For discharge to sanitary sewer, see Section 3.02 Discharge below.
3. Final Treatment Chemicals
- a. Once pipe is clean, refill and immediately add 1 gallon of Apollo TWT-2258 per 1000 gallons of system volume (OR 2 gallons per 1000 gallons TWT-2256 if system is in Round Rock)
  - b. Circulate for 4 hours, sample, then shut down pumps and shut in system after satisfactory sample results have been obtained.
  - c. Provisions will need to be made to allow for intermittent circulation and analytical testing if pipe is projected to stay full and idle longer than 2 weeks.
  - d. For each step in the process (flushing, cleaning, passivating, & final treatment) the Owner, Owner's water treatment supplier, and Owner's representatives shall review and approve results prior to proceeding to the next step.

- e. Once the system is readied for the tie-in to the main chilled water system, no further action is required.
- B. Contractor
- 1. Coordinate with representatives of Texas State University, A/E, and Consultants regarding circulation piping installation, operation, and water quality testing.
    - a. Attend meeting(s) with representatives of Texas State University to plan and coordinate cleaning, passivation, flushing, discharge and chemical treatment activities.
  - 2. Contractor will provide the following:
    - a. Chemicals shall be provided by Contractor.
    - b. Contractor is responsible for performance of all flushing/cleaning/passivating and final treatment activities unless noted herein.
    - c. The flushing and final treatment procedures shall apply to all piping systems in condenser, chilled/hot water service that contain any carbon steel or iron (piping, or steel body/iron valves).
    - d. The cleaning/passivation procedures shall apply to: carbon steel piping systems and carbon steel piping systems that are connected to HDPE piping systems.
    - e. For HDPE piping systems that contain carbon steel/iron body valves, it may not be necessary to perform the cleaning and passivation step if the piping is not contaminated and can be adequately cleaned through flushing– contact the Owner for further clarification.
    - f. Submittals for chemicals and equipment.
    - g. Circulating pump and power for same.
    - h. All materials necessary to connect circulating pump to new chilled water system piping.
    - i. Tank for storage and proper disposal if water is unacceptable to discharge to sanitary sewer.
    - j. All cleaning will be performed in the presence of the Texas State University qualified representative.
    - k. Cleaning the metal piping must be performed prior to connecting the lines into a Texas State University system loop. The purpose of the cleaning is to remove any dirt or debris that was introduced during construction as well as oils and coatings on the piping left from the manufacturing process. This cleaning standard also applies to metal pipe for hot water and metal pipe for chill water system.
    - l. If discharge to sanitary sewer is not allowed by test results or by the City of San Marcos, discharge to the storage tank and properly dispose of water off-site.

- m. Install, delay installation of, or temporarily remove flanges, valves, fittings, etc. as required to facilitate cleaning and flushing connections and activities. Use flanged connections to allow for connections. Re-install flanges, valves, piping, etc. to close system and prepare for service after chemical treatment is complete.
- n. A piped source of city water, at local city water pressure, with shutoff valve, in convenient location to allow filling of piping system.
- o. Traffic control and safety fencing if/as required for circulating pump.

### **3.3 DISCHARGE**

1. There will be no discharge to the sanitary sewer or storm sewer without prior approval by Texas State University and the City of San Marcos.
2. ESH&RM (liaison with the City) will notify the City in writing of the volume of cleaning water (provided by contractor), date of cleaning and chemical in use. ESH&RM will notify the City of the sample results and receive approval or denial to discharge to the sanitary sewer.
3. If the discharge is approved by the City, the Director of Utilities Operations and ESH&RM, Contractor can discharge to the sanitary sewer at a rate specified by the approval. Only discharge during normal operating business hours. No overnight discharging will be allowed. Flush the lines by circulating with clean water and discharge to the sanitary sewer until the water has clarified as witnessed by the FPDC representative. Coordinate with the FPDC representative for gradual filling of the lines and preparation to tie into the campus piping loop.
4. If the City denies the discharge to the sanitary sewer, offsite disposal of this volume plus two rinse volumes will be required at the expense of the Contractor. Contractor is responsible to include an Allowance in the construction cost for disposal of the rinse volume plus two clean water rinses. If Allowance is not used or required, the Allowance returns to the Owner (Allowance to be indicated as a separate line item on the Schedule of Values). The ESH&RM representative must approve the offsite disposal method and location and receive documentation of the shipment.

END OF SECTION 23 25 00