SECTION 23 21 00.1

FLUSHING AND CLEANING OF HYDRONIC PIPING SYSTEMS

PART 1: GENERAL

1.1 PURPOSE

A. This guideline is intended to provide useful information to the Professional Service Provider (PSP) to establish a basis of design. PSP is to apply the principles of this section such that the University of Texas at Arlington (UTA) may achieve a level of quality and consistency in the design and construction of their facilities. Deviations from these guidelines must be approved by UTA and may require justification through Life Cycle Cost (LCC) analysis and submitted to UTA for approval.

1.2 **LESSONS LEARNED AND DESIGN CONSIDERATIONS**

A. A separate subcontractor should be required for the pipe flushing procedure. Companies that have experience flushing hydronic piping should be required over the mechanical contractor.

B. Bypasses should be installed around equipment and components, do not flush through components. The bypasses should be line size or sized for the required flowrate.

C. Use an external pump and not building pumps for flushing.

D. Consideration of pipe sizes throughout the piping system should be considered when calculating the required velocity of the flush and not just the main pipe sizes.

1.3 SUBMITTALS

A. Submit a detailed plan for the Engineer's and Owner's review and approval describing in full detail the individual steps associated with the cleaning and flushing process before any piping is installed including proposed cleaning solution and pipe velocities in each pipe section.

B. Submit Safety Data Sheets for each chemical that will be used in the cleaning and flushing process.

C. Submit the third party flushing and cleaning company proposed for review.

D. Final flushing and chemical treatment report. The report should include at minimum, project name, date, location, parties involved, type of pipes treated, scope summary, flows, durations, and other relevant information.

PART 2 - PRODUCTS

2.1 Flow Meters:

A. Clamp on ultrasonic type.

B. Calibration documentation is required.

C. Must be compatible with Steel and HDPE piping systems.

D. Accuracy: +/-1% of reading or +/- 0.1 ft/sec.

E. Flow range will be within 10%-90% of the full overall meter range.

F. Manufactures/Model: Onicon F-4400 or equivalent.

PART 3 - EXECUTION

3.1 Flushing and Cleaning of Steel Piping Systems

A. After the mechanical contractor has pressure tested the piping, it is to be flushed and cleaned for service. Provide a complete water flushing and cleaning of the closed loop chilled and hot water systems as specified herein. Systems must be commissioned as clean and meet water treatment specifications.

B. A third-party flushing company will be used for flushing and cleaning of the hydronic piping.

C. All chilled, and hot water piping and related equipment shall be thoroughly flushed out with pre-cleaning chemicals designed to remove deposits such as pipe dope, oils, loose rust, mill scale and other extraneous materials. Recommended dosages of pre-cleaner chemical products shall be furnished by water treatment supplier, added and circulated throughout the water systems. The water system shall then be diluted and final flushed thoroughly until no foreign matter is observed and total alkalinity of the water is equal to or better that that of the make-up water.

D. All temporary connections required for flushing, cleaning, purging, and circulating shall be included. Provide line size pipe bypasses at each coil and heat exchanger during the flushing and cleaning operation.

E. Self-contained flush unit requirements will contain a pump or pumps connected that will meet or exceed the volume required to flush and purge the system at the required velocity rate through the largest pipe. Pump curve will be submitted along with other important documentation for the related equipment on the unit. This will include, at minimum, filtration, flow meter(s), pressure gauges, and unit description or picture. All operators will comply with all safety regulations of the project site. The flushing operation will be manned continuously during the flushing process**.** Building pumps will not be allowed for flushing.

F. Flushing Procedure:

1. Pre-Flush Procedure:

    a. Bypass loops should be installed in front of any strainers and control valves at all equipment components.

    b. Install temporary strainer elements in front of pumps, tanks, solenoid valves, control valves, and other equipment where permanent strainers are not indicated that are not bypassed. Keep these strainers in service until the equipment has been tested, then remove either entire strainer or straining element only.

    c. Flush ports should be identified along with the type of high pressure hose or piping that will be used to connect to the system. The water source should be identified and must be adequate to fill and make up water in a timely manner to the system during the flush process. A water dump location should be identified which is usually the sanitary.

2. Clear Water Flush:

    a. Fill the piping system with clean potable water. The first flush is a clear-water flush intended to circulate water through the system and force loose debris to low point drains and flush cart filtration system. This flush should be at minimum velocity throughout the system of a minimum of 7 ft/sec throughout. Filtration should be at minimum, 50 microns. This flush shall continue until the system water is comparable to the make-up water. Iron content should be under 2.0 ppm.

    b. The required minimum velocities will be calculated from the pump curve and differential pressure measurements across the pump or by calibrated clamp on flow meters. More than one may be required to confirm minimum velocities in each section of the system.

3. Cleaning and Passivation:

a. The second flush cycle is a combined flushing cycle where cleaning and passivation chemicals are introduced into the system to clean the oils and treat the inside wall of the piping system. This process will be monitored by the chemical treatment company to meet the chemical specifications of the water. The cleaning velocity should be a minimum of 5 ft/sec throughout, and the circulation time will be based on the chemical testing, but will be at minimum, 24 hours.

b. The required minimum velocities will be calculated from the pump curve and differential pressure measurements across the pump or by calibrated clamp on flow meters. More than one may be required to confirm minimum velocities in each section of the system.

4. Final Clear Water Flush:

a. The system will be continuously flushed while discharging chemicals into the sanitary system as approved locally. As the existing treated water is being discharged, a fresh water make-up source will be utilized to ensure air is not introduced into the system. Continue to drain the system while adding domestic water to dilute the treated water. The chemical treatment company will monitor the outgoing water composition and compare the composition with the incoming water. Flush with fresh water until the conductivity is reduced to that of the make-up water and iron meets specifications. The final system water should be approved by the chemical treatment company. Filtration should be 5 microns.

5. Final Chemical Fill:

a. Once the chemical treatment company has determined the system has been brought back to the correct composition, the chemical treatment company will inject the final chemicals into the system. Once the system is filled with the final chemicals it is important the water not be left stagnant.

b. Verify satisfactory completion of clean piping and a final flushing and chemical treatment report should be submitted by field personnel.

c. Cleaning chemicals, procedure, water testing, reporting, and consultation must be provided by a qualified water treatment company specializing in this type of work.

3.2 Flushing and Cleaning of Polypropylene and HDPE Hydronic Piping

A. Preflush:

1. Bypass loops should be installed at all equipment or building components. Strainers should be removed when a self-contained purge unit is used in conjunction with on board filtration. Flush ports should be identified along with the type of high pressure hose or piping that will be used to connect to the system. The water source should be identified and must be adequate to fill and make up water in a timely manner to the system during the flush.

B. Clear Water Flush:

1. Fill the piping system with clean potable water. The first flush is a clear-water flush intended to circulate water through the system and force loose debris to low point drains and flush cart filtration system. This flush should be at a velocity throughout the system of a minimum of 7 ft/sec throughout. Filtration should be at minimum, 5 microns. Minimum duration should be calculated using a formula of 1 hour per 1000’ of linear pipe and until system water is comparable to make up water source. The minimum circulation time should be 1 hour regardless of the length.

2. The required minimum velocities will be calculated from the pump curve and differential pressure measurements across the pump or by calibrated clamp on flow meters. More than one may be required to confirm minimum velocities in each section of the system.

C. Final Chemical Fill:

1. Once the chemical treatment company has determined the system has been brought back to the correct composition, the chemical treatment company will inject the final chemicals into the system if required. Once the system is filled with the final chemicals it is important the water not be left stagnant and to mix chemicals.

2. Verify satisfactory completion of clean piping and a final flushing report will be submitted by field personnel. The report will include at minimum, project name, date, location, parties involved, type of pipes treated, scope summary, flows, durations, and other relevant information.

END OF SECTION 23 21 00.1