

NC State University Design and Construction Guidelines

Division 23 Water Treatment

1.0 Purpose

- A. This section includes water-treatment systems for the following:
 - 1. Heating, hot water piping (closed-loop system).
 - 2. Chilled-water piping (closed-loop system).
 - 3. Heating, steam and condensate piping.
 - 4. Condenser water piping (open system).
 - 5. Domestic water piping.

2.0 General Requirements

- A. Chemical Feed Description
 - 1. Closed-Loop System shall include one bypass feeder on each system. Isolating and drain valves shall be installed at circulating pumps.
 - 2. Closed-Loop Steam and Condensate Piping shall introduce the chemical to the boiler through a chemical feed system. Coordinate with the NC State HVAC water treatment contractor.
 - 3. Open-Loop Condenser Water Piping shall include chemical feed and bleed control systems with integrated chemical feed systems based upon the current water treatment program.
- B. System performance requirements shall be subject to compliance with the NC State water treatment contractor. Contractor shall provide products obtained from the Chemical Treatment Vendor for NC State for initial treatment.
- C. Submittals shall include product data for shipping, installed, and operating weights, rated capacities, water-pressure drops, and furnished products listed below:
 - 1. Pumps
 - 2. Chemical feed and bleed control systems with integrated inhibitor and dual biocide feed tank
 - 3. Chemical bypass feeders
 - 4. Filters
- D. Chemical Treatment Contractor shall inspect installation and initial water treatment. Contractor shall provide test of initial charge and a verification retest within five (5) days prior to opening utility distribution valves or within five (5) prior to beneficial occupancy.

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3.0 Materials & Standards

- A. Products shall be provided by the current Chemical Treatment Vendor for NC State.
- B. All unused chemicals and empty containers shall be removed per NC State Environmental Health and Public Safety Requirements.

4.0 Installation

- A. Flushing Procedures
 1. All water used during the hydrostatic pressure tests, cleaning, flushing and filling of piping systems shall be provided by the contractor. This water shall be metered from project beginning until the piping system is cleared to be connected to the campus utility systems and/or at project close-out.
 2. Flush all water, steam and condensate systems thoroughly for a minimum of one (1) hour, to ensure removal of all dirt and foreign matter from piping system. Flushing shall continue until water draining from the pipe is clear and clean of any dirt and debris as determined by NC State. Pumps and equipment shall be bypassed and strainers removed from strainer bodies. Circulation shall be provided by Contractor supplied pumping apparatus. Process or production steam piping shall be flushed with steam at design pressure.
 3. After initial flushing of system. use portable pumping apparatus for continuous 24-hour minimum circulation of cold water detergent similar to Nalco 2567 cleaner. Detergent shall be flushed clear with continuous draining and raw water fill for an additional 12 to 24 hours, or until all cleaner is removed from system and conductivity, pH, and iron concentrations are within guidelines. NC State shall verify compliance with guidelines. Strainers shall be replaced, permanent pumping apparatus reconnected, and all apparatus bypassed.
 4. Contractor shall be responsible for phasing and scheduling piping installation work to ensure all sections of the new piping are cleaned and flushed as specified. Contractor shall provide temporary access tapping at all high points and low points through valves, tees, flanges, etc. to facilitate the cleaning and flushing process.
 5. Contractor shall provide all water for flushing. Fire hydrant meters shall be coordinated with the City of Raleigh NC State depending on hydrant system owner.
 6. Contractor shall provide all temporary piping from water source to piping system and shall provide means for conducting testing and cleaning water from

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underground piping system to the appropriate sewer; i.e. pumps, piping, hoses, etc. Contractor shall remove all temporary piping, pumps, hoses, etc. from the site after flushing has been completed.

7. Contractor shall provide temporary piping or hose to bypass coils, control valves, heat exchangers, other factory cleaned equipment, and any component which may be damaged.
8. System shall be sectioned to obtain minimum velocity of six (6) fps. Temporary piping shall connect dead-end supply and return headers, as necessary, with a loop 1/3 the size of the installed pipe. Bottom of risers shall be flushed.
9. Pipes 18" and larger, shall maintain a velocity close to six (6) fps, but not below two (2) fps.
10. Piping 42" and larger shall be internally accessed and cleaned. Cleaning shall involve an initial vacuuming process, followed by a wet wipe down of all internal surfaces.
11. NC State shall visually inspect piping systems as installed and/or flushed to verify cleanliness.
12. A chemical inhibitor equivalent to Nalco 8338 shall be added to closed loop water systems.
13. New piping system shall match the water chemistry for that system as determined by the NC State water analysis requirements. Once requirements are met, the loop shall be filled to 100% with excess air ejected from all high points.
14. Oil shall be used when flushing fuel oil piping.
15. Gas piping shall be flushed with clean dry, compressed air for one (1) hour minimum. Ensure that drip legs are open and clean. Flushing shall be repeated until no debris is found in drip legs.
16. Compressed air piping shall be flushed with clean dry, compressed air for one (1) hour minimum. Ensure that drip legs are open and clean. Flushing shall be repeated until no debris is found in drip legs.
17. Contractor shall provide NC State with records of flushing, treating chemicals (quantities and concentrations) and final water chemistry.

B. Water Analysis Requirements

1. Specific numbers will be determined at the time of construction as city water and system values vary on campus.
2. Chilled Water piping
 - a) conductivity: Approximate existing system conditions
 - b) pH: Approximate existing system conditions
 - c) target inhibitor PPM level: Approximate existing system conditions

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- d) iron concentration: Approximate existing City of Raleigh water conditions
 - 3. Condenser Water piping
 - a) conductivity: Approximate city water
 - b) pH: Approximate city water
 - c) iron concentration: Approximate existing City of Raleigh water conditions
 - 4. Steam piping
 - a) conductivity: Approximate city water
 - b) pH: Approximate city water
 - c) iron concentration: Approximate existing City of Raleigh water conditions
 - 5. Condensate piping
 - a) conductivity: Approximate city water
 - b) pH: Approximate city water
 - c) iron concentration: Approximate existing City of Raleigh water conditions
 - 6. Domestic Water piping
 - a) conductivity: Approximate city water
 - b) pH: Approximate city water
 - c) iron concentration: Approximate existing City of Raleigh water conditions
 - 7. Heating Hot Water piping
 - a) conductivity: Approximate existing system conditions
 - b) pH: Approximate existing system conditions
 - c) target inhibitor PPM level: Approximate existing system conditions
 - d) iron concentration: Approximate existing City of Raleigh water conditions
- C. Field Quality Control
 - 1. A water treatment service representative shall perform startup service.
 - 2. A water treatment service representative shall inspect field-assembled components, equipment, and initial chemical water treatment. Reports shall be provided to the university.
 - 3. Contractor shall inspect piping and equipment to determine that systems and equipment have been thoroughly chemically cleaned, rinsed, and filled with

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water, and are fully operational before introducing chemicals for water treatment system.

4. Contractor shall place HVAC water treatment system into operation and calibrate controls during the preliminary phase of HVAC systems startup procedures.

D. Training

1. The contractor shall retain the current NC State water treatment service representative to train NC State's maintenance personnel to adjust, operate, and maintain HVAC water treatment systems and equipment. Training shall include:
 - a) Procedures and schedules for starting and stopping troubleshooting, servicing, and maintaining equipment and schedules.
 - b) Four (4) hours of training with NC State scheduled with at least seven (7) days' advance notice.
 - c) Manufacturer's safety data sheets for handling of chemicals.