CLEANING OF PIPING SYSTEMS

DESIGN GUIDELINES

1. General
    a. This section is intended for final cleaning of piping for both new and renovation projects.
    b. Small renovation projects that have minimal water treatment require flushing of systems and refill.
    c. Refer to HVAC Water Treatment for additional guidelines regarding water treatment chemicals and feed equipment, coordinate with WUSM Project Manager.
    d. If renovation project includes modifying or tying into an existing piping system with ethylene glycol, confirm with facilities for scope of replacement. These older systems are to be replaced with new propylene glycol systems. Verify with WUSM Project Manager for design of new system.
    e. Test and document the percentage of glycol in system prior to any demolition or renovation work on a piping system. Fill the system back to the same percentage as existing.
        - Contact Tom Thompson (636-288-1939) or Mike Burke with Chemtron.
    f. Red dye propylene is preferred.
2. Chemical Treatment
    a. Perform an analysis of makeup water to determine type and quantities of chemical treatment needed to keep system free of scale, corrosion, and fouling, and to sustain the following water characteristics
        - pH: 9.0 to 10.5.
        - "P" Alkalinity: 100 to 500 ppm.
        - Boron: 100 to 200 ppm.
        - Chemical Oxygen Demand: Maximum of 100 ppm.
        - Corrosion Inhibitor:
            1. Sodium Nitrate: 1000 to 1500 ppm.
            2. Molybdate: 200 to 300 ppm.
            3. Chromate: 200 to 300 ppm.
            4. Sodium Nitrate Plus Molybdate: 100 to 200 ppm each.
            5. Chromate Plus Molybdate: SO to 100 ppm each.
        - Soluble Copper: Maximum of0.20 ppm.
        - Tolyiriazole Copper and Yellow Metal Corrosion Inhibitor: Minimum of 10 ppm.
        - Total Suspended Solids: Maximum of 10 ppm.
        - Ammonia: Maximum of 20 ppm.
        - Free Caustic Alkalinity: Maximum of 20 ppm.

- Microbiological Limits:
    1. Total Aerobic Plate Count Maximum of 1000 organisms/mL
    2. Total Anaerobic Plate Count: Maximum of 100 organisms/mL.
    3. Nitrate Reducers: 100 organisms/mL.
    4. Sulfate Reducers: Maximum of zero organisms/mL.
    5. Iron Bacteria: Maximum of zero organisms/mL.

b. Install bypass chemical feeders in each hydronic system where indicated.
    - Install in upright position with top of funnel not more than 48 inches above the floor.
    - Install feeder in minimum NPS 3/4 bypass line, from main with full-size, full-port, ball valve in the main between bypass connections.
    - Install NPS 3/4 pipe from chemical feeder drain to nearest equipment drain and include a full-size, full-port, ball valve.
    - Move the above equipment guidelines to Water treatment section.

c. Clean piping system as follows:
    - Flush system with water until water runs clean from all drain locations.
    - Fill system with fresh water and add liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products from piping.
    - Bypass all coils and equipment prior to flushing. Facilities to witness flushing and circulating. See field quality control below.
    - Circulate solution for a minimum of 24 hours, drain, clean strainer, and screens.
    - Flush system with clean water to rinse of cleaning solution while draining at all low points.
    - Fill system with clean water.

d. Add initial chemical treatment and maintain water quality in ranges noted above for the first year of operation.

e. Fill systems that have antifreeze or glycol solutions with the following concentrations:
    - Hot-Water Heating Piping: Minimum of 40% percent propylene glycol which correlates to minus 20 degrees F freeze protection.
    - Chilled-Water Piping: Minimum of 40% percent propylene glycol which correlates to minus 20 degrees F freeze protection.
    - Dual-Temperature Heating and Cooling Water Piping: Minimum of 40% percent propylene glycol which correlates to minus 20degrees F freeze protection.
    - Glycol Cooling-Water Piping: Minimum of 40% percent propylene glycol which correlates to minus 20 degrees F freeze protection.

3. Field Quality Control

    a. Prepare hydronic piping according to ASME B31.9 and as follows:

- Leave joints, including welds, uninsulated and exposed for examination during test.
- Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
- Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
- Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
- Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

b. Perform the following tests on hydronic piping:

- Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
- While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
- Isolate expansion tanks and determine that hydronic system is full of water.
- Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
- After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components and repeat hydrostatic test until there are no leaks.
- Prepare written report of testing.
- WUSM facilities representative to be witness flushing, air purging and final pressure testing after all leaks have been repaired and prior to tying into any existing systems.

END OF SECTION

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