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Standard Practice

Inspection, Cleaning, and Remediation Technology for Water Piping in Buildings

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Foreword

This standard presents information and procedures that can be used by owners, managers, or operators of inhabited, nonindustrial buildings to assess the quality of the piping systems and the options available to return the piping systems to a serviceable condition (remediation). The remediation may involve cleaning, piping replacement, or other steps. It is a risk-based approach—the ultimate risk is leakage of the system, system unavailability, or both. The focus of this standard is on the options available and the steps taken when determining whether the risk is acceptable or whether a more cautious remediation program must be selected. The information provided in this standard is based on the understanding that it is economically and physically feasible to remediate the system being evaluated. This standard presents recommendations on how to identify the problems, assess their severity, determine an appropriate course of action, and guide the owner through the implementation of that course of action. The delivery of potable water to users, along with the removal of used water products, is also addressed in this standard.

Piping systems provide an essential function to any building's operation. Occasionally, these piping systems operate at less than optimum efficiency or fail to operate. The ability of the building to function (i.e., to offer an appropriate operating environment) is fundamental to the economic viability of that building. If a piping system fails to operate as it was designed, the building loses its marketability. Maintenance of the operating capability of building piping systems is a task that relies on many individuals. This standard is intended for use by heating plant operators, water treatment providers, and those who operate comfort cooling equipment and computer cooling equipment.

This standard was prepared by Task Group (TG) 158, "Inspection, Cleaning, and Remediation Techniques for Piping in Buildings." This TG is administered by Specific Technology Group (STG) 11, "Water Treatment." This standard is issued by NACE under the auspices of STG 11.

In NACE standards, the terms *shall, must*, *should,* and *may* are used in accordance with the definitions of these terms in the *NACE Publications Style Manual.* The terms *shall* and *must* are used to state a requirement, and are considered mandatory. The term *should* is used to state something good and is recommended, but is not considered mandatory. The term *may* is used to state something considered optional.

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Section 1: General

1.1 Introduction

The water-usage systems addressed in this standard are as follows. (Note: this list covers all piping systems in residential and office buildings; it is not applicable to industrial facilities.)

GROUP I: The predominant water-usage systems in most buildings consisting of potable water (hot and cold); steam and condensate systems; and waters for heating, ventilation, and air conditioning (HVAC) (open and closed systems)

GROUP II: Waste water—sewage and drainage

GROUP III: Higher quality waters—preconditioning systems and boilers

GROUP IV: Fire-protection systems—wet, dry, foam, and other systems

GROUP V: Architectural systems—fountains, waterfalls, and other displays

1.2 Group I: Highest Water-Usage Systems in Buildings

1.2.1 The Group I piping systems include the potable-water system and building systems that are major users of potable water.

1.2.2 Potable-water systems are seldom cleaned except when flow conditions or leakage mandate that maintenance be performed. The U.S. Environmental Protection Agency (EPA)[(1)] requires these systems to be sanitized before being placed back into operation to prevent transmission of disease.[1]

1.2.3 Steam systems typically use high-purity water, which ensures long life of the generating equipment or the steam piping systems. The condensate system, however, requires treatment to make it less susceptible to corrosion. This piping system usually requires more attention than the steam system.

1.2.4 HVAC systems may be open or closed, depending on the design of the system. Open-condenser water systems usually have a cooling tower and associated highwater usage. Water treatment programs are critical for open and closed HVAC systems.

1.2.5 Closed systems require little to no make-up water because there is no draining or blow-down. Replacement water is added only when the system is opened or drained for maintenance, or because of unavoidable leakage from components or piping connectors. Closed heating/cooling systems may require cleaning because of interior fouling.

1.3 Group II: Waste waters and Drain Waters

1.3.1 Wastewater and drain-water systems are almost never chemically treated (except for grease disposal) and are discharged from the building into the local sewage system for processing. This may be the building's own leaching field, a local sewer system and water treatment facility, or a major metropolitan wastewater treatment program. It is common practice for hotels and restaurants to chemically treat grease traps and ejector pits.

1.3.2 Wastewater and drain water piping systems are rarely cleaned except when the system is inoperative. The cleaning is primarily mechanical, such as high-pressure water washing or mechanical rotor cleaning, if such cleaning is appropriate.

1.4 Group III: Systems Requiring High-Quality Waters

Higher-quality water is required for the operation of some equipment, such as boiler feed water systems. Additional equipment, such as reverse-osmosis (RO) systems or sodium zeolite systems, may be required to condition the water.

1.5 Group IV: Fire-Suppression Water Systems

[(1)] Environmental Protection Agency (EPA), Ariel Rios Building, 1200 Pennsylvania Ave. N.W., Washington, DC 20460.

1.5.1 Wet systems are filled and allowed to remain stagnant without circulation and usually without treatment. Recent sprinkler code changes require that where microbiologically influenced corrosion (MIC) concerns are suspected, water treatment chemicals shall be used.

1.5.2 Wet systems are connected to, but isolated from, the main potable water system by means of a backflow prevention device.

1.5.3 Generally, there is no active circulation in the stand pipes, except during testing periods; there may be limited circulating, charged headers in certain systems. Dry systems are pressurized with air or nitrogen. These systems may be damp because of periodic hydrostatic testing or internal condensation if used outside, where a risk of freezing exists. This interior moisture condition can lead to severe unexpected corrosion problems with leakage occurring from the inside of the pipe.

1.6 Group V: Architectural Applications—Fountains, Waterfalls, Display Uses

These systems are usually open recirculating systems with wide open basins, full-stream filters, and circulating pumps. Piping is mostly polyvinyl chloride (PVC), although copper and steel pipes are sometimes used. System water is usually accessible to the public for decorative display. It is kept clean with full-stream filtration and intermittent treatment with oxidizing biocide for esthetic purposes. Open areas are mechanically cleaned on a regular basis.

1.7 Cleaning can only provide clean surfaces, which represent original piping minus the corrosion loss. Lost wall thickness and pipe wall damage from pitting corrosion cannot be restored.

1.8 However, cleaning provides the option of restarting with a deposit-free, clean system that responds to properly treated water by minimizing the corrosion rate. Cleaning has the added benefit of maximizing the life of the remaining pipe.

Section 2: Definitions

Acid: Chemical compound that produces hydrogen (H^+) ions replaceable with metal ions in solution. A solution with a pH below the neutral value of 7.0 is considered acidic; this occurs when more H^+ ions than hydroxide (OH^-) ions are present in the solution.

Alkaline: Chemical compound that neutralizes acids in solution, and is capable of receiving H^+ ions from other compounds; solution of soluble salts having a pH greater than the neutral value of 7.0.

Biocide: Material that exhibits toxicity toward certain bacteria, fungi, molds, or other microbial populations.

Blowdown (Bleed off): *(1)* the injection of air or water under high pressure through a tube to the anode area for the purpose of purging the annular space and possibly correcting high resistance caused by gas blockage (cathodic protection use); *(2)* the process of discharging a significant portion of the aqueous solution in order to remove accumulated salts, deposits, and other impurities (boiler or cooling water tower use).

Boiler: Equipment fired by a direct heat source (such as gas, coal, electricity, or oil) that heats water under pressure to produce steam used for heat, process, or power generation needs.

Chelants: Chelants form soluble complexes with certain types of deposits such as iron and copper oxides.

Chilled Water: Water cooled in a chiller and circulated through a converter to produce cool air for building air conditioning systems.

Closed Loop (Closed System): System that circulates water for heating or cooling needs that is not open to the atmosphere. A closed loop typically has very low rates of water loss. The system should experience less than 5% of volume loss per year.

Condensate: Any gas that is condensed to a liquid state through the release of heat. In building systems, the term is typically used to refer to steam condensed to water at the individual heat load. Because steam condensate normally contains considerable usable energy and should be very pure, it is recovered and recycled in the boiler loop.

Condenser Loop (Open System): System that rejects heat from a chiller by evaporation in a cooling tower.

Cooling Tower: Device in which water from a chiller condenser or cooling coils is cooled by atmospheric evaporation.