Water and Steam System Guidelines

Introduction

All heating and cooling systems are susceptible to valve and system problems caused by improper fluid treatment and system storage problems.

These guidelines are provided to help avoid valve and water system problems from improperly treated water or storage procedures in cooling, hot water, and steam systems, and to obtain maximum life from Schneider Electric valves. While all cooling and heating systems are susceptible to problems, closed chilled water systems, including those containing brine or glycol, are especially prone to system and valve problems.

The best way to avoid problems is to follow the advice of professional water treatment and control specialists.

Leak Prevention

Durability of valve stems and packing is dependent on maintaining non-damaging fluid conditions. Inadequate treatment or filtration, not in accordance with the recommendations of a qualified treatment specialist or the ASHRAE handbook recommendations, can result in corrosion, scaling, or abrasive particle formation.

Scale and corrosion products can migrate from pipe walls to control valves, resulting in stem and packing scratches, and can adversely affect packing life and other parts of the hydronic system. This condition can be avoided by the use of proper cleaning, treatment chemicals, and storage procedures.

Water must be treated and soft. Trace leaks of hard water result in hard calcium carbonate particles on the outside of the valve, which after time will scratch the sealing members creating leak potential.

To maintain non-damaging conditions, the system should be cleaned prior to start-up. Filtration equipment should be used where needed, and a regularly scheduled program of water condition monitoring and/or treatment should be followed.

Control valve operation should be stable and not hunt at any time. Excessive stroking of the valve stem due to improper system setup can result in premature wear.

System Commissioning and Storage

Cleaning

New systems usually contain dirt, solder flux, and weld and pipe scale. Thorough flushing with a 1% to 2% solution of trisodium phosphate and thorough rinsing is necessary.

Wet storage

If the system is stored wet, it should be completely filled with properly treated water and isolated to avoid slow leaks, which can contribute to serious corrosion problems.

Dry Storage

If drained, the system should be air dried, sealed, and treated with a desiccant to prevent “atmospheric corrosion” of pipes, a major source of “pipe scale.” Pipe scale is dried rust which will slough off the pipe walls as abrasive particles and migrate throughout the system.

Strainers and Filters

- Many closed water systems have slow leaks or seepage, resulting in water loss without particulate removal. Consequently, particulate solids often build up in closed systems, resulting in deposits. In open systems like cooling towers, particulate solid build up is not as common because continuous “blowdown” is used to remove solids from the system.
- Side stream water filtration is often needed in closed systems because there is no regular blowdown to remove pipe scale, sand, grit, and other abrasive or sticky particulate matter. Abrasive particles must not be allowed to circulate through the system.

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- To determine whether a filtration system is required, perform a visual inspection of the water. Flush a line with turbulence to assure that a representative water sample is collected and observe the turbidity. Let the water settle for 5 minutes and inspect for particulate that has dropped out.
- If chip scale and particulate are found in circulation, install some type of filtration device such as a "Y" strainer, a cartridge filter, an automatic backwashing side stream sand filter, or a "chemical pot feeder" packed with cheesecloth that can replaced periodically. Backwashing sand filters (sized at 1/2% to 3% of system circulation rate) are often a good choice, because they are simple, inexpensive, and effective.
- Lines carrying water to and from the filtration system should be sized for high flow rates to make sure the particulate matter is carried into the filtration system.
- Filtration is often necessary when chemical treatment is started in a system which has not previously been chemically treated. The treatment often dislodges old deposits, which then migrate to heat exchangers and valves unless removed by filtration.
- Before installing a sophisticated filtration system, make sure strainer baskets are emptied regularly. Also make sure the baskets have not been permanently removed — a common practice when they "fill up" quickly and too much work is required to keep them clean.
- Before installing filters or strainers in systems containing glycol, consult the glycol vendor for the proper type.

Chemical Water Treatment

- If the make-up water hardness is greater than 50 ppm (3 grains per gallon) as calcium carbonate, the water should be softened or a treatment should be used that contains a polymeric "dispersant" material which forms a soft sludge not allowing the formation of hard scale or gritty residue.
- Make-up water iron should be less than about 1.0 ppm. Manganese should be less than 0.1 ppm (0.05 ppm if the system has significant leakage). If not, an iron/manganese removal system or a new water source should be used.
- Water treatment control addresses four problem areas: corrosion, scale, deposition, and bacteria. For control, a nitrite or molybdate based program is typically used in conjunction with testing and monitoring.
- The corrosion control program most commonly used is 600 to 1200 ppm sodium nitrite or 100 to 300 ppm molybdate, at a pH of 9.5 to 10.5. Include a copper corrosion inhibitor such as Tolytriazol (TTA) or Benzotriazole (BZT) since uncontrolled copper corrosion can lead to corrosion of steel.
- The addition of glycol, especially automotive antifreeze, does not assure corrosion protection. Specify industrially inhibited ethylene glycol (phosphate based) without silicates to ASTM D1384. Refer to the manufacturer's literature for specific requirements, including concentrations and materials of construction.
- Control of bacteria is important because bacteria can break down the nitrites. The level of bacteria should be kept at less than 10,000 CFUs (colony forming units) per ml of water. Follow your supplier's instructions for bacterial control.
- Operate your chemical treatment program within the guidelines set by your water treatment supplier. Monitor results monthly, switching to weekly if problem resolution is necessary.
- Boiler water treatment for steam systems should be continuous. Follow industry guidelines such as "Marks Standard Handbook for Mechanical Engineers." For oxygen removal, catalyzed sodium sulfate is usually recommended.
- Be careful using hydrazine that results in ammonia and must be controlled to prevent stress corrosion and embrittlement leading to fracture of certain brass alloys.

Control Loop Operation

- Valves should not be oversized. Refer to CA-28, Control Valve Sizing, F-13755, for information on proper valve sizing and selection. Set the control system operating parameters so that hunting does not occur, even at light load conditions such as fall, spring, and morning operation. Valves which cycle often or continuously require a preventative maintenance program to replace worn parts.