WATER TREATMENT SUMMARY

ALBERTA PUBLIC WORKS SUPPLY & SERVICES

PROPERTY MANAGEMENT DIVISION

Prepared by

G. Yuzwa, P.Eng.

Montreal Engineering Co. Ltd.

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PURPOSE

The purpose of the Property Management Division Water Treatment Program is to provide a standard system whereby deterioration of heating and cooling water systems in ALBERTA buildings is prevented.

PHILOSOPHY

The philosophy of the Property Management Division Water Treatment Program is to minimize the cost of chemical treatment by ensuring that the water systems are mechanically correct in design, operation and maintenance, and by ensuring that water put into the systems is of good quality.

SUPPORT

1. Directors, Managers, Superintendents;
2. Water Treatment Coordinators;
3. Laboratory technicians;
4. Consultants.

HOT WATER HEATING SYSTEM

Mechanical Requirements

1. Heat source (i.e. boiler or heat exchanger), circulating pumps, inter-connecting piping, zone valves;
2. Unsoftened water make-up;
3. Chemical pot feeder;
4. By-pass cartridge type filter;
5. Automatic air vents;
6. Pressurized expansion tank (properly sized to prevent overflow) with soft air supply;
7. Fresh water make-up line with water meter, pressure regulator, backflow preventer valve and isolation valves.

Operation

1. Maintain a positive pressure at top of system, i.e.
   $$P = (H/2.31) + 5$$
   where P: static pressure (i.e. pumps off) at pump suction, psig
   H: elevation of system above pump suction, feet;

2. Repair leaks immediately;
3. Do not blow down unless TDS is greater than 2000 ppm or there are suspended solids present;
4. Leave system filled with water during shut-down period.

Chemical Treatment

1. Sodium sulfite to maintain 50-100 ppm S03;
2. Caustic to maintain pH of 8.5-9.5

Monitoring

1. Test and document sulfite, pH & TDS levels, and record water meter reading at least once per month;
2. Document chemical addition and filter cartridge changes;
3. Submit water sample to laboratory twice per year.

Problems

1. Repeated sulfite addition indicates that air is entering system via excessive make-up water, faulty air vents, pump seals, plugged strainers, etc.;
2. Repeated caustic addition indicates possible contamination with corrosive sulfate reducing bacteria;
3. Suspended solids and excessive filter cartridge changes indicates active corrosion.

CHILLED WATER SYSTEM

Mechanical Requirements

1. Cooling source (i.e. chiller or heat exchanger), circulating pumps, inter-connecting piping, zone valves;
2. Unsoftened water;
3. Chemical pot feeder;
4. By-pass cartridge type filter;
5. Automatic air vents;
6. Pressurized expansion tank (properly sized to prevent overflow) with soft air supply;
7. Fresh water make-up line with water meter, pressure regulator, backflow preventer valve & isolation valves.

Operation

1. Maintain a positive pressure at top of system, i.e.

   $P = (H/2.31) + 5$

   where P: static pressure (i.e. pumps off) at pump suction, psig
   H: elevation of system above pump suction, feet;
2. Repair leaks immediately;
3. Do not blow down unless TDS is greater than 2000 ppm or there are suspended solids present;
4. During shutdown period, leave system full but isolate, drain, purge & fill coils near make-up air in-take with glycol (note glycol must be drained completely before start-up in order to prevent bacteria contamination).

Chemical Treatment

1. Sodium sulfite to maintain 50-100 ppm S03;
2. Cobaltous chloride solution at 20 ml/lb sulfite;
3. Caustic to maintain pH of 8.5 – 9.5.

Monitoring

1. Test and document sulfite, pH and TDS levels, and record water meter reading at least once per month);
2. Document chemical addition & filter cartridge changes;
3. Submit water sample to laboratory once per year.

Problems

1. Repeated sulfite addition indicates that air is entering system via excessive make-up water, faulty air vents, pump seals, plugged strainers, etc.;
2. Small amounts of glycol could lead to contamination with corrosive sulfate reducing bacteria, indicated by repeated caustic addition;
3. Suspended solids and excessive filter cartridge changes indicate active corrosion.

STEAM BOILER SYSTEM

Mechanical Requirements

1. Steam boiler, condensate return tank, pumps, steam traps, (deaerator and /or condensate polisher on large units);
2. Softener (dealkalizer on some units);
3. Chemical injection system (metering system preferred, pot feeder minimum requirement).

Operation

1. Drain water gauge glass at least once per day (prove low level firing cut-off at the same time;
2. Prove the operation of the bottom blow down valve by opening and closing it once per day;
3. Drain and inspect the boiler once per year or as required by the Boilers Branch;
4. Repair steam and water leaks immediately;
5. Blow down to maintain TDS of 1500-3000 ppm in boiler water;
6. Drain system when it is hot and store it dry during its shut down period.

Chemical Treatment

1. Sodium sulfite to maintain 30-60 ppm in boiler water;
2. Phosphate (tri-sodium or hexameta) to maintain 40-80 ppm PO4 in boiler water;
3. Caustic to maintain OH alkalinity of 150-300 ppm CaCO3, maximum total alkalinity of 700 ppm and pH of 10.5-11.5 in boiler water;
4. Morpholine to maintain pH of 8.5-9.5 in condensate.

Monitoring

1. Test and document boiler water sulfite, pH (boiler water and condensate), TDS, phosphate and alkalinity levels, and record water make-up water meter reading at least 2-3 times per week (once per shift on HP systems);
2. Document chemical addition and softener/dealkalizer runs;
3. Submit water samples to laboratory twice per year.

Problems

1. Excessive boiler water TDS concentration indicates insufficient blowdown, softener over-run, excessive chemical addition;
2. Excessive alkalinity indicates excessive chemical addition, dealkalizer over-run;
3. Insufficient alkalinity indicates excessive hexameta phosphate addition, insufficient caustic addition;
4. Excessive phosphate addition indicates softener over-run;
5. Excessive sulfite addition indicates improper deaerator operation.

GLYCOL HEATING/COOLING SYSTEM

Mechanical Requirements

1. Heating/Cooling source (i.e. boiler, exchanger, chiller), circulating pumps, interconnecting piping, zone valves;
2. Soft water fill;
3. Chemical pot feeder or chemical pump system;
4. By-pass cartridge type filter;
5. Automatic air vents;
6. Pressurized expansion tank, diaphragm type on large systems (properly sized to prevent overflow) with soft air supply;
7. Fresh water make-up line with water meter, pressure regulator, reduced pressure type of backflow preventer valve and isolation valves.

Operation

1. Maintain a positive pressure at top of system, i.e.

   $$P = [S.G. \times (H/2.31)] + 5$$

   where P: static pressure (i.e. pumps off) at pump suction, psig
   S.G.: specific gravity of glycol
   H: elevation of system above pump suction, feet;
2. Repair leaks immediately;
3. Do not blow down;
4. Limit maximum control temperature to 180F (82C);
5. Leave system filled with glycol during shut down period.

Chemical Treatment

1. Inhibited industrial grade ethylene glycol (or inhibited industrial grade propylene glycol if reduced oral toxicity is required) to maintain a pH greater than 9.0, an RA (100%) value grater than 9.0 and a glycol concentration of approximately 50% wt%;
2. Inhibitor to maintain an RA (100%) value and a pH value grater than 9.0.

Monitoring

1. Record water meter reading at least once per month;
2. Document glycol addition and filter cartridge changes;
3. Submit glycol sample to laboratory once per year.

Problems

1. Black suspended solids indicate that air is entering system via excessive make-up water, faulty air vents, pump seals, plugged strainers, etc.;
2. Glycol concentrations less than approximately 20% could lead to contamination with bacteria, indicated by low pH;
3. Suspended solids and excessive filter cartridge changes indicate active corrosion.

CONDENSER WATER (COOLING TOWER) SYSTEM

Mechanical Requirements

1. Cooling tower, heat exchanger, chiller, circulating pumps, interconnecting piping;
2. Soft water make-up for generic chemical treatment;
3. Unsoftened water for proprietary chemical treatment;
4. Chemical metering system;
5. By-pass cartridge type filter;
6. Continuous bleed-off system;
7. Water make-up line with water meter and float valve well above normal operating level in the basin.

Operation

Since the water within these systems is continuously aerated, the prevention of corrosion cannot be accomplished by operational techniques. Therefore, chemical treatment must be used for this purpose.

The system must be drained and stored dry during its shutdown period.

Chemical Treatment

1. Generic Program:
   - hexameta phosphate to maintain a poly phosphate level of 10-20 ppm PO4;
   - sodium hypochlorite to maintain a total bacteria count of less than 10^4 colonies per milliliter.
2. Proprietary Program:
   - phosphonate based inhibitor to maintain prescribed limits;
   - biocide to maintain a total bacteria count of less than 10^4 colonies per milliliter.

Monitoring

1. Test and document pH, TDS, phosphate and alkalinity levels, and record water make-up water meter reading at least 2-3 times per week (once per day on large systems);
2. Document chemical addition and softener/dealkalizer runs;
3. Submit water samples to laboratory twice per year;
4. Submit corrosion coupons to laboratory once per month.

Problems

1. Scale indicates insufficient inhibitor addition, excess TDS concentration, excess alkalinity concentration, excess hardness concentration;
2. Corrosion (i.e. iron corrosion rate greater than 5 mpy, copper corrosion rate greater than 0.2 mpy) indicates insufficient inhibitor addition;
3. Excess bacteria indicates insufficient biocide addition.

AIR WASHER (HUMIDIFIER) SYSTEM

Mechanical Requirements

1. Basin, spray nozzles, eliminator pads, circulating pump;
2. Chemical metering system;
3. Continuous bleed-off system;
4. Water make-up line with water meter and float valve well above normal operating level in the basin.

Operation

Since the water within these systems is continuously aerated, the prevention of corrosion cannot be accomplished by operational techniques. Therefore, chemical treatment must be used for this purpose.

The system must be drained and stored dry during its shutdown period.

Chemical Treatment

1. Generic Program:
   - hexameta phosphate to maintain a poly phosphate level of 10-20 ppm PO4;
   - sodium hypochlorite to maintain a total bacteria count of less than 10^2 colonies per milliliter;
2. Proprietary Program:
   - phosphonate based inhibitor to maintain prescribed limits;
   - biocide to maintain a total bacteria count of less than 10^2 colonies per milliliter.

Monitoring

1. Test and document pH, TDS, phosphate and alkalinity levels, and record water make-up water meter reading at least once per week;
2. Submit water sample to laboratory once per year.

Problems

1. Scale indicates insufficient inhibitor addition, excess TDS concentration, excess alkalinity concentration, excess hardness concentration;
2. Corrosion indicates insufficient inhibitor addition;
3. Excess bacteria indicates insufficient biocide addition.