Design Standard

Hydronic Piping in Buildings

Detailed specifications follow.

PART 1 GENERAL

1.1 Above ground hydronic piping 2 inches and less in diameter shall be ASTM B88, hard drawn, Type L seamless copper tube with wrought copper fittings, ASTMB16.22 or PEX-a cross linked polyethylene piping, ASTM 876 with oxygen-diffusion barrier that meets DIN 4726 and F1960 cold expansion fittings or Aquatherm Polypropylene piping and fittings manufactured from a PP-R resin meeting the requirements of ASTM F2389. Fittings shall be installed using socket fusion, electrofusion, or butt fusion as applicable.

1.2 Above ground hydronic piping 2.5 to 10 inches in diameter shall be ASTM A52, Grade B standard weight seamless or electric resistance welded black steel pipe with standard weight seamless steel welded fittings, satisfying ASTM A234, Grade WPA or WPB, ANSI B16.9, or Aquatherm Polypropylene piping and fittings manufactured from a PP-R resin meeting the requirements of ASTM F2389. Fittings shall be installed using socket fusion, electrofusion, or butt fusion as applicable.

1.3 For condensate drain piping provide one of the following:
   A. Copper piping as specified above
   B. PEX-a piping as specified above
   D. Polypropylene as specified above

1.4 For PEX-a and polypropylene applications, piping shall be terminated at the control valve at the AHU. Piping from the control valve to the coil shall be copper.

1.5 Isolation Valves
   A. Provide the piping systems with line size shutoff valves located at risers, at main branch connections at each floor, at branch takeoffs serving equipment and at each heating and cooling coil. Valves shall be provided on both supply and return lines.
   B. At air handling units where multicoil (stacked) arrangement is used, provide each supply and return line to and from each stacked coil section with a union, pressure gauge, thermometer and a balancing valve with memory stop and valves for isolation of each coil.
1.6 Provide insulation with minimum thickness and conductivity values in compliance with ASHRAE Standard 90.1-2010, Table 6.8.3A & B. Consider additional insulation to ensure compliance with requirements of Building Energy Efficiency Analysis Design Standard.

1.7 All hydronic piping systems (CHW and HHW) shall have automatic air venting at the highest point in the system.

1.8 Stainless steel fine wire mesh strainers shall be installed at all pumps and air handling units to mitigate problems with particulate matter.

1.9 The methodology for initial flushing and treatment of hydronic systems contained in Appendix A, or equivalent approved in advance by UES, is required for any new hydronic system (chilled water or heating hot water) prior to start-up.

1.10 The methodology contained in Appendix B, or equivalent approved in advance by UES, is required for any hydronic system(chilled water or heating hot water) shutdown or layup of more than 30 days duration

1.11 Di-electric insulating flanges shall be provided at all connections between copper and steel piping and maintained for the life of the piping system

PART 2  PEX-a AND POLYPROPYLENE PIPE REQUIREMENTS

2.1 Standard Grade hydrostatic pressure ratings from Plastic Pipe Institute in accordance with TR-3 as listed in TR-4. The following three standard-grade hydrostatic ratings are required:

   A.  200 Degrees F at 80 psi
   B.  180 Degrees F at 100 psi
   C.  73.4 degrees F at 160 psi

2.2 Certification of flame spread/smoke development rating of 25/50 in accordance with ASTM E84 when wrapped with standard pipe insulation, field installed.

2.3 Where installed in systems with pumps in excess of 7.5 HP, piping shall be protected from excessive heat generated by operating the pump at shut-off conditions. Where the possibility exists that the pump will operate with no flow, the protection method shall be a temperature relief valve or comparable level of protection, set to a maximum temperature of 185° F.
APPENDIX A
GE CLOSED SYSTEM FLUSHING AND TREATMENT
PART 1- EXECUTION

1.1 Treatment
   a. Pre-operational cleaning and flushout of closed hot, chilled and process water systems.

   b. Testing of conductivity, iron, copper, and cleaning agents. After cleaning and before adding chemical initial charge, system must be flushed to meet these minimum requirements:
      i. Conductivity no higher than 20 mmho above city water level
      ii. No foam
      iii. Copper level less than 0.5 ppm
      iv. Iron level less than 1.0 ppm
      v. pH 9.4 or less
      vi. less than 1 ppm phosphates (as ortho-phosphate $PO_4$)

1.2 Cleaning Procedure for both hot and chilled closed systems only

   The following procedure is considered an optimal cleaning and passivation procedure. Some of the special considerations for a closed loop are foaming, surge tank volume and capability of flushing the entire system as opposed to blowdown over a long period of time.

1. Review with local EH&S on discharge the cleaning solution (based on the available Environmental Data information)
2. Have 5 gallons GE Betz AF2290 Anti-foam on hand in case of high foaming
3. Wear proper safety equipment (rubber gloves, goggles, face shield, long sleeve shirt, dusk mask, etc.) when working with the chemicals
4. Confirm water consumption and water needs throughout the system
5. Determine the system volume if unknown
6. Gather baseline iron, pH, conductivity and temperature data
7. Allow for enough volume to add 1.0% solution of GE Betz Ferroquest 7101 volumes
8. Flush the equipment to remove large debris at the maximum possible flow rate. Fill the system to 80% design volume to allow room for expansion and chemicals.
9. Bypass filters. Note: Be certain that expansion tanks are not bypassed. Be sure provisions are made for thermal expansion. Failure to provide for expansion can result in explosive failures of piping or equipment. 
10. **Ferroquest will remove the zinc coating from galvanized metal.** Insure tower sump and other areas of cooling system and hot water are not galvanized material prior to cleaning start up.
11. Charge with Ferroquest. Circulate the cleaning solution through the exchangers for 12 to 24 hours to remove finishing oils and greases and passivate metallurgy. Have anti-foam available in event of excess foaming.
12. Flush with fresh water until the conductivity is reduced to that of the make-up water and iron level is 0.5 ppm or less. Inspect the system. Inspect some flanges, valves, or strainers to insure solids are removed. If the system is still dirty repeat the process.

APPENDIX B

GE LAY-UP OF BUILDING HHW & CHW SYSTEMS
Lay-Up of Building HHW Systems

If any part or all of a heating hot water system will be taken out of service for a period of time, precautions must be taken to prevent severe corrosion damage, both traditional and microbiologically induced. Freeze protection of coils is briefly covered under this document but may also be a factor. All equipment must be taken into consideration, including heat exchangers and water loops that may be normally isolated.

Preparation

If equipment has become fouled during operation, then a cleaning should be completed first. Depending on the nature of the deposit and the metallurgy, a scale cleaning or iron based corrosion by-product type cleaning may be appropriate.

Wet Layup Method

Drain the system and refill with enough water to adequately circulate. Charge with a molybdate based product such as GE Betz CorrShield* MD4107 at 1250-2000 ppm or 10-17 lbs./1,000 gal and also add additional copper protection such as GE Betz Inhibitor AZ8104 at 100 -140 ppm or 1-1.5 lbs per 1,000 gallons of system volume.

Also add a high dose of a broad-spectrum biocide such as Spectrus* NX1100 at 100-200 ppm (0.83-1.7 lbs./1,000 gal).

Continuous circulation without load is preferred, but if not practical, circulate weekly and test monthly for microbiological activity and chemical residual.

Special Considerations with Freezing Conditions

In the unlikely event that building HHW system will be down and not recirculating during freezing conditions, layup of air coils with propylene glycol may be necessary, in this case a 35% solution of propylene coil is added to the coil system. It is essential if glycol in the coil is used, that it be COMPLETELY DRAINED and flushed with city water. All residual glycol must be removed before interconnecting this system with the larger UES system.

An alternate is to blow warm return air through the coil. Consult UES if you want to consider this as an option.
Lay-Up of Building Chilled Water Systems

If any part or all of a chilled water system will be taken out of service for a period of time, precautions must be taken to prevent severe corrosion damage, both traditional and microbiologically induced. Freeze protection of coils is briefly covered under this document but may also be a factor. All equipment must be taken into consideration, including heat exchangers and water loops that may be normally isolated.

Preparation

If equipment has become fouled during operation, then a cleaning should be completed first. Depending on the nature of the deposit and the metallurgy, a scale cleaning or iron based corrosion by-product type cleaning may be appropriate.

Wet Layup Method

Drain the system and refill with enough water to adequately circulate. Charge with a molybdate based product such as GE Betz CorrShield* MD4107 at 1250-2000 ppm or 10-17 lbs./1,000 gal and also add additional copper protection such as GE Betz Inhibitor AZ8104 at 100 -140 ppm or 1-1.5 lbs per 1,000 gallons of system volume.

Also add a high dose of a broad-spectrum biocide such as Spectrus* NX1100 at 100-200 ppm (0.83-1.7 lbs./1,000 gal).

Continuous circulation without load is preferred, but if not practical, circulate weekly and test monthly for microbiological activity and chemical residual.

Special Considerations with Freezing Conditions

In the event that building chilled water system will be down and not recirculating during freezing conditions, layup of air coils with propylene glycol may be necessary, in this case a 35% solution of propylene coil is added to the coil system. It is essential if glycol in the coil is used, that it be COMPLETELY DRAINED and flushed with city water. All residual glycol must be removed before interconnecting this system with the larger UES system.

An alternate is to blow warm return air through the coil. Consult UES if you want to consider this as an option.