SECTION 15511
HYDRONIC PIPING AND SPECIALTIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Pipe Materials
2. Fittings
3. Specialty Items
4. Glycol Antifreeze Protection
5. Process Cooling

B. Related Sections:

1. Section 15010 - Basic Mechanical Requirements.
2. Section 15050 - Basic Mechanical Materials and Methods: Valve, pipe hangers, supports and accessories, identification of piping, freeze protection systems, welding, sleeves, plates and closures.
3. Section 15240 - Mechanical Sound and Vibration Control: Piping isolation hangers, supports, flexible piping connectors.
4. Section 15250 - Mechanical Insulation: Piping insulation.
5. Section 15540 - HVAC Pumps.
6. Section 15548 - HVAC Water Treatment: Pre-start up cleaning of HVAC piping systems, manifolds, solenoid water valves with strainers, pot feeders.
7. Section 15950 - Controls: Automatic control valves, aquastats, temperature sensing wells, flow switches.
8. Section 15990 - Testing, Adjusting and Balancing: Balancing of hydronic systems.

1.02 REFERENCES

B. American National Standards Institute (ANSI).
C. American Society of Mechanical Engineers (ASME).
D. American Welding Society (AWS).


1.03 SYSTEM DESCRIPTION

A. Design Requirements:

1. Specify Type K hard drawn copper tube for open-loops and Schedule 40 black steel pipe or Type L for closed loops.

2. Obtain approval from UCB to allow Contractor's option to use mechanical grooved pipe in accessible locations only for chilled and condenser water piping and mechanical equipment piping connections.

3. Design piping systems with drain valves at main shut-off valves, low points of piping, bases of vertical risers and at equipment.

4. We strongly encourage the installation of isolation valves. Specify and indicate location of isolation valves for all zones, risers, branches and equipment.

5. Specify unions or flanges downstream of valves and at equipment and apparatus connections. Unions are not required for reheat coils and terminal units, BBRs, convectors, CUHs and UHs or 2-way valves associated with them.

6. Specify manual air vents at all changes in elevation downward in direction of flow with full size air chamber and pipe down to accessible location with 1/4 inch copper tubing to a petcock.

7. Specify diaphragm-type compression tanks, and where glycol is to be used in the system, specify a diaphragm which is compatible with glycol.

8. Plain steel expansion tanks are unacceptable.

9. Specify flow measuring and balancing device combinations of orifices, venturis, throttling valves and temperature and pressure taps to provide accurate flow measurement for manual balancing of hydronic systems. Test ports shall be on one side of the valve or be provided with a shut-off valve on the pressure side of the balancing valve. Balancing valves shall have full shut-off capability and memory stop. Valves shall be installed upstream of balancing ports to allow cleaning of ports.

10. For BBR, in order to achieve adequate heat transfer, turbulent flow is necessary. Therefore, do not specify a flow rate below that which is necessary for turbulence in the specified BBR pipe size. Specify flow (GPM) at all locations of balancing devices.
11. Automatic pressure-compensating variable-orifice type regulating valves to balance flow are unacceptable as substitutes for manual balancing of hydronic systems.

12. In hydronic systems subject to freezing, the University requires “pumped coils”. Inhibited ethylene glycol antifreeze solution (See 2.10 below) may be used only when approved by the University.

13. Glycol system expansion tanks should be sized per ASHRAE recommendations.

14. For initial fill of glycol systems, specify and require metering of volume to determine correct mix for specified concentration.

15. For glycol-filled systems, specify that all components exposed to glycol shall be compatible with the specified glycol (especially the seals and gaskets).

16. Provide the following system glycol concentrations:
   Chilled Water System 35 percent
   Hot Water System 40 percent
   Reclaim Water System 40 percent
   Solar Water System 40 percent

17. Automatic glycol/water feeder systems are typically not required in University applications where antifreeze systems are used. Provide pressure sensor to alarm through central DDC.

18. System fill shall be performed by means of a temporary fill tank totally isolated from domestic water system. Fill connection shall be a female hose-end ball-valve. Supply shall be with a removable hose which can be connected to a male hose-end valve connected to a backflow prevention device.

19. All pressure relief valves in glycol systems shall drain into feeder tank (if present) or relief reservoir.

20. Temperature gauges across coils and pressure gauges across pumps are required. P&T taps are not sufficient. Use brass piping. Black iron is not acceptable because it rusts and plugs up. Specify shut-off valves at gages.

21. Specify that test and balance ports in chilled-water systems be long enough to extend beyond insulation. Cutting-back the insulation or covering the ports is not acceptable.

22. Process cooling systems are required in order to avoid water-wasting cooling.

23. For process-cooling systems, specify hose-end drain cock between equipment connector and return shut-off valve. (This is to purge air after connecting equipment).

24. When multiple/stacked chilled-water coils are required, specify reverse-return manifolds. This has proven to be necessary at low-flow conditions where using
balancing valves has allowed freezing conditions because the valves are not linear for all flow conditions.

25. For outdoor underground chilled-water installations, it is acceptable to use uninsulated plastic piping, either C900 PVC with ductile-ion joints, or equivalent polyethylene at least 4 feet deep.

PART 2 - PRODUCTS

2.01 PIPING MATERIALS

A. Pipe:


2. Exterior uninsulated underground chilled-water: 2900 PVC with ductile-ion fittings. High density polyethylene (HDPE)

3. For exterior insulated underground chilled-water: HDPE manufactured by PermaPipe or Thermacore Process, Inc.

B. Tube:

1. Type K, hard copper for open loops, Type L for closed loops. Solder fittings with antimony-free and lead-free solder with shear strength not less than 7250 PSI. Allstate, "Aquasafe" or equal. Pipe diameters of 2” and above shall be brazed with filler material of no less than 15% silver.

2. Hot-water copper tubing shall have copper-clad clamps or plastic isolators at clamps.

3. Chilled-water piping shall have full insulation where clamped.

C. Mechanical Grooved Pipe (only where pre-authorized by the University):

1. Manufacturers:
   a. GRUVLOCK.
   b. Victaulic
   c. Central

2. Grooved Pipe:
   a. Black steel, Schedule 40, standard square cut or roll grooved to coupling manufacturer's specification and recommendations for the specified application.

2.02 RELIEF VALVES

A. Manufacturers:

1. Kunkle
2. Lonegren  
3. Lunkenheimer  
4. McDonnell and Miller  
5. Watts  

B. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labeled.  

2.03 DIAPHRAGM - TYPE COMPRESSION TANKS  
A. Manufacturers:  
   1. Amtrol  
   2. American Tube and Controls  
   3. Bell and Gossett  
   5. Taco  
B. Tested and stamped in accordance with Section 8D of ANSI/ASME Code.  

2.04 AIR SEPARATORS  
A. Manufacturers:  
   1. Spirovent only.  
      a. Note: Contractor shall make arrangements through TM Sales to get air separators with a 0.60 cost multiplier of list price when buying them from local distributors for UCB Projects.  

2.05 STRainers  
A. Manufacturers:  
   1. Armstrong  
   2. AW Cash  
   3. Boylston  
   4. Hoffman  
   5. ITT  
   6. Keckley
7. Mueller
8. Plenty

B. Basket Strainers: Duplex, quick-opening covers, stainless-steel baskets, single-handle or hand-wheel operation of valve.

2.06 PUMP SUCTION FITTINGS

A. Manufacturers:
   1. Allis Chalmers
   2. Armstrong
   3. Aurora
   4. Bell and Gossett
   5. Peerless
   6. Taco
   7. Weinman

B. Fitting to match specified pump.

2.07 COMBINATION PUMP DISCHARGE VALVES

A. Manufacturers:
   1. Armstrong
   2. Bell and Gossett

2.08 FLOW INDICATOR SWITCHES

A. Manufacturers:
   1. McDonnell and Miller
   2. Mueller

2.09 FLOW MEASURING AND BALANCING DEVICES

A. Manufacturers:
   1. Manual Balancing
      a. Not acceptable: Bell and Gossett “Circuit Setters” and other variable-orifice ball-valve balancing valves
b. Flow Design “Flowset”  
c. Flowpac  
d. Gerand  
e. Griswold “Quickset”  
f. Nibco globe-style with isolation valve  
g. Tour & Andersson  

B. Design notes:  

1. Mechanical Consultant shall add to specifications. "Mechanical contractor shall obtain approval in writing from Balancing contractor for all balancing devices."  
2. All specified balancing valves shall have test ports on one side of the valve.  

2.10 INHIBITED GLYCOL  
A. Manufacturer: The Dow Chemical Company  
B. Product: Dowtherm 4000 Heat Transfer Fluid (Ethylene Glycol) for hot water systems; Dowtherm SR-1 for chilled-water systems. Dowfrost HD (Propylene Glycol) may be used if authorized or required due to concerns about cross-contamination or toxicity.  

2.11 VALVES  
A. The University requires ball valves with stainless steel ball and trim, Teflon seats, seals and gland nuts, or high-quality butterfly valves, instead of gate valves.  

2.12 CHILLED WATER BTU METER  
A. Project Engineer of Record shall submit to Utility Services the projected Maximum, Minimum, and Normal operating conditions of each service.  
B. Project Engineer of Record shall submit building annual consumption projections.  
C. Units  
   1. Steam shall be in Klbs/h for and Klbs for consumption projection  
   2. Chilled water shall be in ton-h for peak and tons for consumption  
   3. Water shall be in kgal for consumption  
D. Utility Services Meter Panel (UMP)  
   1. All meter panels shall be in accordance with the University of Colorado Boulder Utility Standard No. EO-100-A latest revision for integration into the Utility Control System (UCS). Coordinate UMP with all other utility main meters (ie steam, domestic work, and electric).
2. Meter Panel shall house flow computers (totalizers) and Advanced Metering Infrastructure (AMI) Gateways devices.

3. The UCS gateway (Master) device shall reside in the meter panel.

4. Gateway device shall be industrial grade with internal firewall.

5. Acceptable manufacturers:
   a. MOXA Mgate Model #3170 (or approved equal).

6. All meters (chilled water, electrical, steam, domestic water) shall communicate via a dedicated RS-485 network utilizing ModBus RTU Protocol.

7. One dedicated IP connection shall be installed for the UMP

8. A dedicated 115V circuit shall be supplied for the UMP

E. Flow Computer / Totalizer

1. Specify Kessler-Ellis Products (KEP) ES-749 flow computer to be connected to all CHW meters. The KEP shall be panel mount type and installed in UMP. The KEP flow computer will receive the analog flow signal as an input from the chilled water meter and the supply and return temperature signals from a set of matched pair (precision) 3-wire 100 ohm platinum RTDs.

2. Outputs:
   a. KEP shall send consumption (ton-hr), supply and return temperatures (°F), differential temperature, and peak (tons) output via Modbus RTU Protocol to the Utility Control System (UCS) Gateway device located in the UMP over a dedicated RS485 communication trunk. All wiring and terminations are to be completed by Temperature Control or Electrical Contractor (approval required), including installation of KEP, wiring of meter components to KEP, wiring of KEP to UCS, setup, and KEP programming.
   b. All KEP installations shall be in accordance with the University of Colorado Boulder Utility Standard No. EO-100-A latest revision

F. Meters

1. Full Bore (In-line) Electromagnetic Flow Meter:
   a. Specify full bore electromagnetic meter for new installations or existing installations 3” or larger. Meter shall be installed with temperature differential (delta T) transmitters to calculate total BTU’s. Meter size and installation shall be approved by UCB Utility Services. Meter to have ANSI class 150 flanges.

2. Acceptable Manufacturers:
   a. Onicon model F-3100 series
   b. Rosemount
   c. Yokogawa
   d. ABB
3. Insertion Type Electromagnetic:
   a. Insertion type electromagnetic meters are acceptable for existing installations of 3” and larger service line size. Meter to be installed with 3-wire matched pair 100 ohm platinum RTDs for calculating chilled water temperature differential. Meter size and installation shall be approved by UCB Utility Services. Meter to be supplied with hot tap installation hardware from manufacturer.
   b. Acceptable Manufacturers:
      i. Onicon model F-3500
      ii. UCB Utility Services approved equal

4. All CHW meter installations shall be in accordance with the University of Colorado Boulder Utility Standard No. EO-101-A latest revision

5. Meter Submittal
   a. All main (primary) service Chilled Water meters shall be approved by Utility Services prior to purchase and installation.

PART 3 - EXECUTION

3.01 INSTALLATION

   A. In general, for project specifications, remove "Design Requirements" sub-paragraph A in Part 1, paragraph 1.03 "System Description" of this Design Guide and use list to expand on specific requirements of installation for each product specified.