

232000 HVAC Piping and Pumps

Sections Included In This Standard:

- 1.1 Chilled Water Systems
- 1.2 Steam Distribution Systems
- 1.3 Steam and Steam Condensate Specialties
- 1.4 Refrigerant Piping
- 1.5 HVAC Base-Mounted Pumps
- 1.6 HVAC Vertical close coupled in-line pumps
- 1.7 Chemical Water Treatment
- 1.8 Variable Frequency Drives
- 1.9 HVAC Piping Components

1.1 CHILLED WATER SYSTEMS

A. GENERAL

1. The campus is served by several chilled water plants. The chilled water system of each new building shall be designed so as to be compatible with the characteristics of the chilled water plant(s) serving it. New buildings shall have chilled water pumps, variable frequency drives, and connect to the Campus chilled water system.
2. Chilled water systems on the Exterior of the building shall follow the 3360000 Standard.
3. Buildings served by a central chilled water plant should not have an expansion tank or an automatic water make-up system. Make provision for flushing and initial filling of the chilled water system, using domestic water.
3. Existing loads on all UF chilled water plants operate at a higher flow-per-ton ratio, under peak conditions, than the chillers are designed for. This results in loss of system capacity and efficiency. In order to help remedy this situation, new chilled water loads are required to have exceptionally low flow-per-ton ratios, or high chilled water return temperatures; the overall average return temperature, under design conditions, should be at least 60° F. This may require some oversized coils, series arrangement of chilled water coils, pre-cool coils for outside air, or other options. The engineer shall select the most appropriate mix of options to satisfy the overall average. The engineer shall also investigate the application of some of the following for energy savings and dehumidification: Tri-coils, heat pipes, enthalpy energy recovery ventilators (fixed plate and wheel), and preconditioned outside air.
4. All buildings shall be provided with shut-off valves within the building where the chilled water supply and return lines enter the building. Provide manual air vents on the plant side of the shut-off valves, thermometers and pressure gauges on the supply and return. Provide the means to drain and vent the building piping, as well as automatic air vents at the high points of supply and return risers.
5. All new and renovated buildings shall be provided with chilled water metering and shall follow the 330900 Standard.
6. Chilled water pipes need to enter a building in such a way that they can be replaced.

B. Chilled water piping

1. Nipples less than 6" in length and 2" in diameter or less will be schedule 80 nipples. (Store bought or custom made)
2. Minimum ½" thread-o-let or tee for all gauges accompanied with 6" schedule 80 nipple with valve.
3. Differential pressure or gauge connection shall not use the factory supplied 1/8" or 1/4" taps on pump housing.

C. EXECUTION: All lines shall be cleaned, reverse flushed, pre-treated, and all air vented before water is turned on from the central plant. See also "Chemical Water Treatment" located in this Section.

1.2 **STEAM DISTRIBUTION SYSTEMS**

- A. DESIGN DRAWINGS: Piping design drawings for steam and heating hot water heat exchangers shall include all valves, traps, drip legs, etc. with the intent that this drawing shows all expected equipment and devices.
- B. PIPING
 1. Steam: Steam lines shall be a minimum of Schedule 40, **seamless** black steel pipe.
 2. Condensate: Condensate lines shall be a minimum of Schedule 80 **seamless** steel pipe.
 3. Use flexitallic gaskets (not paper) where required for steam and condensate system.
- C. **CONDENSATE PUMPS AND RECEIVERS**
 1. See Standard 336000, Detail STM-2 for details on condensate receiver tank
 2. Receiver tank shall be located within 3' (horizontally) of a floor drain.
 - a. The potential temperature of the condensate going to this drain needs to be considered when designing this drains materials. Follow 702.5 of the Florida Building code, Plumbing.
 3. Condensate pumps shall be designed for 210°F condensate with no cavitation.
 4. Pump and piping system shall be designed so that a circuit setter is not required.
 5. Provide elevated receiver if necessary for npsh.
 6. Steam driven condensate pumps are preferred. Electric powered pump motors are allowed with written permission from Facilities Services.
 7. Cast iron receiver tanks preferred
 8. Specify a duplex unit.
 9. Acceptable Manufacturers: Hoffman; Sterlco(Sterling), **Watson McDaniel** or other equivalent.
- D. METERING: All new and renovated buildings shall be provided with steam and condensate isolation valves and metering at the point the lines enter the building that shall follow the 330900 Standard.
- E. SHUT-OFF VALVES: All buildings shall be provided with shut-off valves within the building where the steam supply and return lines enter the building.

- F. Steam and Condensate systems on the exterior of the building shall follow the 336000 Standard.
 - 1. The conduit piping system needs to be terminated inside the building.
- G. Steam and Condensate pipe need to enter a building in such a way that they can be replaced.

1.3 STEAM AND STEAM CONDENSATE SPECIALTIES

A. STEAM TRAPS

- 1. Non-vented traps shall be used on high and low drip leg trap assemblies only. Not on heat exchangers or steam coils.
- 2. Acceptable Manufacturers: Watson McDaniel, Spirax Sarco; Armstrong Yarway; Velan,

1.4 REFRIGERANT PIPING

- A. TUBE SIZE THROUGH 1/4": Use hard drawn tempered copper tube.
- B. TUBE SIZE GREATER THAN 1/4": Hard drawn tempered copper tube or Soft copper tube are allowed.

1.5 HVAC BASE-MOUNTED PUMPS

- A. ACCEPTABLE MANUFACTURERS: Aurora; Bell and Gossett
- B. PUMP MOTORS: Provide high efficiency, inverter duty motors.
- C. VIBRATION ISOLATION:
 - a. All base-mounted pumps shall have the base grouted into the housekeeping pad or installed on spring-mounted housekeeping pads/bases to provide vibration isolation and to prevent sound from resonating into the piping system.
 - b. Vibration isolation systems are required for pumps on both the supply and return sides.
- D. SUCTION STRAINER: All HVAC (chilled and hot water) pumps shall have a self-contained suction strainer to protect the pump from foreign matter or dirt, with a blow down line and a ball valve with plug or a hose fitting with cap to flush debris from strainer. Inline pumps shall have an inline strainer. The suction strainer shall have a removable insulation box around the strainer.

1.6 HVAC VERTICAL CLOSE COUPLED IN-LINE PUMPS

- A. ACCEPTABLE MANUFACTURES: Aurora, Bell & Gossett, Armstrong, Taco

1.7 CHEMICAL WATER TREATMENT

- A. CHILLED, HEATING, AND CONDENSER (COOLING TOWER) WATER:
 - a. All chilled, heating, and cooling tower water piping shall be reverse flushed, cleaned, pre-treated, and initially treated by the Contractor.
 - b. Submit an inspection request to Facilities Services Operations Engineering department to witness the piping systems' flushing, cleaning, pre-treating, and initial treating, and

- to coordinate identification, determination of chemical type and quantity needed and purchase of water treatment chemicals.
- c. Contractor shall purchase these chemicals in the chemical type and quantity needed directly from the Water Treatment Vendor under contract with Facilities Services at the time the system is put into service. The Water Treatment Vendor will supply chemicals at the University contract price, deliver the chemicals to the job-site and invoice the Contractor, who shall pay the Water Treatment Vendor for the chemicals delivered.
 - d. The Contractor is required to maintain treatment for all closed loop building piping systems during the entire warranty period, providing monthly water sampling and written reports to the A/E and Facilities Services with copy of such sampling and reports maintained on the job-site.
 - i. The Contractor water treatment responsibility for building piping connected the central chilled water and steam systems ends upon Facilities Services agreeing to, and the subsequent connection to the central system.
 - e. Building piping systems shall be flushed, cleaned and pre-treated prior to introducing water to air handling units, heating units and other terminal equipment (except for use of clean potable water for hydrostatic pressure testing).
 - i. Initial treatment shall not commence until all operating valves are opened to equipment tied into the building piping system (including air-handling units, heating units and other terminal equipment).
 - ii. No equipment shall be put into service prior to initiation of water treatment.

1.8 VARIABLE FREQUENCY DRIVES

- A. COMMUNICATIONS: Variable frequency drives shall be equipped with a serial interface to allow bi-directional communication with the existing controls system and the UF Web based Ethernet WAN with BACnet/IP protocol from the building level controller up to the Web based server operating system.
- B. At a minimum, the following points shall be made available to the controls system: Set Point, Drive Speed (RPM), Frequency (Hz), Current (A), Power (KW), Energy (KWH), Last Fault Number, OK/Faulted Status, Stop/Run Status, and Hand/Off/Auto Status.
- D. HARMONICS: Any project installing a VFD into a new or existing system and generating harmonics is required to eliminate such harmonic noise. In order to prevent obtaining such an installation, as part of submittal data, calculations shall be provided to pre-warn of the possibility of the VFD creating harmonics based upon project parameters. If the calculations show the potential for harmonics, solution(s) must be implemented-to include changing the installation, incorporating harmonic suppression filters, etc. to eliminate the problems. If harmonic suppression filters are required, they may be installed either as part of the equipment itself, or ahead of the equipment on the electrical system. Finally, the installation must be checked to verify the VFD is not generating harmonics. Wiring for the line side of the VFD and the load side of the VFD cannot be run in the same electrical conduit.
- E. ACCEPTABLE MANUFACTURERS: Asea Brown Boveri (ABB), Danfoss, Yaskawa
- F. WARRANTY: The warranty period shall begin at Substantial Completion for a minimum of 2 years.
- G. APPLICATION: Consider providing VFD's for all motors 3 Horsepower and larger, where the motor speeds can be reduced as conditions change (partload). Consider multispeed motors and Electronically Commutated motors (ECM) for smaller motor applications such as exhaust fans, blower fans, Fan Powered VAV's, and Fan Coil Units.

- H. VFD's shall **not** be an integral part of the motor they are associated with. They need to be an independent standalone component so that one can be replaced without the other (VFD and Motor).
 - a. Motors of 1/4hp or less are allowed to have VFD's that are integral to the pump.
- I. VFD's shall be equipped with an external bypass switch.
- J. The SCCR rating for the VFD assembly should be 100kA or survey the total circuit from source (transformer) to the VFD and calculate the maximum available fault current. Ensure that the VFD panels SCCR exceeds the maximum available fault current at the input side.
- K. Provide method to limit the on-off operation to only once per minute to allow VFD to be cool even during manual bypass operation. (BAS, internal or other strategies can be employed)

1.9 HVAC PIPING COMPONENTS

- A. Piping components shall be required in standalone chilled water AHUs (Liebert and others) located inside of buildings.
- B. Flow sensors, pressure and temperature measuring devices shall not be located inside the AHU. All components must be located outside the unit.
- C. At a minimum, provide the following at each stand-alone AHU, FCU, VAV boxes, Chiller and terminal devices. For AHU's all components shall be located outside the unit.
 1. Shutoff valves for both supply and return, within 48 inches of the device / coil.
 2. Chilled water control valve or equivalent.
 3. Balancing valve with pressure taps.
 4. In lieu of Pete's plugs install ½ shut off valves at all pressure and temperature device locations.
 5. Install 4" pressure gauges on both supply and return within five feet of unit. (does not apply to Heating Hot water coils, See 235000, 1.3, E)
 6. Install thermometers on supply and return piping within five feet of unit. (does not apply to Heating Hot water coils, See 235000, 1.3, E)
 7. Pressure test ports at coil supply and return legs wherever a pressure sensor or pressure gauge exists. Add valve
 8. Temperature test ports at coil supply and return legs wherever a temperature sensor or thermometer exists. Add valve
 9. Flexible piping connections are required on coil supply and return sides or main's supply and return sides both entering and leaving the mechanical room or locate them at the AHU.
 10. Check valves will be required to protect the direction of flow. Preferred style is

independent non slam.

- D. Locate low point drains in a way that promotes full draining of the system.
 - i. Drain must include a full open valve with a capped hose connection.
- E. Manual highpoint air vents shall be installed on all systems.
 - i. Must include a full open valve that is plugged or capped.
- F. Strainers shall be required in all HVAC piping located in Central Plants, distribution piping, and inside of buildings. All strainers shall be installed with blowdown valves and screwed plug or screwed hose fitting with cap.
- G. HHW & CHW branch lines 2" and smaller shall be run off the top of all mains unless there is no room to do so. In the event there is no room they must drop out the bottom of the main with a drip leg. A full sized drain valve and a valve 12" within the drip leg on the branch shall be installed.

END OF SECTION