

## HEAT EXCHANGERS - HYDRONIC

### DESIGN GUIDELINES

1. Material and/or Equipment Type:
  - a. Shell-and-tube
  - b. Plate and frame heat exchangers
2. Design
  - a. Shell and tube heat exchangers are to be used in steam to hot water applications.
  - b. Steam to hot water heat exchangers.
    - Design to be mounted at an elevation that will permit gravity draining of condensate back to building condensate pump.
    - Condensate shall not be "lifted".
    - Heat exchangers shall be located at a height that is accessible. They shall not be mounted above other equipment that will restrict the access with a ladder.
  - c. Plate and frame heat exchangers may be used in water to water applications and shall be installed on concrete pads.
  - d. Use of ethylene glycol is not permitted as an anti-freeze agent. Propylene glycol shall be used where needed.
  - e. Designs shall be efficient in part load operation and have considered minimum flow for proper operation and efficiency.
  - f. Safety relief valves are required for both steam and hot water side of heat exchangers and shall be piped to a floor drain.
  - g. Provide connections on piping at plate and frame heat exchangers for cleaning of heat exchanger. Provide ports between shutoff valves and heat exchanger on all four connections.
  - h. All heat exchangers serving hot water systems shall be labeled to read, "Maximum hot water supply temperature shall be set to XXX°F and maximum pressure of XXX psi.
  - i. Provide thermometers, pressure gauges on all piping in/out of heat exchangers. Thermometers shall be installed in thermos wells so the system does not have to be drained when replacing thermometers.
  - j. Shell and tube heat exchangers shall be installed on a stand high enough for the condensate to gravity flow to the receiver. The piping connected to the heat exchanger shall be independently supported so that it does not place pressure on the connections. This has led to premature leaks in the system.
3. Redundancy
  - a. Where a heat exchanger is installed in a system that serves a building with animals, clinical equipment or research equipment, then a redundant heat exchanger is required(N+1).
  - b. If a building is mixed use, the most stringent requirements apply.

- Office buildings or buildings where people could be sent home would not require redundant heat exchangers.
  - c. Where a heat exchanger serves terminal reheats for a VAV air handling system, a redundant heat exchanger is required(N+1).
  - d. Where failure or maintenance downtime of a heat exchanger will result in more than one hour of disruption to University operations, a backup heat exchanger shall be specified. Domestic water may be used as a form of backup to a heat exchanger where the water temperature is applicable.
  - e. The heat source for duplex heat exchangers shall be piped in a manifold such that failure of a control valve will not cause one heat exchanger to be removed from service.
  - f. Shutoff valves shall be provided for each heat exchanger downstream of the control valve manifold.
  - g. Provide redundant steam traps on steam condensate at shell and tube heat exchangers.
  - h. Provide 20% spare capacity in heat exchangers. Additional spare capacity to be considered on a project basis and discussed with WUSM project manager. This information shall be provided in the Design Narrative.
4. Clearances
- a. Heat exchangers shall be designed such that there is adequate clearance to remove tube bundles and rebuild plate heat exchangers.
  - b. Drawings shall indicate the location of service clearance and illustrate that clearances can be maintained.
  - c. Heat exchanger control valves shall be designed for adequate maintenance clearance.
  - d. Control valves/operators shall be installed on a 45 degree angle for heat dissipation in any steam or hot water application.
  - e. Control valves with pneumatic operators are required in steam applications for longevity in high temperature applications. An E/P(electric-to-pneumatic) control required to interface from DDC system to valve operator.
5. Related Sections
- a. DDC Controls
  - b. Pumps - Hydronic
  - c. Piping and Valves – Hydronic
  - d. Piping and Valves - Steam
  - e. Insulation

## EQUIPMENT and PRODUCT REQUIREMENTS

1. Shell and Tube Heat Exchangers:
- a. Approved Manufacturers: (in order of preference)
    - Bell & Gossett

- b. Equivalent products by other manufacturers shall be approved by a WUSM representative. Construction to comply with ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels," Division 1 and "TEMA Standards."
  - c. U-tube with removable bundle.
  - d. Tube velocity shall be limited to a maximum of 7.5 fps.
  - e. Materials:
    - Shell - Steel.
    - Head - Cast iron / Flanged and bolted to shell.
    - Tubes -  $\frac{3}{4}$ " seamless copper tubes.
    - Tube-sheet - Brass or stainless steel.
    - Baffles - Brass or stainless steel.
    - The above guidelines may differ per project, EOR to discuss with WUSM as required.
  - f. Vacuum breakers are required on all shell and tube heat exchangers utilizing steam heating.
2. Gasketed Plate Heat Exchangers
- a. Approved Manufacturers: (in order of preference)
    - Bell & Gossett
  - b. Equivalent products by other manufacturers shall be approved by a WUSM representative.
  - c. Freestanding assembly consisting of frame support, top and bottom carrying and guide bars, fixed and movable end plates, tie rods, individually removable plates, and one-piece gaskets.
  - d. Construction to comply with ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels," Division 1.
    - Plate material to be 304 stainless steel min.
    - Gasket material to be EPDM else Nitrile rubber, Viton, Neoprene, Hypalon, Resin-cured butyl rubber as needed for specific service and as approved by WUSM Project Manager.

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