

**SECTION 236500 – COOLING TOWERS**

- 1.0 ASHRAE 90.1 Compliance: University of Pennsylvania buildings shall comply with the Commercial Energy Efficiency Requirements of ASHRAE Standard 90.1-2016. The ASHRAE 90.1-2016 compliance paths shall be followed instead of the International Energy Conservation Code (IECC) requirements as permitted by 2018 IECC Section 401.2 Application.
- 2.0 All cooling towers shall have the following characteristics:
- A. Modular cell, induced draft type with vertical discharge and counterflow arrangements.
  - B. Gear driven, direct drive fans. Belt drives are discouraged due to maintenance costs. Provide a close coupled oil sight glass visible from the exterior of the tower.
  - C. Propeller type fans which are individually adjustable and replaceable.
  - D. Towers shall be of non-combustible construction with non-combustible or limited combustible fill material; otherwise the A/E shall evaluate the requirement for sprinkler protection. Towers that are Factory Mutual approved do not require sprinkler protection.
  - E. Fill, louvers and drift eliminators shall be constructed of 15 Mil PVC capable of service up to 125oF and supported by hot-dipped galvanized structural tubing. Drift losses shall not exceed 0.005% of the design GPM. Fill shall be elevated above the cooling tower basin to permit cleaning. Dampers and linkages shall be stainless steel.
  - F. Basins (hot and cold), framework, casing, fan deck and fan cylinder shall be constructed of one of the following options:
    - 1. Concrete.
    - 2. Fiberglass reinforced polyester, stainless steel and PVC.
    - 3. Protruded fiberglass reinforced plastic (preferred choice).
  - G. Nominal design conditions shall be 78oF entering wet bulb, 95oF entering water temperature, and a nominal 10oF water temperature drop. The A/E should investigate alternative entering and leaving conditions to determine the most economical and efficient choice.
  - H. Personnel shall be able to safely access all sections of the cooling tower requiring service without danger of falling (all decking ladders and stairs shall be provided to meet this requirement). Fan motors shall have a motor removal hoist provided. Specify at a minimum a steel ladder, ladder extension, cell partitions, fan cylinder extensions and hot water basin covers. Hot water basin covers shall be hinged to facilitate access. All ladders shall have safety cages.
  - I. The cooling towers shall be located so that the hot water basin is the highest point in the condenser water system. The difference in elevation between the condenser water pump impeller and the cold water basin shall be such that the net positive suction head entering the pump (available) will be greater than the pump requirements when using a fluid vapor pressure of 14.7 psia.
  - J. Calculations shall not use a fluid vapor pressure corresponding to the maximum fluid temperature (i.e. 95-100oF).

- K. Cooling towers shall be located in areas that are fully accessible.
- L. Tower efficiency shall not be reduced by cosmetic screening. For towers with screening, and where screening is installed closer than cataloged minimum clearances, the A/E shall submit the manufacturer's analysis for the tower rating at the specific conditions to the Office of the University Engineer.
- M. The location of the tower shall take into consideration the effects of tower noise and plume upon adjacent occupied spaces, outside air intakes, and parking areas. The location shall also give consideration to the building's wake and prevailing wind, etc.
- N. The design and location of cooling towers must consider the effects of noise, aesthetics, and service access. Some buildings on campus are listed in the Historical Register and must conform to the requirements of such. On a project by project basis, exterior installations of cooling towers shall be evaluated against local site noise level goals and criteria. Refer to Part I, General Section XI. The A/E shall submit an acoustic report to the University representative identifying any noise impacts.
- O. For field fabricated towers constructed on concrete basins, provide a slide gate and screen between the basin and the pump sump. The screen shall be constructed of ¾" x 12 gage stainless steel mesh panel as furnished by USC Screen, Inc., (Sketch 833 or equal).
- P. Winter Protection – Basin freeze protection shall be provided when towers are intended for winter use.
  - 1. For factory fabricated package units, provide each cell with a basin electrical heating package. The package shall include a control relay, control transformer, low water cut-off electrode or float switch, thermostat with capillary and bulb mount, magnetic contactors, and necessary immersion heaters to maintain the basin water at 40 degrees F when the outside temperature is 0 degrees F with 15 mph winds. All outdoor equipment shall be in a NEMA 4X enclosure. The package immersion heaters shall utilize 480-volt electrical power, and shall be designed for intermittent service and be UL approved.
  - 2. For field fabricated units consider alternate methods of basin heating such as the use of an electric hot water boiler system or a compressed air bubbling system.
  - 3. Exterior piping (condenser water, fill and drain) shall be heat traced.
- Q. Variable speed drives shall be used for tower fans on all tower installations.
- R. ASHRAE 90.1-2016 Compliance Requirements: Fan systems shall be provided in accordance with the requirements of Section 6.5.5 of ASHRAE 90.1-2016.
- S. The A/E shall consider field performance testing for cooling tower installations. Review specific applications with the University Engineering Department.
- T. Specify that the tower, less motor, shall be warranted for five (5) years. The warranty period shall commence following the University's acceptance of the tower(s) field performance test(s) and when commissioning efforts are complete.