

NC State University Design and Construction Guidelines

Division 23 Cooling Towers

1.0 Purpose

- A. The following guideline is provided for the selection and specification of cooling towers and their components.

2.0 General Requirements

- A. At a minimum specifications shall include the following references:
 1. ANSI/AFBMA 9 - Load Rating and Fatigue Life for Ball Bearings.
 2. ANSI/AFBMA 11 - Load Rating and Fatigue Life for Roller Bearings.
 3. ASME PTC-23 - Atmospheric Water-Cooling Equipment.
 4. Cooling Tower Institute (CTI) ATC-105 - Acceptance Test Code for Water Cooling Towers.
 5. Cooling Tower Institute (CTI) - Certification Standard STD-201.
 6. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- B. General
 1. Cooling towers shall be induced draft type. Fan drive shall be right angle gear type.
 2. Towers shall be provided with a ladder and safety railing.
 3. Distribution, collection basins, and sump shall be 316 stainless steel.
 4. Provide one cooling tower per chiller having thermal capacity to cool the required flow (GPM) of condenser water from 95°F to 85° F at a design entering air wet-bulb temperature of 80° FWB.
 5. Design structural system for a minimum of 50 psf live load and 21 psf wind load in addition to tower dead-loads and operating-loads.
 6. Structural system, including assembly of collecting basin and steel casings, shall be fabricated via bolt connections with stainless steel fasteners. Joints shall be sealed to make watertight enclosure.

3.0 Materials & Standards

- A. Central plant casings shall be fiberglass reinforced plastic.
- B. Fill material shall be chevron shape and fabricated of minimum 15 mil thick polyvinyl chloride plastic (PVC) capable of withstanding 130°F condenser water.
- C. Drift eliminators shall be and be fabricated of PVC.

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- D. A weatherproof enclosure with electric immersion basin heaters shall be provided for those cooling towers intended to operate year round. A thermostat and low water cutout shall be included. Basin heaters shall be sized to maintain basin water at 40°F at ambient temperature of 12°F.
- E. Provide Mechanically Operated, Collection Basin Water-Level Control: Manufacturer's standard adjustable, mechanical float assembly and valve. Ultrasonic Level Sensor shall provide continuous level indication through a 4- to 20-mA signal, for connection to BMS.
- F. Fans:
 - 1. Cross flow cooling towers shall be equipped with aluminum alloy propeller fan of fixed-pitch type. The fan assembly shall be statically balanced, and the tip speed shall not exceed 12,000 fpm. Fan & shaft shall be supported by heavy-duty grease packed ball bearings designed for a minimum L10 life of 40,000 hours. Fan and motor sheave shall be fabricated from cast aluminum.
 - 2. Counter flow cooling towers shall be equipped with dynamically balanced forward curved centrifugal fans with galvanized steel blades. Provide inlet rings for smooth air flow and energy efficiency. Fan shall be supported by a corrosion resistant steel shaft with heavy duty lubricatable bearings.
- G. Provide totally enclosed, fan-cooled type motor (TEFL). All motors shall be capable of operating with a variable frequency drive.
- H. Test and certify cooling tower thermal performance according to CTI Standard ... Maximum sound pressure level of 85 dB(A) measured at 5 feet above the fan discharge during full speed operation in accordance with CTI Standard ATC-128.

4.0 Installation

- A. One tower per water-cooled chiller shall be installed. Dual cell, common sump towers are not acceptable. Condenser water piping system shall provide for individual tower isolation as well as ability for individual tower to serve any given chiller.
- B. Constant piping geometry shall be provided between cell outlets and the point of common connection on return headers. Tower-outlet piping from each cell shall be identical to assure equal water flow between multiple cells. Provide sump equalizing lines between all towers.
- C. When pumps are to be installed only a few feet below a tower basin, it is imperative that low net positive suction head (NPSH) pumps be utilized. Upon completion of the net positive suction head, available (NPSHA) calculation, the designer shall select the pumps

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net positive suction head, required (NPSHR) maximum head pressure, with the following ratio: $NPSHA/NPSHR = 1.2$.

- D. One water treatment system per cooling tower shall be provided, and should meet all NC State requirements.