

SECTION 23 65 00 - COOLING TOWERS

PART 1 - GENERAL

1.1 SYSTEM DESIGN REQUIREMENTS

- A. General Information:
 - 1. Use outdoor conditions of 95 degree F dry bulb and 64 degree F wet bulb to size cooling tower capacity.
 - 2. Consider closed loop, evaporative sprayed cooling towers to use in conjunction with heat exchangers for systems having winter cooling requirements.
- B. Remote Sump:
 - 1. Allow minimum water level of 4 feet of suction head under operating conditions or greater, if required to meet NPSH of pump.
 - 2. Provide a minimum of 150 percent of drain down storage capacity.
 - 3. Drain down capacity to consist of volume of cooling tower water retention plus all piping exposed to freeze conditions.
 - 4. Provide ventilation in sump room to control humidity.
- C. Provide ladders and safety cages to meet ANSI standards.
- D. Provide manufacturer's certification of tower cooling capacity, based on factory-performance tests, and provide performance curve plotting Leaving-Water Temperature (LWT) against Wet-Bulb Temperature (WBT).
- E. Provide certification of tower wind resistance to withstand pressure indicated, in any direction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Baltimore Aircoil Co., Inc.
 - 2. Marley Cooling Tower Company
 - 3. Evapco

2.2 MATERIALS, GENERAL

- A. General Information:
 - 1. Supply cooling towers with 2-1/2 inch minimum size drain outlet in bottom of sump and located on opposite side of suction outlet of sump. Pipe drain lines to nearest roof drain. Consider indoor sumps as an alternative with the benefit of cold weather operation.
 - 2. Provide tower sections with access ladders from top to bottom in accordance to OSHA standards.
 - 3. Locate tower fan motors outside of the air stream for access for maintenance and not in air stream. Fan motors shall utilize VFD for capacity control.
 - 4. Provide access openings to sumps, valves, motors, belts, sheaves sprays, etc.
 - 5. Provide water treatment piping with bleed solenoid valve, wye strainer and blow down valve upstream. Lockout timer shall have a 3-hour minimum setting.
- B. Factory-fabricated Cooling Towers:
 - 1. General: Fabricate cooling towers using manufacturers' standard design, materials, and construction in accordance with published product information, except as otherwise indicated.

2. Design structural system for the following live loading in addition to dead-loads and operating-loads.
 - a. Wind Loading: 30 psf on exposed vertical surfaces.
 - b. Earthquake Resistance: Acceleration on 1.0 G horizontally through the center of gravity.
3. Fabricate structural system including assembly of collecting basin and steel casings by one of the following methods:
 - a. Bolt connections with fasteners having equal or better corrosion-resistance than the materials being fastened; seal joints to make a watertight enclosure.
 - b. Weld connections and weld metal seams continuously to make unit watertight.
 - c. Provide rigging supports on structure for final rigging.
4. Casings: Install galvanized steel, fabricated and installed by manufacturer to make tower watertight.
5. Provide integral type collecting basin with depressed side outlet sumps with lift-out strainer with openings smaller than nozzle orifices, and with connections for drain, overflow and water make-up.
6. Wetted Surface Fill: Provide vertical sheets of polyvinyl chloride plastic having a flame spread rating of 5 per ASTM E 84 and fabricated into wave-formed configurations installed by the manufacturer to assure break-up of water into droplets.
7. Drift Eliminators: Provide vertical sheets of polyvinyl chloride plastic having a flame spread rating of 5 per ASTM E 84 fabricated by the manufacturer into a three-pass configuration to limit drift-loss to indicated maximum percentage of circulating-water flow-rate.
8. Louvers: Provide galvanized steel designed and installed by manufacturer, and of sufficient thickness and rigidity to prevent visible sagging.
9. Water Distribution System: Galvanized steel, open basin, gravity-flow type with plastic metering orifices; installed by manufacturer to ensure even distribution of water over wetted-surface-fill. Schedule 40 PVC pipe header and removable schedule 40 PVC pipe branches.
10. Nozzles: Provide removable plastic, brass or ceramic nozzles with a maximum pressure drop of 5 psi.
11. Basin Covers: Galvanized steel sheet, removable and with handles, installed by the manufacturer to prevent debris from entering basin and to inhibit algae growth by eliminating sunlight.
12. Inlet Screens: Galvanized steel mesh mounted in removable frames by the manufacturer.
13. Discharge Hoods: Galvanized steel, including access doors, fabricated and installed by the manufacturer to prevent the recirculation of discharge air.
14. Basin heaters: Provide electric immersion heaters including thermostat and low-water cutout, in a weatherproof enclosure, adequate for field wiring. Size basin heaters to maintain basin water at 40 degree F. (4.4 degrees C) at an ambient temperature of -10 degrees F. and with a wind velocity of 15 mph.
15. Handrails: Provide galvanized steel pipe rails of required height above tower. Include knee and toe rails of required diameter and heights.
16. Water Level Control: Provide electric float switch and solenoid make-up valve.
17. Flow Control Valves: Provide heavy duty cast iron, high capacity flow control valves for balancing flow to each distribution basin, and for shut-off during servicing. Do not install ball valves or other valve types that may trap water within the valve to prevent freezing conditions from damaging the valve when the system is not in operation.
18. Fans and Drives:
 - a. Provide cast aluminum propeller fan of adjustable pitch type.
 - b. Provide a gear-drive including speed reducer, with oil level sight glass.
19. Fan Bearings: Provide bronze sleeve bearings with extended external oil lines, sight glass and fittings.
20. Motor Type: Provide totally enclosed, fan-cooled energy efficient type motor. Rated for cooling tower duty service. Efficiency and construction shall comply with Section 23 65 00.
21. Assemble components by one of the following methods:
 - a. Use galvanized or stainless fasteners and accessories to assemble components.
 - b. Weld metal seams and joints.

- c. Apply phosphatized pretreatment on zinc coated surfaces which have not been mill-phosphatized or polymer-coated. Apply gasoline-soluble rust preventative compound on ferrous parts that cannot be galvanized, including shafts and machined parts.
- 22. Finish components with zinc-coated metal surfaces using one of the following methods:
 - a. Coat abraded areas and welded areas with galvanizing repair paint. Finish-paint exposed surfaces with a zinc-chromatized paint.
 - b. Provide 2-1/4 oz. (per sq. ft. of sheet) zinc coating on basin and sump, after fabrication, by hot-dip galvanizing process. Coat abraded areas and welded areas of work with galvanizing repair paint.
 - c. Apply to metal surfaces not galvanized, zinc-rich paint which has been tested and accepted by UL as being equivalent to hot-dipped galvanized steel.
- 23. Vibration Cutout Switch: On induced towers with propeller fans provide switch to de-energize fan motors if excessive vibration occurs due to fan imbalance.
- 24. For polymer-coated surfaces, electrostatically spray with thermosetting hybrid polymer fuse bonded to hot-dipped galvanized substrate during thermally activated curing stage. Provide polymerized metal surfaces that are capable of:
 - a. When "X" scribed to base substrate, withstand 6,000 hrs. of 5% salt spray test according to ASTM B 117, with no blistering or chipping around intersection of scribes, nor any undercutting or creepage along scribes.
 - b. When directly impacted with 160 in. lbs. from 0.625 in. radius impact tool, in accordance with ASTM D 2794, show no fracture or delamination.
 - c. When exposed to 6,000 hrs. of continuous ultraviolet exposure, equivalent to 120,000 hrs. of normal sunlight radiation, show no cracking.
 - d. When subjected to 200 thermal shock cycles between -25 and 180 degree F (-32 and 82 degree C), show no signs of deterioration.
 - e. When exposed continuously for 6,000 hrs. to high pressure (60 psig) water jet, show no signs of erosion.

C. Spare Parts: Refer to Section 01 78 46 – Extra Stock Materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions under which factory-fabricated cooling towers are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. General Installation: Install cooling towers where indicated, in accordance with equipment manufacturer's written instructions and with recognized industry practices, to ensure that cooling towers comply with the requirements and serve intended purposes.
- B. Access: Provide access and service space around and over cooling towers as indicated, but in no case less than that recommended by the manufacturer.
- C. Support:
 - 1. Install roof-mounted units on structural steel mechanical equipment stand. Anchor cooling tower to stand with removable fasteners.
 - 2. Install floor-mounted units on 4-inch high reinforced concrete pad, 6-inches larger on each side than cooling tower base. Cast anchor bolt inserts into pad.
- D. Construct mechanical equipment stand as indicated, and in accordance with NRCA handbook and Accepted Roofing Knowledge.

- E. Placement: Mount unit on vibration isolators if recommended by cooling tower manufacturer. Install gaskets or sealants between cooling tower cells. Level units to tolerance of 1/8" in 10'-0", in both directions.
- F. Condenser Water Piping: Provide flanged or mechanical coupling connections to cooling tower, with flexible pipe connections if tower is mounted on vibration isolators. Pitch lines so water will drain into sump. Connect inlets to cooling tower with shutoff valve and balancing valve (if two or more inlets) Connect outlets with shutoff valves.
- G. If the tower consists of more than one cell, in order to facilitate cleaning and maintenance, each cell shall have the capability to be completely drained and isolated from the other cell through a network of piping and valves. Provide equalizing piping between cells with automatic control valve.
- H. Make-up and Water Piping: Provide flanged, mechanical couplings, or union connections to cooling tower. With flexible pipe connections if tower is mounted on vibration isolators. Pitch lines so that the water will drain into the sump. Connect to automatic fill valve with a 3-valve bypass, and backflow preventer.
- I. Drain Piping: Connect drain, overflow, and bleed lines to cooling tower as indicated, full size of connection on cooling tower.
- J. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.

3.3 TESTING, CLEANING, AND CERTIFICATION

- A. Testing: Test each cooling tower to show that it will operate in accordance with indicated requirements.
- B. Cleaning: Clean inside of cooling tower thoroughly before filling for start-up. Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.
- C. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 Sections. Do not proceed with equipment start-up until wiring installation is acceptable.
- D. Start-up: Comply with manufacturer's instructions for filling and start-up of operation, but not less than the following:
 - 1. Verify lubrication of rotating parts; lubricate as needed.
 - 2. Verify fan for correct rotation.
 - 3. Verify that the motor amperage is in accordance with the manufacturer's data.
 - 4. Balance condenser water flow to each tower, and to each inlet for multiple inlet towers.
 - 5. Adjust water level control for proper operating level.
 - 6. Adjust bleed valve for indicated percentage of circulated water volume.
 - 7. Balance equalizer lines between multiple towers (if necessary).
 - 8. Adjust temperature controls and verify operation.

3.4 COMMISSIONING (DEMONSTRATION)

- A. Provide services of a manufacturer's technical representative for one 8-hour day to instruct the university's personnel in operation and maintenance of the cooling tower.
- B. Schedule training with at least seven (7) days notice to the Contractor, the University Project Manager and the Engineer of the training date.

END OF SECTION 23 65 00