

University of Houston Master Specification

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SECTION 23 6514 - PACKAGED INDUCTED-DRAFT COOLING TOWERS

Revise this Section by deleting and inserting text to meet Project-specific requirements.

Maintain Section format, including the UH master spec designation and version date in the center columns of the header and footer. Complete the header and footer with Project information.

This Section uses the term "Engineer." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

Delete hidden text after this Section has been edited for the Project.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. The Contractor's attention is specifically directed, but not limited, to the following documents for additional requirements:
 - 1. The current version of the *Uniform General Conditions for Construction Contracts*, State of Texas, available on the web site of the Texas Facilities Commission.
 - 2. The University of Houston's *Supplemental General Conditions and Special Conditions for Construction*.

1.2 DESCRIPTION OF WORK

- A. Scope: Extent of cooling tower work required by this Section is indicated on drawings and schedules, by requirements of this Section, and Section 23 0100 "Mechanical General Provisions."
- B. Types: Types of cooling towers specified in this Section include the following:
 - 1. Induced-mechanical-draft.
 - a. Crossflow.
 - b. Counterflow.
- C. Arrangement: See Drawings for cooling tower arrangements. Tower dimensions and arrangements shall fit the space available.
- D. Division 26: Refer to Division 26 sections for the following work:
 - 1. Power wiring and disconnects from the power source and VSD to connections on the tower.
- E. Other Divisions: Refer to other divisions of the specification for the following work:
 - 1. Structural steel supports.

1.3 QUALITY ASSURANCE

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- A. Factory Fabricated Towers: Design, fabricate and test factory fabricated towers in conformance with CTI Code and Standards, including:
 - 1. ATC-105 Standard Specifications for Thermal Testing of Wet/Dry Cooling Towers
 - 2. STD-111 Standard Specifications for Gear speed Reducers for Application on Industrial Water-Cooling Towers
 - 3. STD-131 Standard Specifications for Fiberglass-Reinforced Plastic Panels for Application on Industrial Water-Cooling Towers
 - 4. STD-201 Certification Standard for Water-Cooling Towers
- B. Wind Load: Design and certify towers for a wind load complying with governing codes, but not less than **[30] [Insert value]** pounds per square foot.
- C. Certifications: The cooling tower's performance shall be certified by the Cooling Tower Institute (CTI) in accordance with CTI Certification Standard STD-201 or, a field acceptance test shall be conducted in accordance with CTI Acceptance Test Code ATC-105, by CTI or other qualified independent third party testing agency. Submit certifications of tower conformance to CTI design and testing standards and American National Standard Institute (ANSI) A58.1, "Minimum Design Loads for Buildings and Other Structures."
- D. Provide tower components conforming to the following:
 - 1. Underwriters Laboratories, Inc. (UL) and National Electrical Manufacturers Association (NEMA): Provide motors, electrical wiring, conduit, lighting, and electrical devices listed and labelled to conform to UL and NEMA.
 - 2. Occupational Safety and Health Administration (OSHA): Construct stairways, walkways, platforms and ladders in conformance with OSHA requirements.

1.4 ACTION SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data, including rated capacities, pressure drop, fan performance data; weights (shipping, installed, and operating), installation and start-up instructions, and rating curves with selected points clearly indicated.
- B. Contractor's Certification: Submittals shall include a certification, signed by an officer representing the Contractor and stipulating that the submittal prepared by the manufacturer has been reviewed, and checked on an item by item basis.
 - 1. Equipment and products not in strict conformance with contract documents shall be separately submitted, clearly flagged and proposed under the change provision of the contract.
- C. Shop Drawings: Submit shop drawings indicating dimensions, weight loadings, required clearances and certification of conformance with referenced standards.
- D. Controls: Submit shop drawing on:
 - 1. Make-up water level control and wiring diagrams.
 - 2. Bleed control.

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E. Additional information as required in Section 23 0100 "Mechanical General Provisions."

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: Submit maintenance data and parts lists for each cooling tower, control, and accessory. Include this data, product data, shop drawings, and wiring diagrams.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish the following spare parts:

1. One spare set of matched fan belts for each belt driven fan.
2. Three spare spray nozzles for each tower cell.
3. One spare gasket for each gasketed access and inspection opening.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Handle cooling towers and components carefully to prevent damage, breaking, denting, and scoring. Do not install damaged cooling towers or components, replace with new.

B. Store cooling towers and components in a clean place. Protect from dirt, construction debris, and physical damage.

C. Comply with manufacturer's rigging and installation instructions for unloading cooling towers and moving them to the final location.

1.8 WARRANTY

A. Warranty: The mechanical equipment, with the exception of the motor itself, shall be warranted against failure caused by defects in materials and workmanship for a period of five (5) years from the date of tower shipment. The warranty shall cover the fans, speed reducers, couplings or belts, fan shaft and mechanical supports.

PART 2 - PRODUCTS

2.1 COOLING TOWER GENERAL REQUIREMENTS

A. Manufacturer: Provide cooling towers which are the product of a manufacturer regularly engaged in the production of cooling towers, who publishes descriptions and catalog capacities of the proposed equipment, who maintains facilities capable of testing towers in accordance with CTI testing requirements and can demonstrate that the proposed cooling tower product has been in satisfactory service for not less than three years prior to the date of Invitation For Bids of this Contract. Provide the following models or approved equal:

1. Evapco AT-Line.
2. Marley (SPX) NC Series.
3. BAC Series 3000.

B. Structural Supports: Modify design details of tower supports, structural framing, vibration isolators to suit cooling tower proposed.

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1. Any modifications to the cooling tower supports, stub columns, additional structural steel of vibration isolators required to suit the particular tower shall be furnished without additional cost.
 2. Vibration isolation modifications shall conform to the requirements of Section 23 0548 "Vibration Isolation."
- C. Galvanizing: Where the term "galvanizing" is used in reference to cooling towers, it shall mean either hot-dip galvanizing or electro-deposited zinc coating at a rate not less than 2 ounces per square foot of surface, performed after the material has been fabricated.
1. The use of zinc pigment paint in lieu of galvanizing will not be permitted.
- D. Stainless Steel: Provide Type 316 stainless steel, where stainless steel is specified and not noted.

2.2 INDUCED-DRAFT COOLING TOWERS

- A. General: Provide factory-assembled induced-draft counterflow or crossflow cooling towers of quantity, capacity, and sizes indicated on the Drawings. Towers shall be designed for multiple or dual side air entry and vertical air discharge.
- B. Cold Water Basin and Accessories: The entire cold water basin shall be constructed of heavy gauge Type 304 stainless steel. Each cooling tower cell shall include a side outlet depressed or sloped sump, overflow, drain, stainless steel anti-vortexing hood and removable screen, and **[brass make-up water control valve with float assembly.]****[Ultrasonic level sensor and transmitter with stainless steel make-up water control valve]** Outlet connection shall be designed to mate with ASME Class 150. pipe flange or grooved mechanical coupling connection.
1. Provide factory installed basin sweeper distribution piping and nozzles to minimize sediment from collecting in collection basin. Sweeper piping shall be PVC or CPVC, schedule 40 minimum and treated with UV inhibitors to allow for installation in direct sunlight without degradation. Extend sweeper piping for connection to bottom of cooling tower unless otherwise noted on the drawings.
- C. Casing: The casing shall consist of stainless steel support structure and frame with a stainless steel mechanical support. Casing panels shall be constructed of heavy duty Fiberglass Reinforced Polyester (FRP) or 304 stainless steel. Fan deck shall be constructed of 304 stainless steel or FRP and designed as required to support weight of service personnel for maintaining tower. Casing shall be UV resistant to weathering.
- D. Louvers: The louvers shall be constructed of UV resistant FRP or PVC. Louvers shall be mounted in easily removable frames as required for access to the basin for maintenance. The louvers shall be designed to prevent splash out and block direct sunlight into the basin.
- E. Propeller Fans: Provide a fixed or adjustable pitch multi-blade heavy duty axial propeller fans statically balanced. Fans shall be constructed of aluminum alloy blades with cast aluminum hubs.
- F. Bearings:
1. Fan shaft bearings shall be heavy duty self-aligning ball bearings with moisture-proof seals. Bearings shall be designed for a minimum L-10 life of 75,000 hours.

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2. Bearing lube lines shall be extended to the exterior of the unit for easy access.

Retain one of the two following paragraphs regarding belt or gear drives.

G. Belt Drive:

1. The fan drive shall be a multi-groove, solid back V-belt type with taper lock sheaves designed for 150% of the motor nameplate horsepower or geared reducer drive used in model provided.
2. Belt material shall be neoprene reinforced with polyester cord and specifically designed for cooling tower service.
3. Fan sheaves shall be aluminum alloy construction.
4. Motor shall be located outside of cooling tower casing.

H. Gear Drive:

1. The fan drive housing shall be cast iron with epoxy or polyurethane finish.
2. Service factor shall 2.0 based on motor nameplate horsepower.
3. Mounting shall be directly to fan hub and connected to motor so motor shaft is horizontal.
4. Capable of both forward and reverse operation.
5. Motor shall be located outside of cooling tower casing.
6. Extend oil fill, drain and vent to outside of cooling tower casing.

- I. Motor: Provide a totally enclosed, air over (TEAO) or total enclosed fan-cooled (TEFC) type motor single-speed motor design rated for inverter duty. Motors used in belt drive applications shall be mounted on adjustable base for belt adjustment.

1. Motor shall be specially rated for the application.
2. Motors controlled through variable frequency controllers shall be equipped with shaft grounding protection.
3. Motors equipped with internal electric heaters that are electrically interlocked to automatically energize when motor is off and de-energize when motor is on.

- J. Hot Water Distribution System: Provide one of the following hot water distribution systems:

1. Gravity Type for Use in Crossflow Designs: Gravity type distribution system shall consist of Class 150 flange or grooved pipe inlet connection, pre-strainer assembly, stainless steel distribution basin, and replaceable nozzles installed in floor of hot water basin to ensure even distribution of water over the fill of gravity flow. Provide easily removable distribution basin covers constructed of high density polyethylene (HDPE) or Type 304 stainless steel.
2. Pipe each cooling tower cell internally to a single Class 150 flanged or grooved connection that is located on the bottom of the cooling tower unless otherwise noted on the drawings. All internal piping shall be done at the manufacturer's factory.
3. Spray Type for Use in Counterflow Designs: Spray type distribution system shall consist of steel pipe connection, schedule 40 PVC spray header and branches and removable ABS spray nozzles. The spray header, branches and nozzles shall be easily removed for cleaning purposes.

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- K. Fill: The cooling tower fill shall be PVC of cross-fluted design with a minimum thickness of [15] [Insert thickness] mils before forming. The fill shall be self-extinguishing for fire resistance with a flame spread rating of 15 or less per ASTM E84-81a. The fill shall be resistant to rot, decay, or biological attack.
- L. Eliminators: Provide drift eliminators constructed entirely of inert PVC. Maximum drift rate shall be less than 0.005% of the circulating water rate.
- M. Equalizer Connection: Each tower shall be supplied with a factory equalizer connection to balance the level of the cold water basins for multiple cell or tower arrangement.
- N. Access and Safety:
1. Access Doors: Provide hinged access door at both ends of the tower walls for access to eliminators and fan plenum section.
 2. Fan Guard: Provide a heavy gauge stainless steel wire fan guard for each fan cylinder.
 3. Ladders, Platforms, Walkways and Railings: Design in accordance with OSHA requirements. Construct of fiberglass, aluminum, type 304 stainless steel. Furnish ladders with safety cage as required. Ladders, platforms, walkways and railings shall be provided as required to access and maintain all cooling tower serviceable components, i.e., motor, fan drive, hot and cold water distribution systems, etc.
 4. Provide one manual equipment hoisting assembly with davit arm to lower and raise components from fan deck to base of cooling towers. Design assembly to accommodate 1.5 times the heaviest single component. Provide davit socket pedestal that allows assembly to be temporarily mounted to each cooling tower fan deck. Provide any additional supports required to lift or lower the components.
- O. Vibration Switch: Provide a factory-accessory, manual reset vibration switch with alarm contacts for each tower cell fan which shall de-energize fan motor if excessive vibration occurs due to fan imbalance. Alarm contacts shall be monitored by the BCAS. Vibration limit switch shall be in a cast iron waterproof NEMA enclosure.
- P. Bolting: Bolting connections shall be with stainless steel bolts, nuts, and washers. All joints shall be sealed watertight.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install cooling towers where indicated, in accordance with equipment manufacturer's written instructions and ensure that cooling towers comply with specification requirements and serve intended purposes.
- B. Access: Provide access and service space around and over cooling towers, but in no case less than that recommended by manufacturer.
- C. Placement: Install cooling towers on steel framing member provided under other section of the specifications. Level units to tolerance of 1/8-inch in 10 feet, in both directions.

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- D. Piping Connections: Piping at cooling tower shall be supported externally to cooling tower so that no weight is born by cooling tower.
- E. Make-Up Water Piping: Provide flanged or union connections to cooling tower, with flexible pipe connections. Pitch lines so water will drain into sump. Connect to automatic fill valve with 3-valve bypass and backflow preventer.
- F. Drain Piping: Connect drain overflow and bleed lines to cooling tower full size of connection on cooling tower.
- G. Electrical Wiring: Install electrical devices furnished by manufacturer.

3.2 ADJUSTING AND CLEANING

- A. Cleaning: Clean inside of cooling tower thoroughly before filling for start-up. Clean factory-finished surfaces. Repair any marred or scratched surfaces according to cooling tower manufacturer's instructions.
- B. 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 rotation direction.
 - 3. Verify that motor amperage is in accordance with manufacturer's data.
 - 4. Balance condenser water flow to each tower cell 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.
 - 8. Adjust temperature controls and verify operation.

3.3 CLOSEOUT PROCEDURES

- A. General: Provide services of manufacturer's technical representative for two 2-hour sessions to instruct personnel in operation and maintenance of cooling towers. One session at or around startup and one session into first cooling season.
 - 1. Schedule training with at least 7 days notice.

END OF SECTION 23 6514