

SECTION 236513 - COOLING TOWERS, STAINLESS STEEL

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. The Cooling Tower Manufacturer shall be responsible for the design, fabrication, and delivery of materials to the project site, and for the installation of the tower components.
- B. The Cooling Tower Manufacturer shall be responsible for furnishing structure sizes, weight loading information and support features required for proper installation.
- C. The steel structure will be designed by the Engineer and installed by the Contractor based upon certified loading and dimensional data provided by the Cooling Tower Manufacturer.

1.2 QUALITY ASSURANCE

- A. Experience: At the time of submission of the proposal, the cooling tower model must have been in standard production for a minimum of one year.
- B. CTI (Cooling Tower Institute) Standards: Provide cooling towers which meet the performance standards of CTI Standards STD-201.
- C. NEMA (National Electric Manufacturers Association) and IEEE Compliance: Provide electric motors which meet the scheduled full load efficiency, per NEMA Standard MGI-12.53a, based on dynamometers testing per IEE 12 Method B.
- D. NFPA Compliance: Comply with applicable provisions of ANSI/NFPA 70 "National Electric Code", pertaining to construction and installation of electrically operated components.
- E. NEMA and UL (Underwriters Laboratories) Compliance: Provide electric motors and products which have been listed and labeled by UL and comply with NEMA standards.
- F. Factory Mutual

1.3 MANUFACTURERS

- A. Marley-SPX (Basis of Design)
- B. Manufacturers approved by Engineer prior to bidding.

1.4 BASE

- A. Provide an induced draft, crossflow type, two cell, factory assembled, film fill, industrial duty, stainless steel cooling tower situated as shown on the plans. The limiting dimensions of each cell shall be 19.92ft wide, 9.90ft long, and 11.98ft high. The Total limiting overall dimensions of the tower shall be 19.92ft wide, 20.08ft long, and 11.98ft high. Total operating power of all fans for the tower shall not exceed 100hp, consisting of 2 @ 50hp motor(s). Tower shall be similar and equal in all respects to Marley Model NC8405UAN2.

1.5 PERFORMANCE DATA

- A. The tower shall be capable of cooling 2820gpm of water from 95 to 85 at a design entering air wet-bulb temperature of 80F, and its thermal rating shall be Certified by the Cooling Technology Institute. The tower shall be capable of a minimum 41.4 gpm/Hp efficiency per ASHRAE Standard 90.1.

1.6 SOUND

- A. The cooling tower shall be designed for quiet operation, and shall produce an overall level of sound not higher than 67 dB(A) measured at 50' ft from the Cased Face Location. Sound levels shall be independently verified by a CTI-licensed sound test agency to ensure validity and reliability of the manufacturers published values. Measurement and analysis of the sound levels shall be conducted by a certified Professional Engineer in Acoustical Engineering. Sound pressure levels shall be measured and recorded in the acoustic near-field and far-field locations using ANSI S1.4 Type 1 precision instrumentation and in full conformance with CTI ATC-128 test code published by the Cooling Technology Institute (CTI). All low sound options shall be CTI certified for thermal performance.

1.7 PHYSICAL DESCRIPTION

- A. A physical description of the cooling tower shall be provided. The physical description shall include the following information:
 - 1. Detailed drawings of the proposed equipment including a top view, right side view, and end view. The drawings shall indicate the dimension of the cells, locations of all connections (tower water, electrical controls, drain, overflow, make-up water, etc.), and service clearances. The drawings shall also indicate the type and size of each piping connection. Provide ACAD and BIM / Revit digital format drawings to scale.
 - 2. Detailed electrical wiring diagram that indicates all required field wiring and components including power and controls.
 - 3. Detailed shipping instructions including shipping weights, operating weights, and rigging instructions.
 - 4. Detailed installation instructions that address all installation requirements including rigging piping, anchors, mounting of sensors, etc.
 - 5. Product data indicating motor speed (RPM), type of motor, type of bearings, fan description, fill material, and tower shell material.
 - 6. Other information required to verify compliance with the Proposal Documents.

1.8 BASE WARRANTY

- A. Provide a complete equipment warranty on all parts, material, and labor for 1 year after the applicable date of Project Acceptance. The entire tower, including structure, casing, basins, decking, fan(s), motor(s), and all mechanical drive components (including belts, if used) shall be warranted against failure due to defects in materials and workmanship for a period of five (5) years from the date of shipment to the job. Towers not covered by a warranty of this scope will not be accepted.

1.9 EXTENDED WARRANTY PRICE – NINE YEAR EXTENSION

- A. Supplier shall provide a price to provide a 9-year parts and labor extension of the first year equipment warranty

1.10 INSTALLATION AND START-UP ASSISTANCE

- A. Supplier shall provide installation and start-up assistance to the Contractor. Such assistance shall be provided by a factory trained and certified technician. The date of the installation and start-up assistance provided by the Supplier shall be coordinated with the Contractor and the Owner. Service representative shall inspect the equipment installation and verify that the installation is in accordance with factory recommendations. Service representative shall verify that the power wiring, control wiring, piping connections, flow rates, and temperatures are correct prior to starting the equipment. The service representative shall thoroughly document the conditions at start-up in a detailed report. The service representative shall submit electronic version of the report to the Contractor for processing and review by the Architect, Engineer, and Owner. The cost of the installation and start-up assistance shall be included in the base bid of the tower.

1.11 SUBMITTALS

- A. After receipt of a Letter of Intent or Purchase Order, the Supplier shall submit one (1) electronic PDF submittal documents to the Contractor. The submittal shall be clearly marked to indicate the name of the project, Owner, Contractor, Architect, Engineer, and Supplier. The information shall be organized into sections (PDF shall be organized with tabs and bookmarks). Each section shall be tabbed and labeled. Each set of submittal documents shall include the information listed below:
 - 1. Physical Description: Refer to Paragraph 1.06 above for required information.
 - 2. Performance Data: Refer to Paragraph 1.05 for required information.
 - 3. Operation and Maintenance Manuals: Manuals shall include operating instructions, maintenance instructions, troubleshooting information, parts lists, and other related information.
 - 4. Provide ACAD files and BIM/Revit object files.

PART 2 - PRODUCTS

2.1 INDUCED DRAFT CROSSFLOW COOLING TOWER

- A. Provide an induced draft, factory packaged crossflow cooling tower. Installation will be by the Contractor. Entire construction (casing, basins, internal components, fasteners, etc.) shall be stainless steel.
- B. The tower shall be listed in the current FM Approval Guide (approvalguide.com) and conform to the FM Approval Standard for Cooling Towers, Class Number 4930 that is approved for use without sprinkler systems. The tower shall have successfully passed full scale fire testing, static and cyclic wind pressure testing, large missile impact testing (for Zone HM), and structural design evaluation as administered by FM-Approvals. The tower shall be capable of +180/-252 psf for Zone HM as defined by FM Global. A copy of the FM Approval Certificate of Compliance dated November 2013 or later shall be available upon request.

- C. The tower structure, anchorage and all its components shall be designed by licensed professional engineers, employed by the manufacturer, per the International Building Code to withstand a wind load of 83 psf. The fan deck, hot-water basin covers and, where specified, maintenance platforms shall be designed for 60 psf live load or a 200 lb concentrated load. Guardrails, where specified, shall be capable of withstanding a 200 lb concentrated live load in any direction, and shall be designed in accordance with OSHA guidelines.
- D. Lower cold water basins shall be Series 304 stainless steel welded seam. The basin shall include the number and type of suction connections required to accommodate the outflow piping system shown on the plans. Suction connections shall be equipped with stainless steel debris screens. An overflow and drain connection shall be provided in each cell of the cooling tower. The basin floor shall slope toward the drain to allow complete flush out of debris and silt that may accumulate. Towers of more than one cell shall include a method for flow and equalization between cells. The basin shall be accessible and maintainable while water is circulating. All steel items that project into the basin shall also be made of stainless steel.
- E. Single Hot-Water bottom Inlet Connection per Cell: Each cell of the tower shall include a single hot-water inlet connection located as shown on the plans. An internal system of PVC piping shall deliver water equally to the distribution basins without the need for balancing valves. This internal piping system shall require no scheduled maintenance, and shall be located such that it does not interfere with normal maintenance access. The internal piping must extend to the tower exterior surface of the tower.
- F. Two open stainless steel basins (one above each bank of fill) shall receive hot water piped to each cell of the tower. These basin components shall be installed and sealed at the factory and assembled with bolted connections. Tap screws shall not be allowed due to their potential to develop leaks. The basins shall be equipped with removable, stainless steel covers capable of withstanding the loads described in paragraph 4.1. The water distribution system shall be accessible and maintainable during tower fan and water operation.
- G. Heavy-duty flow-regulator valves shall be provided at the hot-water inlet connections. These valves shall be disc-type, with cast iron bodies and stainless steel operating stems. There shall be a locking handle to maintain the valve setting in any position. Valves shall be right-angle configuration, precluding the need for inlet elbows.
- H. The water distribution system shall be equipped with a method to operate under variable flow conditions while maintaining a uniform air-side pressure drop through the fill to maximize cooling efficiency and minimize the risk of ice and scale formation in the fill. System must accommodate flow rates down to 50% of design flow per Florida Energy Codes.
- I. Fan(s) shall be low sound, quiet or ultra-quiet (as required to meet sound performance criteria). Each fan shall have cast aluminum (or fiberglass) airfoil blades with anti-recirculation hub assembly. Each blade shall be of the adjustable pitch design with raised pitching boss and shall be factory preset to design conditions. The top of the fan cylinder shall be equipped with a velocity recovery stack. A complete mechanical equipment support shall be provided on which shall be rigidly mounted a right angle helical gear reduction unit and drive motor.
- J. Gear-reducer shall be of the five year maintenance free type, charged with synthetic lubricant at factory and not requiring lubricant change for a full 5 years. All gearbox bearings shall be rated at an L10A service life of 100,000 hours or greater and the gear sets shall have AGMA Quality Class of 9 or greater. Gear-reducer shall be rated for 30-100% speed (without oil pump). Provide accelerometer Flats or Pads on gear box housing.

- K. Motors shall be Premium Efficiency, variable torque, 1.15 service factor, suitable for cooling tower duty and additional windings for inverter duty. Motor shall be inverter duty/ready for operation with Variable Frequency Drives (VFD) and shall not exceed nameplate amperage rating at design loads. Motors shall be TEFC (TEAO or ODP not permitted). Variable Frequency Drives (VFD) shall be provided by others. Provide accelerometer Flats or Pads on motor (one per each bearing assembly).
- L. Fill shall be film type, thermoformed of PVC, with louvers and eliminators formed as part of each fill sheet. Fill shall be suspended from stainless steel structural tubing supported from the tower structure, and shall be elevated above the floor of the cold-water basin to facilitate cleaning. Air inlet faces of the tower shall be free of water splash out.
- M. Drift eliminators shall be PVC, triple-pass, and shall limit drift losses to 0.005% or less of the design water flow rate.
- N. The top of the tower shall be equipped with a guardrail complete with kneerail and toeboard, designed according to OSHA guidelines and factory welded into subassemblies for ease of field installation. Posts, toprails and kneerails shall be 1.5" square tubing. The guardrail assembly shall be hot dipped galvanized after welding and capable of withstanding a 200 pound concentrated live load in any direction. Posts shall be spaced on centers of 8'-0" or less. A 1'-6" wide aluminum ladder with 3" I-beam side rails and 1.25" diameter rungs shall be permanently attached to the endwall casing of the tower, rising from the base of the tower to the top of the guardrail.
- O. Options and trim required for each tower fan cell are to include:
 - 1. Electronic Safety vibration cutoff switch (manual reset UL Listed explosion proof).
 - 2. Extended stainless steel oil line outside fan cylinder to level dipstick for external verification of lubricant level.
 - 3. Oil level sensing switch provided for field wiring to fan motor control to shut down tower on low oil level condition.
 - 4. Factory installed and removable covers over hot water distribution basins.
 - 5. Stainless steel interior maintenance access platform assembly with access ladder and handrails factory installed below fan and drive.
 - 6. Stainless steel internal maintenance walkway factory installed full width of tower between doorways to access sump screen, mechanical equipment and basin accessories.
 - 7. Provide for each cell a solid state ultrasonic liquid level sensor and stainless steel stilling chambers mounted to tower basin depressed cold water basin section with level controls (low-low level alarm, low level alarm, fill level, stop-fill level, and high level alarm circuits). Controls shall be connected to existing Building Automation System (BAS). Provide automatic makeup water ball valve two-position. Provide a makeup water level control panel with touch screen display and HOA switch (NEMA 4X Fiberglass). Alternate probe and/or switch style water level sensor shall include costs for a 5 year probe/switch maintenance plan.
 - 8. Tower arrangement shall include OSHA handrail system with access ladder(s) with safety cage and gate for access to all upper basins with fan deck extensions around raised fan cylinders.
- P. The cooling tower shall be designed for quiet operation. Sound ratings shall be compliant to CTI guidelines. Refer to Sections 00400 - 00450 sound pressure requirements. Sound levels shall be measured with a Type 1 (precision) system and in full conformance with ATC-128 test code published by the Cooling Technology Institute (CTI). The measurement system shall have a real-time frequency analyzer and separate microphones with an overall tolerance +/- 3 dB. All "low-sound" options shall be CTI Certified for thermal and sound performance.

- Q. The cooling tower manufacturer shall certify that their proposed tower fully conforms to the performance standards set forth in CTI ATC-128 and STD-201. Measurement and analysis shall be performed by an independent testing agency and certified Professional Engineer in Acoustical Engineering. Sound pressure levels shall be measured and recorded in the acoustic near-field and far-field locations using ANSI S1.4 Type 1 precision instrumentation. Performance certifications notwithstanding, the Owner shall have the right to conduct a CTI or ASME on-site performance test during the first year of operation in the presence of CTI or ASME observers as well as the manufacturer's representatives. In the event that the tower fails to perform within the limits of the test tolerance, the cooling tower manufacturer will pay for the cost of the test and will make such corrections as are appropriate and agreeable to the Owner to compensate for the performance deficiency.
- R. The thermal performance rating shall be certified by the Cooling Technology Institute and efficiency shall comply with latest version of ASHRAE Standard 90.1.
- S. The cooling tower shall be compliant and listed by Factory Mutual (Owners' insurance underwriter).
- T. All connections to any NEMA box or motor terminal shall occur at bottom of box to minimize moisture intrusion.

2.2 START-UP AND TESTING SERVICES

- A. Manufacturer of cooling tower shall provide the services of a factory trained Service Technician or Engineer to inspect the installation to ensure that it is in accordance with the manufacturer's instructions and procedures, that rotating components provide smooth operation within manufacturer's vibration tolerances. They shall advise the installer in writing of any recommended corrective action that is required to meet manufacturer's recommended installation procedures.
- B. Cooling tower start-up by manufacturer's representative shall include verification of mechanical equipment clearances and alignment, adjustment of water flow and operating water levels in hot water and cold water basins, check rotation of fan, balance fan to minimize vibration, verify operating sequences of tower control system and temperature settings. Written start-up report shall be provided to the Engineer and Owner confirming these procedures and including motor operating amperage readings. Manufacturer shall provide for local stock of tower spare and repair parts, and dedicated cooling tower repair personnel for 24 hour emergency service.
- C. The Contractor AND Manufacturer are both responsible to ensure prior (2-weeks minimum) notification is sent to the Engineer and Commissioning Agent. The Engineer and/or the Commissioning Agent will be present during the Equipment Start-Up and Testing phase of the equipment.
- D. Instruction of tower operation and maintenance procedures shall be provided by manufacturer's representative to Owner's satisfaction.

PART 3 – EXECUTION - Not Applicable

END OF SECTION 236513