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The Description of the Project
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SPECIFICATION DIVISION 23

NUMBER SECTION DESCRIPTION

DIVISION 23 HEATING, VENTILATING AND AIR CONDITIONING (HVAC)
SECTION 236500 - COOLING TOWERS

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DIVISION 23 HEATING, VENTILATING AND AIR CONDITIONING (HVAC)
SECTION 236500 - COOLING TOWERS

REVISIONS:
3-31-04: SUBSTANTIALLY REVISED AND POSTED TO WEB.
04-10-08: HYDRONICS MECH TECH GROUP REVISIONS: ADDED TOWER TECH AND EVAPCO. BOTH PRODUCTS ARE UNDER CONSIDERATION AND SHOULD ONLY BE USED IF APPROVED BY H&S MECH TECH TEAM. MINOR REVISIONS IN OTHER AREAS.
06-09-08 APPROVED FOR WEB.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

INCLUDE PARAGRAPH 1.1.A AND B IN EVERY SPECIFICATION SECTION. EDIT RELATED SECTIONS 1.1.B TO MAKE IT PROJECT SPECIFIC.

A. Drawings and general provisions of the Contract, Standard General and Supplementary General Conditions, Division 1 Specification Sections, and other applicable Specification Sections including the Related Sections listed below, apply to this Section.

1.2 SCOPE OF WORK:

A. Furnish and install the cooling towers specified in this section, and as detailed and scheduled in the drawings.

1.3 RELATED SECTIONS:

SPEC EDITOR: THIS PARAGRAPH CAN BE DELETED IF COOLING TOWER IS INCLUDED IN GENERAL CONTRACT.

A. Section 220513 - Motors

1.4 QUALITY ASSURANCE:

A. Manufacturers and Products: The products and manufacturers specified in this Section establish the standard of quality for the Work. Subject to compliance with all requirements, provide specified products from the manufacturers named in Part 2.

B. Cooling Tower shall be CTI certified.

C. Handrails and ladders shall meet OSHA and MIOSHA requirements.

1.5 COOLING TOWER WARRANTY:

SPEC EDITOR: AS IS FOR MARLEY QUADRAFLOW. MODIFY FOR OTHERS.

A. The mechanical equipment including the motor must be warranted by the manufacturer against any failure caused by defects in materials and workmanship for at least five years from date of tower shipment. The balance of the cooling tower shall be warranted by the manufacturer for at least one (1) year from start-up, not to exceed 18 months from equipment ship date.

1.6 THERMAL PERFORMANCE WARRANTY:

SPEC EDITOR: RETAIN FOR ALL PROJECTS UNLESS TESTING IS INCLUDED AS PART OF THE PROJECT).

A. The Tower performance will not be verified, by independent tests, initially under this contract. Balancing will be limited to the extent described in section 230593. The owner, at his option, may hire an independent testing agency, during the performance guarantee period of five years, to test the cooling tower in accordance with applicable Cooling Technology Institute (CTI) standards and in the presence of a representative of the cooling tower manufacturer. If the performance does not meet specifications with no damage to any components of the tower, the tower manufacturer shall pay for the test done by the owner per CTI (Cooling Tower Institute) requirements and for the remedial actions required to meet the performance. Thermal performance must be warranted by the manufacturer for at least five (5) years from start-up.

MOST TOWERS BELOW ARE SPECIFIED AS FM APPROVED. VERIFY THE NEED FOR FM APPROVAL FOR YOUR SPECIFIC PROJECT, AND EDIT THE BELOW ACCORDINGLY. DEPENDING ON TOWER TYPE, SOME MANUFACTURERS MAY NOT BE ABLE TO PROVIDE A FM APPROVED TOWER.

PART 2 - PRODUCTS

2.1 GENERAL COOLING TOWER REQUIREMENTS

A. Design structural system for the following live loading in addition to tower dead-loads and operating-loads:

1. Wind Loading: 30 psf on exposed vertical surfaces.

SPEC EDITOR: DELETE IF NOT WINTERIZED / SELECT APPLICABLE

B. Basin Heater: Basin heaters sized by manufacturer to maintain basin water at 40 deg.F (4.4 deg.C) at ambient temperature of -10 deg.F and wind velocity of 15 mph.

SPEC EDITOR: ONLY ELECTRIC HEATER FOR MARLEY QUADRAFLO

SPEC EDITOR: CONSIDER TWO HEATER ELEMENTS IN LARGE COOLING TOWER CELLS IN SINGLE CELL APPLICATION.

1. Steam injection nozzle for each cold water basin for direct injection of steam into basin. Nozzle shall be Penberthy Model NWH steam injection nozzle with line size discharge pipe and all associated fittings required for a complete installation. Nozzles, piping, etc. shall be field installed.

2. Electric basin heater: One 480v or 208v (as scheduled), 3 phase basin heater element per cell, shipped loose to prevent damage during shipment. 480v or 208v (as scheduled), 3 phase contactor, fixed lockable disconnect, circuit breaker, and control transformer in a NEMA 4, 3R if mounted outdoors, NEMA 1 if mounted indoors, electrical panel. Control system shall be wired to a terminal strip allowing Owners Building Management System to energize contactor coil from a remote set of contacts. Manufacturer's standard combination water level and temperature sensor wired to terminal strip.

C. Water Level Control:

1. Float operated water make-up valves, one per cell, unless detailed or scheduled otherwise on the contract drawings. Make-up valves shall be actuated by a 2 piece float/valve rod assembly, with one rod oriented approximately vertically and connected to the float, and the second rod oriented horizontally and connected to the valve. Valve on-off shall be adjustable by adjustment of the vertical rod length. Floats shall be welded copper or polystyrene filled plastic. All castings for the float valves, float rod and keys, etc. shall be bronze construction with a complete non corroding construction assembly.

SPEC EDITOR: VSD IS ALWAYS REQUIRED.

D. Motor: Unless noted otherwise provide TEFC, inverter duty, 1800 rpm, located outside air stream. Refer to 220513 "Motors" for additional requirements

SPEC EDITOR: VERIFY ACCESS REQUIREMENTS. HANDRAIL AND LADDER NOT AVAILABLE ON QUADRAFLO.

SPEC EDITOR: INDICATE IN DRAWINGS LADDER AND HANDRAIL GENERICALLY. HANDRAIL REQUIRED ON TOP OF TOWER FOR EVAPCO.

E. Handrails: Unless noted otherwise, provide galvanized steel or aluminum pipe rails of required height above tower. Include knee and toe rails of required diameter and heights, meeting all the OSHA and MIOSHA requirements.

F. Ladders: Galvanized steel or aluminum ladder, to the access door and to top of cooling tower working surface, meeting OSHA and MIOSHA requirements. If access platforms are not provided then ladders shall extend beyond bottom of the cooling tower to access from roof, but shall not be supported from the roof.

1. Safety Cage: Include safety cage of galvanized steel or aluminum.
2. Provide ladder from roof to top of tower or highest service level.
3. Provide ladder from service platform to top of tower.

SPEC EDITOR: CONSULT WITH PROJECT DESIGNER, COORDINATE AS TO WHETHER THIS PARAGRAPH SHOULD BE INCLUDED.

G. Maximum Permissible Sound Pressure Level: Use 0.0002 microbar as reference. Measure at 50' in several directions, uniformly covering 360 deg. Do not exceed maximum permissible dB level each of the following octave bands:

SPEC EDITOR: CONTACT REPRESENTATIVE TO FILL IN THE BLANKS.

| 63 Hz - ?? dB |
| 125 Hz - ?? dB |
| 250 Hz - ?? dB |
| 500 Hz - ?? dB |
| 1000 Hz - ?? dB |
| 2000 Hz - ?? dB |
| 4000 Hz - ?? dB |
| 8000 Hz - ?? dB |

H. Vibration Control: Coordinate vibration support locations for cooling towers with steel support.

SPEC EDITOR: CHOOSE TYPE OF COOLING TOWER.

2.2 INDUCED DRAFT CROSSFLOW COOLING TOWER:

SPEC EDITOR: BASED ON MARLEY NC OR BAC SERIES 3000

A. General: Factory fabricated cooling tower, induced draft crossflow type. Cooling tower shall be FM approved.

B. Casings: 16 gauge G-235 galvanized steel minimum, with hot dipped galvanized steel screws and bolts.

C. Collecting Basin and Sump: Welded stainless steel. Collecting basin and sump, including lift-out stainless wire strainer with openings smaller than nozzle orifices, and with connections for equalizer piping, drain, overflow and water make-up.

D. Wetted-Surface Fill: Wave form vertical sheets of PVC having flame spread rating of 5 per ASTM E 84 - 77A.

E. Drift Eliminators: Limit drift-loss to indicated maximum percentage of 0.005 of total water circulated, with PVC, having flame spread rating of 5 per ASTM E 84 formed integral with the fill.

SPEC EDITOR: GALVANIZED STEEL IS BAC. INTEGRAL IS MARLEY.

F. Louvers: Designed and installed by manufacturer, and of sufficient thickness and rigidity to prevent visible sagging. Provide galvanized steel or PVC integral with fill.

G. Water Distribution System: Stainless steel, open basin, gravity-flow type with plastic metering orifices; installed by manufacturer to ensure even distribution of water over wetted-surface-fill, unless otherwise indicated on drawings, provide self-draining internal PVC piping from bottom inlet connection to distribution system.

H. Basin Covers: Galvanized steel or stainless steel sheet removable cover with handles of sufficient construction to permit walking upon, installed by manufacturer to prevent debris from entering basin and to inhibit algae growth by eliminating sunlight.

I. Air Inlet Screens: Galvanized steel mesh, mounted in removable frames by manufacturer or inert PVC integral to fill.

SPEC EDITOR: CAN BE OMITTED WITH TOWERS WITH BOTTOM INLET CONNECTIONS. DESIGNER TO INDICATE SEPARATE SHUT-OFF VALVES TO EACH CELL.

J. Flow Control Valves: Angle valves for balancing flow to each distribution basin or self-balancing distribution system.

K. Fans and Drives: Aluminum propeller-fan. Gear-drive including speed reducer with extended oil line and dipstick.

SPEC EDITOR: COORDINATE WITH ELEC. ENGINEER. SHOW FIELD WIRING TO NEMA 4 JUNCTION BOX WITH RESET BUTTON MOUNTED OUTSIDE OF TOWER. SHOW ON ELECTRICAL DRAWING, REFER TO STANDARD DETAIL.

L. Vibration Cutout Switch: Provide switch to de-energize fan motors if excessive vibration occurs due to fan imbalance. If vibration switch is located inside tower, provide remote reset feature wiring. Manufacturer: Metrix #5550.

M. Fan Guard: Galvanized steel welded steel rod and wire guard

FOR LARGE TOWERS WHERE THE FAN SPEED REDUCER IS NOT ACCESSIBLE FOR SERVICE FROM THE INTERNAL WALKWAY THAT IS SPECIFIED BELOW, DESIGNER SHOULD SPECIFY A SECONDARY PLATFORM WITH LADDER TO REACH THE SPEED REDUCER, WHEN AVAILABLE FROM THE MANUFACTURERS.

N. Access: Large access door at both ends of tower to eliminators and air plenum. Provide with internal walkways that extend the full length of the cooling tower basin, constructed of G-235 galvanized steel with hot dipped galvanized steel screws and bolts.

O. Cooling tower manufacturer: Marley NC or BAC Series 3000.

2.3 INDUCED DRAFT COUNTERFLOW COOLING TOWER:

SPEC EDITOR: BASED ON EVAPCO AT, UNDER CONSIDERATION ON A PROJECT TO PROJECT BASIS. TO BE APPROVED BY HYDRONICS MECH TECH TEAM.

A. General: Factory fabricated cooling tower, induced draft counter flow type. Cooling tower shall be FM approved.

B. Casings: 16 gauge G-235 galvanized steel minimum, with steel screws.

C. Collecting Basin and Sump: Welded 304 stainless steel. Collecting basin and sump, including lift-out stainless wire strainer with openings smaller than nozzle orifices and with connections for equalizer piping, drain, overflow and water make-up, as required for specified application.

D. Wetted-Surface Fill: Wave form vertical sheets of PVC having flame spread rating of 5 per ASTM E 84 - 77a .

E. Drift Eliminators: Limit drift-loss to the indicated maximum percentage of 0.001 of total water circulated, with PVC, having flame spread rating of 5 per ASTM E 84-81a formed integral with the fill.

F. Louvers: Designed and installed by manufacturer, and of sufficient thickness and rigidity to prevent visible sagging. Provide drift eliminators for cooling tower to be PVC and mounted horizontally above the water distribution system.

G. Water Distribution System: Cooling tower to be equipped with a non-corrosive water distribution system consisting of schedule 40 polyvinyl chloride (PVC) header and spray branches, nozzles are to be clog resistant and thread into the PVC header pipe.

H. Air Inlet Screens: Cooling tower shall be equipped with PVC inlet louvers mounted in removable frames by manufacturer.

I. Fans and Drives: Aluminum propeller-fan. Gear-drive including speed reducer with extended oil line and dipstick.

SPEC EDITOR: COORDINATE WITH ELEC. ENGINEER. SHOW FIELD WIRING TO NEMA 4 JUNCTION BOX WITH RESET BUTTON MOUNTED OUTSIDE OF TOWER. SHOW ON ELEC. DRAWING.

J. Vibration Cutout Switch: Provide switch to de-energize fan motors if excessive vibration occurs due to fan imbalance. If vibration switch is located inside tower, provide remote reset feature wiring. Manufacturer: Metrix #5550.

K. Fan Guard: Galvanized steel welded steel rod and wire guard

L. Access: Cooling tower shall be equipped with fan plenum access. Provide removable access port at end of headers to facilitate cleaning of distribution piping.

M. Side mounted Working Platform, Handrail & Ladder with Davit: Provide working platform for access to motor and fan plenum with ladder.

N. Inlet & Outlet connections: Grooved to accept a mechanical coupling device.

SPEC EDITOR: BOTTOM INLET AVAILABLE IN SPECIFIC TONNAGES. FLANGED CONNECTIONS IS AN OPTION AT ADDITIONAL COST.

O. Cooling Tower Manufacturer: Evapco AT series.

2.4 INDUCED DRAFT COUNTERFLOW MODULAR COOLING TOWER

SPEC EDITOR: BASED ON TOWER TECH TTXE SERIES MODULAR; UNDER CONSIDERATION ON A PROJECT BY PROJECT BASIS. TO BE APPROVED BY HYDRONICS MECH TECH GROUP

A. General: Furnish and install as shown on the plans, a Tower Tech factory-assembled, forced draft, counterflow, modular cooling tower, Model TTXE _____. The tower’s principal construction shall be of pultruded Fiberglass Reinforced Polyester (FRP) and must have a flame spread rating less than 25 or a flammability coefficient of 94-V0. The module must be capable of operating independently or in combination with future modules.

B. Tower shell and substructure: (legs) shall be designed to withstand a wind load equivalent to 80 MPH and be able to resist seismic forces classified under Zones 1 and 2.

C. Casing: The cold water basin and the tower casing shall be constructed of pultruded Fiberglass Reinforced Polyester (FRP) with UV inhibitors. It shall have a minimum thickness of ¼" and a minimum density of 0.07 lb/in cubed. Specially placed reinforcement and a UV veil layer will ensure the structural strength and longevity. Wall panels shall be covered by a five (5) year warranty, excluding cosmetic or superficial damage/wear.

D. Water Distribution System: Water shall enter the tower through a single inlet comprised of an enclosed, low pressure, non-corrosive Polyvinyl Chloride (PVC) Schedule 40 piping system. Water will be distributed further using Schedule 40 PVC lateral(s). Water shall be uniformly sprayed over the fill media by evenly spaced and sized rotary spray nozzles that are capable of automatically adjusting the size of their exit orifices to accommodate varying water flows. The nozzles shall have a four (4) inch orifice for clog free operation, produce a square pattern, and shall be located no more than three inches above the fill media. The nozzles must operate between a minimum ½ pound of pressure and a maximum 1½ pounds of pressure. The nozzles shall be made of High Density Polyethylene (HDPE) and/or Acrylonitrile Butadiene Styrene copolymer (ABS). Water distribution system shall be covered by a one (1) year warranty.

E. Perimeter Basin: Tower shell or casing shall have an integral perimeter basin. Its elevated location shall reduce operational pump head requirements. Its high velocity water flow during operation shall prevent accumulation of sediment. Perimeter basin shall be equipped with one inspection port at each corner.

F. Sump: Tower shall be equipped with a terminally mounted (end wall) outlet sump with a flanged discharge connection for simplified piping. Sump casing shall be manufactured of rotationally molded Polypropylene (PP). Standard equipment shall include a mechanical float valve, flanged overflow/equalization connection, and a corrosion-free, easily removable sump screen. Sump shall be covered by a one (1) year warranty.

G. Fill & Drift Eliminators: Fill shall be Polyvinyl Chloride (PVC) of cross-fluted design, 10 mil (after forming), impervious to decay, fungus and biological attack. Fill sheets shall be self-spacing, supported on maximum spans of 12". Each fill sheet shall have a microstructure to improve heat transfer. Fill sheets shall be bonded together to give a cross-corrugated pattern by application of glue only to dedicated glue joints. Fill packs made from random application of glue shall not be acceptable. Fill packs or blocks shall be placed in the tower so as to provide the tightest fit possible without damage to the fill. Drift eliminators shall be minimum three-pass Polyvinyl Chloride (PVC) material of cellular design impervious to decay, fungus and biological attack. Drift losses shall not exceed 0.005% of the design circulating flow rate.

H. Water Collection System: The tower shall utilize a water collection system positioned beneath the fill media and above the air inlet. The water collection system shall collect cold water as it falls from the fill media and channel the cooled water into the tower's elevated perimeter basin permitting the mechanical equipment to be mounted in the cool dry entering air stream beneath the tower. The water collectors shall be made of extruded flame retardant Acrylonitrile Butadiene Styrene copolymer (ABS) material and shall contain an integral damper system that opens mechanically with airflow. The damper system will prevent entry of airborne debris when the fan below it is off. The water collection system shall be covered by a one (1) year warranty.

I. Motor: The tower shall contain _____ motors at ___ horsepower per motor for a total installed horsepower of ____. The motors shall be Totally Enclosed Air Over (TEAO) with a service factor of 1.15 and must be suitable for 230/460-Volt, 3-phase, 60-Hz service. Motors shall operate at 860-900 RPM and be single-speed, single winding. Maximum brake horsepower shall not exceed the nameplate horsepower at design operating conditions. The motor(s) shall be mounted to a 304 stainless steel sub-structure using 304 stainless steel bolts.

J. Fans: Fans shall be of an axial, airfoil design positioned within an aerodynamically streamlined fiberglass shroud and installed with a minimum of tip clearance for maximum efficiency. A fan shall have four (4), eight (8), or six (6) blades when powered by a 3, 5, or 7.5 horsepower motor, respectively. Fan blades shall be manufactured of Fiberglass-Reinforced Polypropylene and be pitch-adjustable. Fan hubs shall be manufactured of high strength, low weight aluminum alloy to minimize stress and wear on motor bearings. The cooling tower shall have ___ direct-drive fans per cell. Both the fan assembly and motor shall be installed outside the tower's hot moist exiting air stream. Towers utilizing gear reducers or belt driven units will not be accepted. A corrosion resistant mesh fan guard to prevent entry of airborne objects into the fan is required.

K. Cooling Tower Manufacturer: Tower Tech TTXE Series.

2.5 FIBERGLASS CROSSFLOW COOLING TOWER:

SPEC EDITOR: BASED MARLEY QUADRAFLOW.

SPEC EDITOR: FIBERGLASS TOWER NOT FM APPROVED. COORDINATE WITH PROJECT FM REQUIREMENTS.

A. General: Induced draft cooling tower constructed entirely from fiberglass reinforced polyester with stainless steel fasteners except where specified below.

B. Casings: Fiberglass Reinforced Polyester (FRP), fabricated and installed by manufacturer to make tower watertight.

SPEC EDITOR: DESIGNER NEEDS TO PROVIDE SUFFICIENT HEIGHT FOR MAINTENANCE PERSONNEL TO ACCESS HATCH IN CENTER OF TOWER. PROVIDE SUFFICIENT SPACE AROUND ENTIRE PERIMETER OF TOWER TO

ALLOW ACCESS TO BASIN COVERS VIA AN EXTERNAL PERIMETER PLATFORM WITH HANDRAILS OR WITH A PORTABLE LADDER.

C. Collecting Basin and Sump: FRP. Provide integral type collecting basin and sump with lift-out strainer with openings smaller than nozzle orifices, and with connections for equalizer piping in multiple cell installation, drain, overflow and water make-up. See plans for requirement on make-up valve and backflow preventer.

D. Wetted-Surface Fill: Wave form vertical sheets of PVC having flame spread rating of 5 per ASTM E 84 - 81A.

E. Drift Eliminators: Limit drift-loss to the indicated maximum percentage of 0.005 of total water circulated, with PVC plastic, having flame spread rating of 5 per ASTM E 84.

F. Louvers: Designed and installed by manufacturer, and of sufficient thickness and rigidity to prevent visible sagging: PVC, integral with fill.

G. Water Distribution System: FRP basin with polypropylene nozzles shall provide full coverage of the fill by gravity flow.

H. Basin Covers: Provide removable cover with handles, installed by manufacturer to prevent debris from entering basin and to inhibit algae growth by eliminating sunlight. Made of FRP.

I. Air Inlet Screens: Stainless steel mesh, mounted in removable frames by manufacturer.

J. Fans and Drives: Aluminum propeller-fan of adjustable-pitch type. Provide gear-drive including speed reducer with extended oil line and dipstick.

SPEC EDITOR: COORDINATE WITH ELEC. ENGINEER. SHOW FIELD WIRING TO NEMA 4 JUNCTION BOX WITH RESET BUTTON MOUNTED OUTSIDE OF TOWER. SHOW ON ELEC. DRAWING.

K. Vibration Cutout Switch: Provide switch to de-energize fan motors if excessive vibration occurs due to fan imbalance. Vibration switch shall be Metrix model #550. If vibration switch is located inside tower, provide remote reset feature with required wiring.

L. Fan Guard: Stainless steel welded steel rod and wire guard

M. Cooling tower manufacturer: Marley Quadraflow

2.6 FORCED DRAFT COOLING TOWERS:

SPEC EDITOR: BASED ON BAC SERIES V AND MARLEY

SPEC EDITOR: PROVIDE ADEQUATE SPACE FOR FAN SHAFT REMOVAL.

A. General: Forced draft cooling tower with vertical discharge and side intake. Cooling tower shall be FM approved.

B. Casings: Galvanized steel fabricated and installed by manufacturer to make tower watertight.

C. Fan/Pan Section: The combination Pan/Fan section shall be constructed with galvanized steel. The fans and motors shall be located in the dry air stream.

D. Surface Section: Removable from the Pan/Fan section to facilitate rigging. Provide serpentine PVC wet deck surface with individually supported fill sheets installed no closer than ¾" to one another, and galvanized casing steel panels.

E. Eliminators: Eliminators shall be steel galvanized and shall limit drift losses to 0.002% of total water circulated.

F. Water Distribution System: One of the following materials designed and installed by manufacturer to ensure even distribution of water over wetted-surface-fill.

1. Schedule 40 PVC pipe header and removable schedule 40 PVC pipe branches.
2. Nozzles: Provide removable plastic or brass.
3. Pressure Drop: Maximum pressure drop of 5 psi.

G. Air Inlet Screens: Galvanized steel mesh , mounted in removable frames by manufacturer:

H. Fans and Drives: Provide forward curved centrifugal fans with galvanized steel blades and V-belt drive with sheave sized for rated air flow.

I. Fan Bearings: Self-aligning ball bearings; include external extended grease lines, and fittings. Installed by manufacturer.

J. Water Distribution System: Water shall enter the tower through a single inlet comprised of an enclosed, low pressure, non-corrosive Polyvinyl Chloride (PVC) Schedule 40 piping system. Water will be distributed further using Schedule 40 PVC lateral(s). Water shall be uniformly sprayed over the fill media by evenly spaced and sized rotary spray nozzles that are capable of automatically adjusting the size of their exit orifices to accommodate varying water flows. The nozzles shall have a four (4) inch orifice for clog free operation, produce a square pattern, and shall be located no more than three inches above the fill media. The nozzles must operate between a minimum ½ pound of pressure and a maximum 1½ pounds of pressure. The nozzles shall be made of High Density Polyethylene (HDPE) and/or Acrylonitrile Butadiene Styrene copolymer (ABS). Water distribution system shall be covered by a one (1) year warranty.

K. Cooling tower manufacturers: Marley, Baltimore Air Coil, Evapco.

PART 3 - EXECUTION

3.1 STORAGE:

A. Store tower and materials off ground until unit is placed. Follow manufacturer's requirements for support.

B. Perform all maintenance as required by manufacturer during storage until unit is turned over to owner Provide documentation on date and type of maintenance preformed.

3.2 INSTALLATION:

A. Any and all items shipped loose with the tower, such as rails, float valves fan shroud, walkways, ladder, motor, motor mount and any item required for proper operation of tower, shall be assembled and installed per manufacturer's requirements.

B. Access: Provide access and service space around and over cooling towers as indicated, but in no case less than that recommended by manufacturer.

C. Support: Install floor-mounted units on 4" high reinforced concrete pad, 4" larger on each side than cooling tower base. Cast anchor bolt inserts into pad.

SPEC EDITOR: STEEL SUPPORT PAINTING BY ARCH. TRADES.

D. Support: Install roof-mounted units on structural steel mechanical equipment supports as shown in the drawings. Anchor cooling tower to supports with removable fasteners. Verify support configuration against tower shop drawing prior to tower delivery.

SPEC EDITOR: DO NOT PLACE TOWER DIRECTLY ON VIBRATION ISOLATORS. CONFIRM WITH MANUFACTURER REQUIREMENTS FOR SECONDARY STEEL.

E. Placement: Mount unit on vibration isolators. 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 union 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 2 or more inlets). Connect outlets with shutoff valves.

SPEC EDITOR: MAKE SURE THIS IS DETAILED ON DRAWING.

G. Make-up and Water Piping: Provide flanged or union connections to cooling tower, with flexible pipe connections if tower is mounted on vibration isolators. Pitch lines so water will drain into sump.(Engineer to verify need for backflow preventer.)

H. Drain Piping: Connect drain and overflow to cooling tower as indicated, full size of connection on cooling tower.

I. Electrical Wiring: Install electrical devices furnished by manufacturer but shipped loose. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.

J. Final Alignment: Factory trained technician shall verify and align if necessary the drive system prior to start-up, within 0.004".

3.3 ADJUSTING AND CLEANING:

A. Start-up: Check, test and startup by manufacturer's technical representative, including final adjustments to blades and drives. 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 water flow to each tower and to each inlet for multiple inlet towers.
5. Adjust water level control for proper operating level.
6. Balance equalizer lines between multiple towers (if any).

B. Commissioning:

1. Manufacturer's representative shall attend pre-field assembly meeting to verify, in writing, that all tower parts have been shipped without damage and to instruct installing contractor on proper assembly.
2. Manufacturer's representative shall attend initial tower startup to verify, in writing, that the tower is properly assembled and fastened, the flow to the hot basins is properly balanced, the float valve operates properly, the fans operate properly through the entire speed range and the fan motors are drawing the proper amperage and verify operation & setting of vibration switch.

SPEC EDITOR: ADD FOR BASIN ELECTRICAL HEATER

3. Manufacturer representative shall verify in writing that each heater element draws the proper amperage and shuts off on low water level

3.4 CLOSEOUT PROCEDURES:

A. Provide services of manufacturer's technical representative for one 8-hour day to instruct Owner's personnel in operation and maintenance of factory-fabricated cooling towers.

1. Schedule training with Owner, provide at least 7-day notice to Contractor and Engineer of training date.

END OF SECTION 236500