SECTION 15640 – PACKAGED COOLING TOWERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK INCLUDED

A. Furnish and install all cooling towers, in the type, capacity and quantities indicated, including all connection points for make-up, overflow and drains to make a complete and operational system.

B. All systems shall be installed in accordance with local codes including drain and overflow discharge termination points.

C. Secure all permits and local/state approval for the installation of all components included under this Section.

1.3 RELATED SECTIONS

A. Examine all drawings and criteria sheets and all other Sections of the Specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.

1.4 REFERENCES

A. Applicable provisions of the following Codes and Trade Standard Publications shall apply to the work of this Section, and are hereby incorporated into, and made a part of the Contract Documents.

B. Material standards shall be as specified or detailed hereinafter and as follows:

1. ABMA STD 9 – Load Ratings and Fatigue Life for Ball Bearings.
2. ABMA STD 11 – Load Ratings and Fatigue Life for Roller Bearings.
3. ASME PTC 23 – Atmospheric Water-Cooling Equipment.
4. ASTM A 123 – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Sheet Products.
5. ASTM A 653/A 653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot Dip Process.

6. ASTM E 84 – Test Method for Surface Burning Characteristics of Building Materials.
7. CTI ATC – 105 – Acceptance Test Code for Water Cooling Towers; Cooling Tower Institute.
8. CTI STD-2-201 – Certification Standard for Commercial Water Cooling Towers; Cooling Tower Institute.
9. NEMA MG 1 – Motors and Generators.

1.5 SUBMITTALS

A. See Section 15050 and General Conditions for additional requirements.

B. Product Data: Provide rated capacities, dimensions, weights and point loadings, accessories, required clearances, electrical requirements and wiring diagrams, and location and size of field connections. Submit schematic indicating capacity controls.

C. Shop Drawings: Indicate suggested structural steel supports including dimensions, sizes, and locations for mounting bolt holes.

D. Manufacturer's Instructions: Submit manufacturer's complete installation instructions.

E. Manufacturer's Certificate: Certify that cooling tower performance, based on CT1 ATC-105, CT1 STD-201, or ASME PTC 23 meet or exceed specified requirements and submit performance curve plotting leaving water temperature against wet bulb temperature.

F. Operation and Maintenance Data: Include start-up instructions, maintenance data, parts lists, controls and accessories.

G. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum five years of documented experience.

B. Installer Qualifications: Company specializing in performing work the type specified in this section, with a minimum of five (5) years of documented experience and approved by manufacturer.

1.7 DELIVERY, STORAGE AND HANDLING

A. Factory assembled. For shipping, disassemble into as large as practical sub-assemblies so that minimum amount of field work is required for re-assembly. Provide a list of field installed equipment and an estimate on assembly time.

B. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

1.8 WARRANTY

A. Provide a one (1) year extended warranty to include coverage for corrosion resistance cooling tower structure, cooling tower package, fan drive, and motor including all labor and materials.

PART 2 - PRODUCTS

2.1 INDUCED DRAFT COOLING TOWERS

A. General

1. Acceptable manufacturers subject to compliance with the specifications shall be as follows:

   a. Marley
   b. Baltimore Air Coil

2. Cooling towers shall be induced draft, vertical discharge, package cross-flow type, direct drive with screened air inlets. Cooling towers shall be factory assembled, induced draft, vertical discharge, and cross-flow type as shown on the plans.
3. Except where otherwise specified, all casings shall be heavy gauge steel, protected against corrosion by G-235 galvanizing. The tower shall be capable of withstanding water having a pH of 6.5 to 8.0, a chloride content (NaCL) up to 500 ppm, a sulfate content (SO_4) up to 250 ppm; a calcium content ($CaCO_3$) up to 500 ppm; a silica content (SiO_2) up to 150 ppm and design hot water temperatures up to 125°F.
4. Fan shall be cast aluminum alloy, with adjustable pitch blades.
5. Fill and drift eliminator material shall be non-corrosive and non-ferrous. Fill shall consist of vertical sheets of polyvinyl chloride. Fill shall be film type, thermoformed of 15 mil (0.38 mm) thick PVC, with louvers formed as part of each fill sheet. Fill shall be suspended from hot dip galvanized 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. Drift eliminators shall be PVC, triple-pass. Drift loss shall be limited to 0.005% of the water circulated.
6. Access panels shall be provided on both end walls for access to the eliminator and plenum section. A heavy gauge, galvanized wire, grille type fan guard shall be provided over each fan cylinder.
7. All bolts, nuts and washers shall be stainless steel or galvanized steel. All steel used in the construction of the cooling tower shall be galvanized or stainless steel.

B. Performance:

1. Thermal rating shall be certified by the Cooling Technology Institute. The performance shall not be less then that scheduled.
2. Acoustical Performance

a. Sound level for a single cell shall not exceed 74 dBA 5 ft from the air inlet.

C. Performance Warranty:

1. CTI Certification notwithstanding, the cooling tower manufacturer shall guarantee that the tower supplied will meet the specified performance conditions when the tower is installed according to plan.

D. Design Loading

1. The tower and all its components shall be designed to withstand a wind load of 30 psf, as well as a .3g seismic load. It shall be designed to withstand shipping and hoisting loads of 2g horizontal and 3g vertical. The fan deck and hot water basin covers shall be designed for 50 psf live load or a 200 lb. concentrated load. Handrails, 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.

E. Fan(s) shall be propeller-type, incorporating heavy aluminum alloy blades and electrogalvanized hubs. Blades shall be individually adjustable.

F. Cooling tower shall be equipped with:

1. S/S Basin

a. The cold water basin shall be heavy-gauge Series 300 stainless steel, and shall include the number and type of suction connections required to accommodate the outflow piping system. Suction connections shall be equipped with stainless steel debris screens. A 4" (102mm) diameter PVC pipe overflow shall be provided in each cell of the tower. The basin shall include a depressed center section into which accumulated silt can be flushed and overflow standpipes shall be removable to permit flush-out cleaning of the basin. The basin floor adjacent to the depressed section shall slope toward the depressed section to prevent build-up of silt under the fill area. All steel items which project into the basin (columns, diagonals, anchor clips, etc.) shall also be made of stainless steel.

2. S/S Hot Water Basin

   a. Two stainless steel open basins (one above each bank of fill) shall receive hot water piped to each cell of the tower. These basins shall be installed and sealed at the factory, and shall be equipped with removable, stainless steel covers capable of withstanding the loads described. All components of these basins, with the exception of the nozzles, shall be stainless steel.
   b. Open gravity type distribution basins shall be made of 304 stainless steel with plastic diffusing type metering orifices. Flanged connections shall be provided to be connected to piping distribution provided by the Mechanical Contractor, including cast iron flow control valves if shown on plans. Removable basin covers shall be factory installed and shall be made of 304 stainless steel. Pressurized spray-type distribution systems are not acceptable. If the winter duty (GPM) is less than half of the summer duty, provide hot water basin dams to accommodate for flow reduction.

3. Make-up Water

   a. Five (5) probe electric level control in each cell

      1) In each cell, provide a probe-type electric water level sensor system. The five-probe assembly shall contain a relay for water make-up, high-level alarm, and a low-level alarm.
      2) Tower makeup and blowdown assemblies shall be located within the chiller Mechanical Room.

4. Internal Walk with stainless steel supports

   a. Provide a galvanized steel bar grating walkway extending from one endwall access door to the other endwall. This walkway shall be supported by a stainless steel framework, and the top of the grating shall be at or above the cold water basin overflow level.

5. Internal Ladder and Platform to Access Motor and Drive

   a. Elevated mechanical platform - An internal ladder shall extend upward from the plenum walkway to an elevated galvanized bar grating platform convenient to the care and maintenance of the tower's mechanical equipment. The platform shall be surrounded by a sturdy handrail and kneerail system.

6. OSHA compliant external ladder and access door platform, each tower from roof level to top of tower

   a. Provide a vertical ladder attached to the tower casing and extending from the base of the tower to the top of the fan deck platform handrail.
   b. Provide a ladder extension for connection to the foot of the ladder attached to the tower casing. This extension shall be long enough to rise from the roof

(grade) level to the base of the tower. The installing contractor shall be responsible for cutting the ladder to length; attaching it to the foot of the tower ladder; and anchoring it at its base.

c. A heavy gauge galvanized steel safety cage shall surround the ladder, extending from a point approximately 7'-0" (2.134m) above the foot of the ladder to the top of the handrail surrounding the fan deck.

d. There shall be an access platform at the base of the tower (as shown on drawings) extending from the vertical ladder to the endwall access door. The platform shall be galvanized steel bar grating, supported by galvanized steel framework attached to the tower. The platform shall be surrounded by a handrail, kneerail, and toeboard.

7. Fan deck hand rail and toe guard.

a. The top of the tower shall be equipped with a sturdy handrail, complete with kneerail and toeboard, designed according to OSHA guidelines. Handrails and kneerails shall consist of 1.66" O.D. x 15 gauge galvanized structural tubing, the handrail of which shall be capable of withstanding a 200 pound concentrated live load in any direction. Posts are 2" x 2" square structural tubing and 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 handrail.

8. Tower air inlet screens each cell.

a. Air inlet screens are to be full height, one inch square by .063" welded wire mesh, galvanized after welding. Screens shall be factory installed.

9. Tower outlet screens each cell.

a. The casing and fan deck shall be heavy-gauge galvanized steel, and shall be capable of withstanding the loads described. The top of the fan cylinder shall be equipped with a conical, non-sagging, removable fan guard, fabricated of welded 5/16" (8 mm) and 7 gauge rods, and hot dip galvanized after fabrication.

10. Fan deck extension

a. Provide extensions on the fan deck with handrails to walk around the end on top.

11. Gear Drive

a. Fan(s) shall be driven through a right angle, industrial duty, oil lubricated, geared speed reducer that requires no oil changes for the first five (5) years of operation. Speed reducers employing pulleys and belts will not be accepted. Gear drive shall be suitable for VFD drive.

b. A neoprene and galvanized steel oil line shall extend from the gear reducer(s) to a point on the fan deck of each cell. The oil level in the gear reducer shall be readable at that point by means of a dip stick.

12. Bottom side outlet anti vortex sump with screen each cell

    a. The cold water basin shall be heavy-gauge Series 300 stainless steel, and shall include the number and type of suction connections required to accommodate the outflow piping system shown on the plans. The outlet connection shall be a depressed, stainless steel sump, including trash screen and anti-vortex plate if required by manufacturer. Flange shall be 14".

13. Provide flanged bottom equalizer connection in each cell.
14. Provide bottom 4" drain and overflow connections for each cell.

    a. A 4" (102mm) diameter PVC pipe overflow shall be provided in each cell of the tower. The basin shall include a depressed center section into which accumulated silt can be flushed and overflow standpipes shall be removable to permit flush-out cleaning of the basin. The basin floor adjacent to the depressed section shall slope toward the depressed section to prevent build-up of silt under the fill area.

15. Basin Heaters

    a. Provide a system of electric immersion heaters and controls for each cell of the tower to prevent freezing of water in the collection basin during periods of shutdown. The system shall consist of one or more stainless steel electric immersion heaters installed in threaded couplings provided in the side of the basin. A NEMA 4 enclosure shall house magnetic contactors to energize heaters; a transformer to provide 24-volt control circuit power; and a solid-state circuit board for temperature and low water cut-off. A control probe shall be located in the basin to monitor water level and temperature. The system shall be capable of maintaining 40°F water temperature at an ambient air temperature of -12°F.
    b. Provide all controls, safeties, contacts, and relays in a NEMA 4 enclosure, one for each cell.

16. Motor

    a. Motor(s) shall be Premium efficiency, TEFC, 1.15 service factor, variable torque, and specially insulated for cooling tower duty.
    b. TEAO motors are unacceptable.
    c. Speed and electrical characteristics shall be 1800 RPM, single-winding, 3 phase, 60 Hertz, 480 volts, unless otherwise noted on the Drawings
    d. Motor shall operate in the shaft-horizontal position, and nameplate horsepower shall not be exceeded at any operating condition.
    e. See Specification 15170 Motors and Controls.

f. Motor shall be single-speed, single-winding, suitable for use with variable speed drives.

17. Vibration Switch

a. A vibration limit switch (one per cell) shall be installed on the mechanical equipment support assembly and wired into the control panel. The purpose of this switch will be to interrupt power to the motor in the event of excessive vibration. It shall be adjustable for sensitivity, and shall require manual reset.

G. Condenser water piping exposed to weather where indicated on the drawings shall be heat traced, insulated and covered with weatherproof insulation covering by the installing contractor. All condenser water piping shall be installed and supported independently from the towers on substantial steel supports as approved by the Architect.

PART 3 - INSTALLATION

3.1 COOLING TOWER

A. Install in accordance with manufacturer's instructions.

B. Install tower on structural steel beams as instructed by manufacturer.

C. Install tower on vibration isolators and Seismic restraint. Refer to Section 15241.

D. Connect condenser water piping with flanged connections to tower. Pitch condenser water supply to tower and condenser water suction away from tower.

3.2 FIELD QUALITY CONTROL

A. Test for capacity under actual operating conditions in accordance with CT1 ATC-105 and verify specified performance. Test shall be performed by CTI personnel.

3.3 STARTING EQUIPMENT AND SERVICES

A. Inspect tower after installation and submit report prior to start-up, verifying installation is in accordance with specifications and manufacturer's recommendations.

B. Supervise rigging, hoisting, and installation.

C. Start-up tower in presence of and instruct Owner's operating personnel.

END OF SECTION