SECTION 236523 - FIELD-ERECTED COOLING TOWERS

This Section includes field erected induced draft, cooling towers and their accessories including control packages normally supplied with towers are available in approximate sizes from 250 to 3000 nominal cooling tons per cell.

Manufacturers found in SpecAgent for this Section were identified as representative and not as an endorsement for meeting the requirements of this specification.

This Section includes performance, proprietary, and descriptive type specifications. Edit to avoid conflicting requirements.

This Section includes the term Architect/Engineer. "Architect" is used in AIA contract documents; "Engineer" is used in EJCDC contract documents. Retain appropriate term.

See the Drawing Coordination Considerations for information needed to coordinate this specification Section with the Drawings.

1. GENERAL
	* + 1. SUMMARY
				1. Section includes cooling tower with structure, casing, fill and basin, controls, heaters fans, motors and drive equipment, condensing water inlet and outlet with internal distribution and ladder and handrails.
				2. Related Sections:

Section 033000 - Cast-In-Place Concrete: Execution requirements for concrete bases and basins specified by this section.

Section 221100 - Facility Water Distribution: Execution requirements for make up water and drain piping specified by this section.

Section 230513 - Common Motor Requirements for HVAC Equipment: Product requirements for electric drive motors for placement by this section.

Section 230529 - Hangers and Supports for HVAC Piping and Equipment: Execution requirements for steel support bases specified by this section.

Section 230548 - Vibration and Seismic Controls for HVAC Piping and Equipment: Product requirements for vibration isolators for placement by this section.

Section 232113 - Hydronic Piping: Product requirements for condenser water piping for placement by this section.

Section 232500 - HVAC Water Treatment: Product and execution requirements for cooling tower water chemical treatment equipment.

* + - 1. REFERENCES

List reference standards included within text of this section. Edit the following for Project conditions.

* + - * 1. American Bearing Manufacturers Association:

ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.

ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

* + - * 1. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

* + - * 1. American Society of Mechanical Engineers:

ASME PTC 23 - Atmospheric Water Cooling Equipment.

* + - * 1. Cooling Technology Institute:

CTI - Acceptance Test Code.

CTI 201 - Certification Standard for Commercial Water Cooling Towers.

* + - * 1. National Electrical Manufacturers Association:

NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

* + - 1. SUBMITTALS
				1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
				2. Manufacturer’s installation instructions shall be provided along with product data.
				3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).

Only request submittals needed to verify compliance with Project requirements.

* + - * 1. Section 013300 - Submittal Procedures: Submittal procedures.
				2. Shop Drawings: Indicate supports with point loads including dimensions, sizes, and locations for mounting-bolt holes.
				3. Product Data: Submit rated capacities, dimensions, weights and point loads, accessories, required clearances, electrical requirements and wiring diagrams, and location and size of field connections. Submit schematic indicating capacity controls. Submit performance curve plotting leaving water temperature against wet bulb temperature.
				4. Field Test Reports: Indicate compliance with specified performance.
				5. Manufacturer's Certificate: Certify cooling tower performance meets or exceeds specified requirements.
				6. Manufacturer's Field Reports: Submit start-up report [**for each unit**]. Indicate compliance with field test.
			1. CLOSEOUT SUBMITTALS
				1. Section 017716 – Contract Closeout.
				2. Operation and Maintenance Data: Submit start-up instructions, maintenance data, parts lists, controls, and accessories.
			2. QUALITY ASSURANCE
				1. Thermal performance in accordance with CTI Acceptance Test Code and CTI 201 “Certification Standard for Commercial Water Cooling Towers”.
				2. Performance Ratings: Required performance not less than prescribed by ASHRAE 90.1 “Energy Standard for Buildings Except Low-Rise Residential Buildings” when tested in accordance with CTI Acceptance Test Code and CTI 201 “Certification Standard for Commercial Water Cooling Towers”.

Include the following paragraph only when cost of acquiring specified standards is justified.

* + - * 1. Maintain [**one copy**] [**<\_\_\_\_\_\_\_\_> copies**] of [**each**] document on site.
			1. QUALIFICATIONS
				1. Manufacturer: Company specializing in manufacturing products specified in this section with minimum [**three**] <**\_\_\_\_\_\_\_\_**> years [**documented**] experience.
				2. Installer: Company specializing in performing work of this section with minimum [**three**] <**\_\_\_\_\_\_\_\_**> years' [**documented**] experience [**and approved by manufacturer**].
			2. PRE-INSTALLATION MEETINGS
				1. Section 013000 - Administrative Requirements: Pre-installation meeting.
				2. Convene minimum [**one**] <**\_\_\_\_\_\_\_\_**> week prior to commencing work of this section.
			3. DELIVERY, STORAGE, AND HANDLING
				1. Section 016500 – Materials and Equipment000 - Product Requirements: Product storage and handling requirements.
				2. Accept cooling tower components on site in manufacturer's shipping packaging. Inspect for damage.
				3. Follow manufacturer's installation instructions for rigging, unloading, and transporting units.
			4. FIELD MEASUREMENTS
				1. Verify field measurements prior to fabrication.
			5. WARRANTY

This article extends warranty period beyond one year. Extended warranties increase construction costs and Owner enforcement responsibilities. Specify warranties with caution.

* + - * 1. Section 017716 – Contract Closeout.
				2. Furnish [**five**] <**\_\_\_\_\_\_\_\_**>-year manufacturer's warranty for [**corrosion resistance of cooling tower structure**] [**cooling tower package**] [**fan drive**] [**motor**] [**labor only**] [**materials only**] [**labor and materials**].
			1. MAINTENANCE SERVICE
				1. Section 017716 – Contract Closeout.

Evaluate need for maintenance and emergency service based Project requirements. If desired, retain the following paragraphs.

* + - * 1. Furnish service and maintenance of cooling tower for [**one**] [**five**] <**\_\_\_\_\_\_\_\_**> years from Date of Substantial Completion.
				2. Examine unit components [**weekly**] [**semi-monthly**] [**monthly**] [**bi-monthly**]. Clean, adjust, and lubricate equipment.
				3. Include systematic examination, adjustment, and lubrication of unit, including fan belt replacement, and controls checkout and adjustments. Repair or replace parts in accordance with manufacturer's operating and maintenance data. Use parts produced by manufacturer of original equipment.
				4. Perform work without removing units from service during building normal occupied hours.
				5. Provide emergency call back service [**at all hours**] [**during working hours**] for this maintenance period.
				6. Maintain locally, near Place of the Work, adequate stock of parts for replacement or emergency purposes. Have personnel available to ensure fulfillment of this maintenance service, without unreasonable loss of time.
				7. Perform maintenance work using competent and qualified personnel under supervision [**and in direct employ**] of manufacturer or original installer.
				8. Do not assign or transfer maintenance service to agent or subcontractor without prior written consent of [**Director’s Representative.**] <**\_\_\_\_\_\_\_\_.**>
			1. EXTRA MATERIALS
				1. Section 017716 – Contract Closeout.
				2. Furnish [**two**] <**\_\_\_\_\_\_\_\_**> sets of matched fan belts.
				3. Furnish [**two**] <**\_\_\_\_\_\_\_\_**> spray nozzles for each cell.
				4. Furnish [**two**] <**\_\_\_\_\_\_\_\_**> gaskets for each access door.
				5. Furnish [**one**] <**\_\_\_\_\_\_\_\_**> valve seat for each make-up or control valve.
1. PRODUCTS
	* + 1. COOLING TOWERS

In this article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=12754) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Baltimore Aircoil Company.

[EVAPCO, Inc](http://www.specagent.com/Lookup?uid=123457139315).

[Marley Cooling Technologies; SPX Cooling Technologies](http://www.specagent.com/Lookup?uid=123457139318).

[Recold](http://www.specagent.com/Lookup?uid=123457139317).

Approved equivalent.

* + - * 1. Field assembled, sectional, cross flow or counter flow, vertical discharge, induced draft type, with casing, structure, fan, motor and drive assemblies, fill, drift eliminators.

Edit the following descriptive specifications to identify requirements and to eliminate conflicts with manufacturers specified above.

First select type of tower structure, then edit remaining paragraphs for Project conditions. Options may be given to allow Contractor to select tower construction.

* + - 1. STEEL STRUCTURE TOWERS
				1. Framework and Casing: Galvanized steel with sheets installed vertically with waterproof flanges.
				2. Collection Basin: Galvanized steel with depressed center section, designed to support tower, with cleanout and drain fitting, 8 gage (4 mm), 1/4 inch (7 mm) mesh strainer, side outlet sump, overflow

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Collection Basin: Concrete built to tower manufacturer's recommendation with sump and outlet. Refer to Section 033000.
			1. FRP STRUCTURE TOWERS
				1. Framework and Casing: Fiberglass reinforced polyester shell with UV inhibitors, cylindrically formed with bolted sections.
				2. Collection Basin: Molded FRP with depressed center section with cleanout and drain fitting bolted to steel support structure.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Collection Basin: Concrete built to tower manufacturer’s recommendation with sump and outlet. Refer to Section 033000.
			1. GENERAL TOWER CONSTRUCTION
				1. Fan: Multi-blade cast aluminum [**fixed**] [**adjustable**] pitch, axial type.
				2. Drive: Geared, right angle drive with ABMA 9 “Load Ratings and Fatigue Life for Ball Bearings” or ABMA 11 “Load Ratings and Fatigue Life for Roller Bearings” L-10 life expectancy of 40,000 hours bearings and drive shaft equipped with non-lubricated flexible couplings.
				3. Motor: [**Single speed**] [**Two speed**] [**(1800/900 rpm)**] with special moisture protection, mounted on welded steel frame in fan deck.
				4. Fan Cylinder: One-piece, welded steel, hot dipped galvanized fan assembly [**Multi-segment FRP**].
				5. Fill: [**Self-supporting fluted polyvinyl chloride plastic**] [**Redwood or fir splash bars supported on glass reinforced polyester grid**].
				6. Drift Eliminators: Two or three-pass polyvinyl chloride plastic, to limit drift loss to [**0.2**] [**0.005**] <**\_\_\_\_\_\_\_\_**> percent of total water circulated.
				7. Louvers: [**Corrugated glass reinforced polyester**] [**pressure treated plywood**] [**or**] [**Formed galvanized steel, sight tight**] spaced to minimize air resistance and splash out.
				8. Distribution Basin: Open, gravity type distribution basin utilizing weirs and plastic metering orifices and flow control valves [**, with fiber reinforced cement fan deck covering**] [**, with pressure treated plywood basin covers**] [**, with galvanized steel basin covers**].

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Distribution Section: [**Polyvinyl chloride**] [**Galvanized steel**] piping header and branches with [**ABS**] plastic spray nozzles.
				2. Access doors at both ends of cross flow tower and at cell partitions to access eliminators and air plenum.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Access hatch from fan deck to ladder and catwalk for access to spray section of counter flow towers.
				2. Safety: Safety railings, and ladder [**with safety cage**] from [**grade**] [**roof**] to fan deck.
				3. Float Valves: Brass or bronze [**balanced piston type**] make-up valve with plastic or copper float.
				4. Hardware, nuts, bolts, and washers: [**Galvanized steel**] [**Stainless steel**] [**Cadmium-plated steel**].

Select options from the following paragraphs.

* + - * 1. Accessories:

Electric Immersion Heaters: In collection basin; suitable to maintain temperature of water in basin at 42 degrees F (5 degrees C) when outside temperature is 0 degrees F (-17 degrees C) and wind velocity is 15 mph (25 kph).

Immersion thermostat and low level control to operate heaters on low temperature.

Electric Temperature Controller: In collection basin; with sensor to cycle fans.

Time Delay Relay: Limits fan motor starts to not more than six per hour.

Vibration cut out switch mounted on drive support with electric contacts and sensitivity adjustment.

Manually Selected Summer/Winter Switch: Time delay relays limit fan motor start-up in reverse rotation during de-ice of inlet louvers; control fan off to allow fan to stop and run (in reverse) for preset time.

* + - * 1. Control Panel: NEMA 250 “Enclosures for Electrical Equipment (1000 Volts Maximum)” [**Type 3 - Drip-proof**] [**Type 3R - Weather Resistant**], containing:

Combination motor controllers.

Electric alternator.

Interlocks and relays.

Non-fused disconnect switch.

Push buttons with pilot lights.

Use for one or identical units. When specifying units of differing sizes, use schedules.

* + - * 1. Capacity:

Water Flow: <**\_\_\_\_\_\_\_\_**> gpm (<**\_\_\_\_\_\_\_\_**> L/sec).

Entering Water Temperature: <**\_\_\_\_\_\_\_\_**> degrees F (<**\_\_\_\_\_\_\_\_**> degrees C).

Leaving Water Temperature: <**\_\_\_\_\_\_\_\_**> degrees F (<**\_\_\_\_\_\_\_\_**> degrees C).

Entering Air WB Temperature: <**\_\_\_\_\_\_\_\_**> degrees F (<**\_\_\_\_\_\_\_\_**> degrees C).

External Static Pressure: <**\_\_\_\_\_\_\_\_**> inch wg (<**\_\_\_\_\_\_\_\_**> Pa).

* + - 1. ELECTRICAL CHARACTERISTICS AND COMPONENTS

Select one or more of the following subparagraphs appropriate to equipment requirements.

* + - * 1. Electrical Characteristics: In accordance with Section 260503 and the following:

[**<\_\_\_\_\_\_\_\_> hp (<\_\_\_\_\_\_\_\_> W).**] [**<\_\_\_\_\_\_\_\_> rated load amperes.**]

<**\_\_\_\_\_\_\_\_**> volts, [**single**] [**three**] phase, 60 Hz.

<**\_\_\_\_\_\_\_\_**> amperes maximum [**fuse size**] [**circuit breaker size**] [**overcurrent protection**].

<**\_\_\_\_\_\_\_\_**> minimum circuit ampacity.

<**\_\_\_\_\_\_\_\_**> percent minimum power factor at rated load.

* + - * 1. Motors: In accordance with Section 230513.
				2. Disconnect Switch: Factory-mount [**in control panel**] [**on equipment**].
1. EXECUTION
	* + 1. EXAMINATION
				1. Verify support is ready to accept tower.
				2. Verify dimensions of support are as shown on shop drawings.
			2. INSTALLATION
				1. Install tower on [**structural steel beams and columns**] [**concrete base**] in accordance with manufacturers requirements.
				2. Install tower on vibration isolators. Refer to Section 230548.
				3. Install condenser water piping with flanged connections to tower. Pitch condenser water supply to tower and condenser water suction away from tower. Refer to Section 232113.
				4. Install make-up water piping with flanged or union connections to tower. Pitch to tower. Refer to Section 221100.
				5. Install overflow, bleed, and drain, to [**floor drain.**] [**storm sewer.**] <**\_\_\_\_\_\_\_\_.**>
			3. FIELD QUALITY CONTROL

Manufacturers Certificate showing CTI certification as shown in "Part 1 General" could be used in lieu of the following optional paragraph.

* + - * 1. Test for capacity under actual operating conditions [**in accordance with CTI Acceptance Test Code**] and verify specified performance.
			1. MANUFACTURER'S FIELD SERVICES
				1. Supervise rigging, hoisting, and installation; include <**\_\_\_\_\_\_\_\_**> eight-hour days per tower.
				2. Inspect tower after installation and submit report prior to start-up, verifying installation is in accordance with specifications and manufacturers recommendations.
			2. ADJUSTING
				1. Adjust bleed, control settings and airflow.
			3. DEMONSTRATION AND TRAINING
				1. Demonstrate starting, maintenance and operation of tower.
			4. SCHEDULES

Include schedule when more than one unit is required. Complete schedule in conjunction with identification method used on Drawings or include schedule on Drawings. No units of measurement are indicated; these may be added to schedule legend or included within each insert.

Consider following examples when developing Project schedules.

* + - * 1. Cooling Towers Schedule:

CT-1:

[**Manufacturer: <\_\_\_\_\_\_\_\_>.**]

[**Model: <\_\_\_\_\_\_\_\_>.**]

Location: <**\_\_\_\_\_\_\_\_**>.

Number of Cells: <**\_\_\_\_\_\_\_\_**>.

Cooling Capacity per Cell: <**\_\_\_\_\_\_\_\_**>.

Water Flow Rate: <**\_\_\_\_\_\_\_\_**>.

Entering Water Temperature: <**\_\_\_\_\_\_\_\_**>.

Leaving Water Temperature: <**\_\_\_\_\_\_\_\_**>.

Entering Air Wet Bulb Temperature: <**\_\_\_\_\_\_\_\_**>.

Fan Motor Size: <**\_\_\_\_\_\_\_\_**>.

CT-2:

[**Manufacturer: <\_\_\_\_\_\_\_\_>.**]

[**Model: <\_\_\_\_\_\_\_\_>.**]

Location: <**\_\_\_\_\_\_\_\_**>.

Number of Cells: <**\_\_\_\_\_\_\_\_**>.

Cooling Capacity per Cell: <**\_\_\_\_\_\_\_\_**>.

Water Flow Rate: <**\_\_\_\_\_\_\_\_**>.

Entering Water Temperature: <**\_\_\_\_\_\_\_\_**>.

Leaving Water Temperature: <**\_\_\_\_\_\_\_\_**>.

Entering Air Wet Bulb Temperature: <**\_\_\_\_\_\_\_\_**>.

Fan Motor Size: <**\_\_\_\_\_\_\_\_**>.

END OF SECTION 236523