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USACE / NAVFAC / AFCESA **UFGS-15645A (February 2005)**

Preparing Activity: USACE **Superseding UFGS-15645A (December 2001)**

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 23 June 2005

Latest change indicated by CHG tags
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DIVISION 15 - MECHANICAL

SECTION 15645A

COOLING TOWER

02/05

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SECTION 15645A

COOLING TOWER
02/05

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NOTE: This guide specification covers the requirements for induced mechanical draft cooling towers (both packaged and field-erected).

Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of technical proponents, including their organization designation and telephone number, is on the Internet.

Recommended changes to a UFGS should be submitted as a Criteria Change Request (CCR).

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.
****

PART 1 GENERAL

1.1 REFERENCES

****
NOTE: Issue (date) of references included in project specifications need not be more current than provided by the latest guide specification. Use of SpecsIntact automated reference checking is recommended for projects based on older guide specifications.
****

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI S1.13	(1995; R 1999) Methods for the Measurement of Sound Pressure Levels in Air (ASA 118)

AMERICAN WELDING SOCIETY (AWS)

AWS Z49.1	(1999) Safety in Welding, Cutting and Allied Processes

ASME INTERNATIONAL (ASME)

ASME PTC 23	(2003) Atmospheric Water Cooling Equipment

ASTM INTERNATIONAL (ASTM)

ASTM A 123/A 123M	(2002) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153/A 153M	(2004) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 48/A 48M	(2003) Gray Iron Castings
ASTM B 117	(2002) Operating Salt Spray (Fog) Apparatus
ASTM C 67	(2003a) Sampling and Testing Brick and Structural Clay Tile
ASTM D 1784	(2003) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 520	(2000) Zinc Dust Pigment
ASTM E 84	(2004) Surface Burning Characteristics of Building Materials

COOLING TECHNOLOGY INSTITUTE (CTI)

CTI ATC-105	(2000) Acceptance Test Code
CTI Std-103	(2004) Redwood Lumber Specifications
CTI Std-111	(1998) Gear Speed Reducers
CTI Std-112	(1997) Pressure Preservative Treatment of Lumber
CTI Std-114	(1996) Douglas Fir Lumber Specifications (Coast Type)
CTI Std-134	(1996) Plywood for Use in Cooling Towers
CTI Std-137	(2003) Fiberglass Pultruded Structural Products for Use in Cooling Towers

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(2003; R 2004) Motors and Generators
NEMA MG 2	(2001) Safety Standard for Construction and Guide for Selection, Installation, and Use of Electric Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 214	(2005) Water-Cooling Towers
NFPA 255	(2000) Method of Test of Surface Burning Characteristics of Building Materials

REDWOOD INSPECTION SERVICE (RIS) OF THE CALIFORNIA REDWOOD ASSOCIATION (CRA)

RIS Grade Use	(1998) Redwood Lumber Grades and Uses

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA G-5	(1998) Western Lumber Grading Rules

1.2 SUBMITTALS

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NOTE: Submittals must be limited to those necessary for adequate quality control. The importance of an item in the project should be one of the primary factors in determining if a submittal for the item should be required.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy projects.

Submittal items not designated with a "G" are considered as being for information only for Army projects and for Contractor Quality Control approval for Navy projects.

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Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Cooling Tower

Manufacturer's standard catalog data, at least [5 weeks] [_____] prior to the purchase or installation of a particular component, highlighted to show material, size, options, performance charts and curves, etc. in adequate detail to demonstrate compliance with contract requirements. Data shall include manufacturer's recommended installation instructions and procedures. If vibration isolation is specified for a unit, vibration isolator literature shall be included containing catalog cuts and certification that the isolation characteristics of the isolators provided meet the manufacturer's recommendations.

Spare Parts

Spare parts data for each different item of equipment specified.

Posted Instructions

Posted instructions, at least [2] [_____] weeks prior to construction completion, including equipment layout, wiring and control diagrams, piping, valves and control sequences, and typed condensed operation instructions. The condensed operation instructions shall include preventative maintenance procedures, methods of checking the system for normal and safe operation, and procedures for safely starting and stopping the system. The posted instructions shall be framed under glass or laminated plastic and be posted where indicated by the Contracting Officer.

Performance Tests

A schedule, at least [2] [_____] weeks prior to the start of the cooling tower performance tests which identifies the proposed date, time, and location for the tests.

Demonstrations

A schedule, at least [2] [_____] weeks prior to the date of the proposed training course, which identifies the date, time, and location for the training.

Verification of Dimensions

A letter, at least [2] [_____] weeks prior to beginning construction, including the date the site was visited, conformation of existing conditions, and any discrepancies found.

SD-06 Test Reports

Performance Tests

[Six] [_____] copies of the report provided in bound 216 x 279 mm (8 1/2 x 11 inch) 8 1/2 x 11 inch booklets. The report shall document compliance with the specified performance criteria upon completion and testing of the system. The report shall document all phases of tests performed as well as conclusions as to the adequacy of the system (including sound performance). The report shall include performance curves which show selection points and predicted performance. The report shall include initial test summaries, all repairs/adjustments made, and the final test results.

SD-07 Certificates

Service Organization

A certified list of qualified permanent service organizations, which includes their addresses and qualifications, for support of the equipment. The service organizations shall be reasonably convenient to the equipment installation and be able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals

[Six] [_____] complete copies of the manual in bound 216 x 279 (81/2 x 11 inch) 8 1/2 x 11 inch booklets listing step-by-step procedures required for system startup, operation, abnormal shutdown, emergency shutdown, and normal shutdown at least [4] [_____] weeks prior to the first training course. The booklets shall include the manufacturer's name, model number, and parts list. The manuals shall include the manufacturer's name, model number, service manual, and a brief description of all equipment and their basic operating features.

[Six] [_____] complete copies of the manual in bound 216 x 279 (81/2 x 11 inch) 8 1/2 x 11 inch booklets listing routine maintenance procedures, possible breakdowns and repairs, and a trouble shooting guide. The manuals shall include piping and equipment layouts and simplified wiring and control diagrams of the system as installed.

1.3 SAFETY REQUIREMENTS

****
NOTE: Catwalk, ladder and guardrail may be required. If so, select the applicable item and delete the others and indicate on drawings the selected item. If not applicable, delete the entire sentence within the brackets.
****

Exposed moving parts, parts that produce high operating temperature, parts which may be electrically energized, and parts that may be a hazard to operating personnel shall be insulated, fully enclosed, guarded, or fitted

with other types of safety devices. Safety devices shall be installed so that proper operation of equipment is not impaired. Welding and cutting safety requirements shall be in accordance with AWS Z49.1. [[Catwalk,] [ladder,] [and guardrail] shall be provided where indicated and in accordance with Section 05500A MISCELLANEOUS METAL.]

1.4 DELIVERY, STORAGE, AND HANDLING

Stored items shall be protected from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Proper protection and care of all material both before and during installation shall be the Contractor's responsibility. Any materials found to be damaged shall be replaced at the Contractor's expense. During installation, piping and similar openings shall be capped to keep out dirt and other foreign matter.

1.5 PROJECT/SITE CONDITIONS

1.5.1 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

1.5.2 Drawings

Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. The Contractor shall carefully investigate the plumbing, fire protection, electrical, structural and finish conditions that would affect the work to be performed and shall arrange such work accordingly, furnishing required offsets, fittings, and accessories to meet such conditions.

1.5.3 Spare Parts

The Contractor shall submit spare parts data for each different item of equipment, after approval of detail drawings and not later than [_____] months prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, a recommended spare parts list for 1 year of operation, and a list of the parts recommended by the manufacturer to be replaced on a routine basis.

PART 2 PRODUCTS

2.1 STANDARD COMMERCIAL PRODUCTS

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacturing of such products, which are of a similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2 year use shall include applications of equipment and materials under similar circumstances and of similar size. The 2 years experience shall be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturer's catalogs, or brochures. Products having less than a 2 year field service record shall be acceptable if a certified record of satisfactory field operation, for not less than 6000 hours exclusive of the manufacturer's factory tests, can be shown. Products shall be supported by a service organization. System components shall be

environmentally suitable for the indicated locations.

2.2 NAMEPLATES

****
NOTE: In a salt water environment substitute acceptable non-corroding metal, such as but not limited to nickel-copper, 304 stainless steel, or monel. Aluminum is unacceptable. Nomenclature (or system identification) should be established by the designer.
****

Major equipment including cooling towers, cooling tower gear drive assemblies, fans, and motors shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment. Plates shall be durable and legible throughout equipment life and made of [anodized aluminum] [stainless steel] [_____]. Plates shall be fixed in prominent locations with nonferrous screws or bolts.

2.3 ELECTRICAL WORK

****
NOTE: Where motor starters for mechanical equipment are provided in motor-control centers, the references to motor starters will be deleted.
****

Electrical equipment, motors, motor efficiencies, and wiring shall be in accordance with Section 16402 INTERIOR DISTRIBUTION SYSTEM. Electrical motor driven equipment specified shall be provided complete with motors, motor starters, and controls. Electrical characteristics shall be as shown, and unless otherwise indicated, all motors of 746 kW (1 hp) 1 horsepower and above with open, dripproof, totally enclosed, or explosion proof fan cooled enclosures, shall be high efficiency type. Field wiring shall be in accordance with manufacturer's instructions. Each motor shall conform to NEMA MG 1 and NEMA MG 2 and be of sufficient size to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor. Motors shall be continuous duty with the enclosure specified. Motor starters shall be provided complete with thermal overload protection and other appurtenances necessary for the motor control indicated. Motors shall be furnished with a magnetic across-the-line or reduced voltage type starter as required by the manufacturer. Motor duty requirements shall allow for maximum frequency start-stop operation and minimum encountered interval between start and stop. Motors shall be sized for the applicable loads. Motor torque shall be capable of accelerating the connected load within 20 seconds with 80 percent of the rated voltage maintained at motor terminals during one starting period. Motor bearings shall be fitted with grease supply fittings and grease relief to outside of enclosure. Manual or automatic control and protective or signal devices required for the operation specified and any control wiring required for controls and devices specified, but not shown, shall be provided.

2.4 COOLING TOWER MATERIALS

2.4.1 Lumber

2.4.1.1 Douglas Fir

CTI Std-114, WWPA G-5, Grade B and better, Industrial Clear. Douglas fir shall have a preservative treatment in accordance with CTI Std-112.

2.4.1.2 Plywood

CTI Std-134, Exterior Grade, type and thickness as specified for the application.

2.4.1.3 Pressure Treated Lumber

Pressure treated lumber shall be in accordance with CTI Std-112. Wood exposed as the result of notching, cutting, or drilling shall be saturated with the preservative.

2.4.1.4 Redwood

CTI Std-103, RIS Grade Use California Redwood, clear of all hearts.

2.4.2 Fiberglass Reinforced Plastic (FRP)

FRP components shall be inert, corrosion resistant, and fire-retardant with a thickness of 3.66 kg/square meter 12 ounces per square foot. FRP components shall contain an ultraviolet (UV) ray inhibitor as per CTI Std-137, Grade 1 or 3.

2.4.3 Zinc-Coated Steel

Components fabricated of zinc-coated steel shall be not lighter than 16 gauge steel, protected against corrosion by a zinc coating. The zinc coating shall conform to ASTM A 153/A 153M and ASTM A 123/A 123M, as applicable and have an extra heavy coating of not less than 0.76 kg/square meter 2-1/2 ounces per square foot of surface. Galvanized surfaces damaged due to welding shall be coated with zinc rich coating conforming to ASTM D 520, Type 1.

2.4.4 Polyvinyl Chloride (PVC) Formed Sheets

ASTM D 1784, Type I, Grade 1 with a flame spread rating of 25 or less per ASTM E 84.

2.4.5 Stainless Steel Sheets

Type 304.

2.4.6 Concrete

Concrete shall conform to Section 03300A CAST-IN-PLACE STRUCTURAL CONCRETE. Exposed concrete shall be rub-finished for smooth and uniform surfaces free of form marks and defects. Honeycomb concrete shall not be permitted.

2.4.7 Hardware

Bolts shall be cadmium-plated, zinc-coated steel, or Type 304 stainless

steel. Each bolt shall be provided with neoprene and cadmium-plated steel washers under the heads. Nails shall be silicon bronze, commercial bronze, or stainless steel. Hardware shall meet the salt-spray fog test as defined by ASTM B 117.

2.5 COOLING TOWER

****
NOTE: The only type of cooling tower defined in this specification is the induced mechanical draft type. Neither the atmospheric type or the forced mechanical draft type will be used for Army construction projects.

This specification covers 2 types of cooling tower construction; 1) packaged (factory fabricated, factory/field-assembled), 2) field-erected. The structural components of a packaged type tower is typically metal, wood, or FRP materials (or a combination of each). The structural components of a field-erected type tower is either wood or concrete. Field-erected towers are typically selected for their longevity over the packaged type, but are considerably more expensive and should only be used if documented to be economically cost effective. Delete all references to either packaged or field-erected towers if not applicable.

The crossflow cooling tower design will be the design of choice. Counterflow designs are typically only used on large field-erected cooling towers.

When project requirements limit the use of wood construction in cooling towers, all references to wood construction will be removed.
****

2.5.1 Type

Tower shall be the induced mechanical draft type of the [crossflow] [counterflow] design and shall be certified by the Cooling Tower Institue (CTI). Factory fabricated, factory-assembled towers which are shipped to the job site in separate cells or modules shall be provided with all appropriate manufacturer's hardware for assembly in the field. Factory fabricated, field-assembled towers shall be assembled and adjusted at the job site by a factory representative.

2.5.2 Framework, Casing, and Supports

****
NOTE: Packaged type cooling towers are typically constructed to withstand a 1.4 kPa (30 psf) windload.
****

Towers shall be designed and constructed to withstand a wind pressure of not less than [1.4] [_____] kPa [30] [_____] pound-force per square foot (psf) on external surfaces. [A 15 percent increased loading shall be included for ice or snow load.] [Air inlet and discharge terminations shall have flanged or lipped projections for connecting ductwork.]

Framework, structural supports, and equipment supports shall be [zinc-coated steel,] [Type 304 stainless steel,] [air-entrained concrete] [FRP,] [or] [lumber]. Casing (exterior enclosing walls) shall be constructed of [zinc-coated steel] [Type 304 stainless steel] [air-entrained concrete] [FRP] [or] [lumber]. Framework design for wood towers shall conform to requirements of CTI Std-103 for redwood construction and CTI Std-114 for douglas fir construction. Notching structural wood members may be permissible only if the members are increased proportionately in size to provide equivalent strength. Materials provided for framework, casings and equipment supports shall be compatible. Structural supports shall be provided in accordance with the recommendations of the manufacturer of the tower unless otherwise indicated. [Cold-pour concrete joints in vertical walls shall have a continuous water-stop stripping of molded polyvinyl plastic (150 mm 6 inch dumbbell).]

2.5.3 Foundations

****

NOTE: For the design of a tower foundation, indicate the location, the size, the reinforcement requirements, etc. necessary for a cooling tower available from three commonly known manufacturers. For small retrofit type jobs the designer may choose to show the general layout of the foundation and rely on the Contractor to design and construct the foundation based on the cooling tower to be provided. Delete the last two sentences of the paragraph if the foundation is not to be designed by the Contractor.

****

Cooling tower foundations shall meet the requirements of the cooling tower manufacturer and be as indicated. Foundation design shall be based on the load conditions and soil bearing value indicated. Foundation calculations shall be submitted with the equipment drawings.

2.5.4 Stairways and Ladders

Provide stairs, 60-degree ship ladders or straight-rung ladders of standard design, starting at [ground] [roof] level and extending as high as required to gain access to fan decks and water distribution systems. Stairways and ladders shall be hot-dip, zinc-coated steel. Ladders higher than 3.66 meters 12 feet shall have a safety cage.

2.5.5 Handrailings

Steel handrailings shall be not less than 1067 mm 42 inches high around the exterior of each working surface that is 3.66 m 12 feet or more above the ground, roof, or other supporting construction. Railings shall be not smaller than 32 mm 1-1/4 inch zinc-coated steel pipe with standard zinc-coated steel railing.

2.5.6 Access Doors

Each tower shall be provided with access doors at grade level to provide entry to the interior for service maintenance without removal of the fill. Doors shall be provided on each endwall of each cooling tower cell. Frame and brace access doors to prevent damage when opening and closing. Doors

shall be located adjacent to float controls.

2.5.7 Louvers

Air inlets for each cooling tower shall be provided with individually removable louvers arranged to prevent the escape of water. Louvers shall be zinc-coated steel, [Type 304 stainless steel,] [FRP,] or lumber. Materials provided for casings and louvers shall be compatible; one material shall not produce stains upon the other. Louvers constructed of lumber shall be of a thickness to withstand alternate wetting and drying without cracking or splitting. Air intakes shall be provided with 25 mm 1 inch zinc-coated steel mesh.

2.5.8 Fan Deck and Cylinder

Each fan shall be mounted in a fan cylinder (or stack) to elevate the fan discharge air. Total extension height shall not exceed the fan diameter. Each fan cylinder shall be provided with a zinc-coated steel 2.75 mm (12 gauge) 12 gauge wire mesh securely mounted to the top of the cylinder in accordance with manufacturer's recommendations. Fan decks shall be designed to withstand a live load of not less than [1.9] [2.9] kPa [40] [60] psf in addition to the concentrated or distributed loads of equipment mounted on the fan decks. [Fan deck and cylinders shall be constructed of zinc-coated steel, lumber, Type 304 stainless steel, or FRP and be compatible with the entire tower construction.] [Fan deck shall be constructed of precast, reinforced lightweight concrete, in multiple sections, forming a complete, vibration-free base for mounting fan, speed reducer, drive shaft, motor, and fan stacks. Fan cylinders (or stacks) shall be constructed of precast, reinforced lightweight concrete in multiple sections, constrained with bands of zinc-coated steel conforming to ASTM A 123/A 123M, not less than 3 x 75 mm 1/8 x 3 inches, and bolted to form a compressive load on stack perimeter. Fan cylinder shall be secured in place on the fan deck with Class A mortar.]

2.5.9 Fans

****

NOTE: When the density of the ambient air to be handled by the fans differs substantially from the density of the standard air value of 1.2 kg per cubic m (0.075 pound per cubic foot) at 21 degrees C (70 degrees F) and 101 kPa (29.92 inches mercury), the density of the air and/or the elevation above mean sea level will be shown on the drawings.

****

Fans shall be the [centrifugal] [or] [adjustable-pitch propeller] type, constructed of zinc-coated steel, Type 304 stainless steel, aluminum or an aluminum alloy, or FRP. Propeller type shall have a maximum tip speed of 330 m/minute 10,800 fpm. Fan blade assembly shall be both statically and dynamically balanced after assembly of the cooling tower. Fan hub shall be constructed of [zinc-coated steel] [stainless steel] [cast aluminum] with adequate surface protection against corrosion. Complete fan assembly (fan and mounting) shall be designed to give maximum fan efficiency and long life when handling saturated air at high velocities. Each cooling tower fan shall be provided with a ball and pedestal type vibration limit switch which shall stop the corresponding fan motor in the event of sensing excessive fan vibration.

2.5.10 Speed Reducers Gears and Drive Shaft

****
NOTE: Double reduction gear reducer should be considered where low noise requirement is a factor.
****

Speed reducer gears shall be rated in accordance with CTI Std-111. Gear reducers shall be of the [spiral bevel, single reduction] [spiral or helical, double reduction] type. Reducer shall be mounted in accordance with manufacturer's recommendations. Each reducer shall be provided with an oil level cutoff switch interlocked to the fan motor. Each reducer shall be provided with an oil level sight glass, fill, drain, and vent lines located in a readily accessible position. Drive shafts shall be the full floating type with flexible couplings at both ends and have a service factor of 1.0 or greater. Drive shafts shall be of stainless steel, fitted each end with flexible couplings (stainless steel plate type). Each drive shaft shall be provided with a galvanized steel guard, to prevent damage to surrounding equipment in case of shaft failure. Provision shall be made for lubrication of all bearings. Bearings shall be accessible to the extent that each bearing can be lubricated without dismantling fan.

2.5.11 Fan Motors

****
NOTE: Delete the last sentence if inapplicable.
****

Each motor shall be a [single speed] [two speed], totally enclosed, insulation Class B, NEMA Design B, continuous-rated type which conforms to NEMA MG 1. Fan motors shall have [open] [dripproof] [totally enclosed] [explosion proof] enclosures and be located outside the discharge airstream. Motors shall be mounted according to manufacturer's recommendations. [Two-speed motors shall have a single winding with variable torque characteristics.]

2.5.12 Code Water Basin

****
NOTE: Delete the bracketed sentences at the end of the paragraph if a field-erected type tower is not specified.
****

Basin shall be completely watertight and constructed of [zinc-coated steel] [Type 304 stainless steel] [high density, air-entrained concrete] [FRP] [36 mm 1-1/2 inch tongue and groove lumber]. Basin shall be constructed and installed to ensure that air will not be entrained in outlets when operating and no water will overflow on shutdown. Each individual sump shall be provided with an individual outlet. Each outlet shall be provided with a 1/2 inch mesh, zinc-coated steel wire securely mounted to prevent trash from entering the outlet. Each basin shall be provided with overflow and valved drain connections. Each basin shall be provided with a float-controlled, makeup water valve as indicated. The makeup water shall discharge not less than 50 mm 2 inches or two pipe diameters, whichever is greater, above the top of the basin. [Basin floor slab shall be made in a continuous pour. A continuous water-stop stripping of molded polyvinyl plastic (150 mm 6 inch dumbbell) shall be located on the centerline position of the basin wall section/floor slab intersection, and at all

other cold pour joints. Basin wall sections shall be made in a second continuous pour, contain the necessary reinforcing steel as submitted by the manufacturer and approved, and be arranged to interlock with the water-stop seal in the floor slab, forming a completely waterproof basin.]

2.5.13 Electric Basin Heater

Heater shall be the electric immersion type with water-tight junction boxes mounted in the basin with sufficient capacity to maintain the basin water temperature above 4.4 degrees C 40 degrees F at an ambient temperature of [_____] degrees C degrees F. Heater shall be complete with control thermostat, transformer, contactor, and low water level heater protection.

2.5.14 Hot Water Distribution System

****

NOTE: The gravity-flow type distribution system will be the system of choice. Pressurized-flow type systems will typically only be specified for field-erected, counterflow type towers

Piping connecting to a cooling tower will be externally supported, independent of the tower structure and piping.

****

Water distribution shall be the [gravity-flow] [pressurized-flow] type system which distributes waters evenly over the entire fill surface. Each tower cell shall be designed so that a water flow of 140 percent capacity will not cause overflowing or splashing. The distribution system for each cell shall include adjustable flow control valves. The entire distribution system shall be self-draining and nonclogging. Piping shall be either cast iron, ductile iron, threaded-glass-fiber reinforced epoxy pipe, polypropylene, PVC or Schedule 80 black steel.

2.5.14.1 Gravity-Flow System

System shall be provided with open basins which include a splash box or baffles to minimize splashing of incoming hot water and holes that evenly distribute the water over the entire decking area. Holes used in a water basin shall be provided with ceramic or plastic orifice inserts.

2.5.14.2 Pressurized-Flow System

System shall include piping, fittings, branches, and spray nozzles. Spray nozzles shall be stainless steel, bronze, polypropylene, or high-impact plastic. Nozzles shall be cleanable, nonclogging, removable, and spaced for even distribution.

2.5.14.3 Basin Cover

Hot water distribution basins shall be provided with the tower manufacturer's standard removable, [wood] [zinc-coated steel] [stainless steel] [FRP] covers. Covers shall prevent airborne debris from entering the basin.

2.5.15 Drift Eliminators

****

NOTE: For small, packaged type towers, the expected drift loss can be specified as low as 0.02 percent of the circulating water rate. In larger, field-erected type towers, the expected drift loss can be specified as low as 0.005 percent of the circulating water rate.

Delete the last set of bracketed sentences if a field-erected type tower is not specified.

****

Eliminators shall be provided in the tower outlet to limit drift loss to not over [0.02] [0.005] percent of the circulating water rate. Eliminators shall be constructed of not less than 10 mm 3/8 inch lumber or polyvinyl chloride (PVC). [Eliminators shall be of the multi-pass zigzag type, assembled into sections making a strong, stable unit. Eliminators sections shall be supported on PVC or FRP tee sections. Tee sections shall be suspended with 6.35 mm 1/4 inch brass rods connected to stainless steel clips embedded in the bottom side of the roof deck at the time of casting. Stainless steel clips shall be supplied by cooling tower manufacturer for installation by Contractor at time of roof deck pour. Eliminators may be supported by brass or stainless steel suspension rods from the fan deck or supported directly on concrete beams.]

2.5.16 Fill (Heat Transfer Surface)

****

NOTE: Typically, both the splash or film type tower fill will be allowed. Film type fill will not be allowed where there is a highly likely possibility that the circulating water will become contaminated with debris (leaves, etc.). Debris in the circulating water will significantly impact the efficiency of a tower with film type fill because of the close spacing of the film material. Note that hot water distribution basin covers will typically prevent most debris from every getting to the fill material.

The most predominant fill material is PVC formed sheets. PVC formed sheets, zinc-coated steel, or lumber will be the typical choices for fill material. Aluminum and/or stainless steel fill will only be specified where either high inlet water temperatures or fireproof construction are concerns. PVC formed sheets will not be provided when the inlet water temperature exceeds 125 degrees F. Tile file will only be considered on field-erected type towers where economically justified.

Delete the bracketed sentences at the end of the paragraph if tile type fill material is not specified.

****

Tower fill shall be the [splash] [or] [film] type. Fill material shall be free to expand or contract without warping or cracking. No plasticized wood cellulose shall be provided for fill material. Fill shall be removable or otherwise made accessible for cleaning. Space supports shall

be corrosion resistant and shall prevent warping, sagging, misalignment, or vibration of the fill material. Fill material and supports shall be designed to provide for an even mixing of air and water. Fill material shall be constructed of [aluminum] [stainless steel] [tile of multi-cell design, set without mortar] [PVC formed sheets, zinc-coated steel, or lumber] in a pattern, and of sufficient height to meet the performance specifications. [Tile fill shall be vitreous, with a low water absorption that will pass a freeze-thaw test conducted in accordance with ASTM C 67. Tile fill shall have a minimum crushing strength of 13.8 MPa 2,000 psi over the gross area of the tile when the load is applied parallel to the cells as tested in accordance with ASTM C 67. Cast iron tee section lintels supporting the tile fill shall conform to ASTM A 48/A 48M, Class 25, 3.2 mm 1/8 inch additional thickness for corrosion. Lintels shall be designed with a safety factor of 2 minimum.]

2.5.17 Fire Safety

****
NOTE: Locate the tower in accordance with NFPA 214, and determine the extent and type of fire protection required for all size towers using the factors indicated in NFPA 214.
****

Towers shall conform to NFPA 214. Fire hazard rating for plastic impregnated materials shall not exceed 25. Plastics shall not drip or run during combustion. Fire hazard ratings shall be in accordance with ASTM E 84 or NFPA 255.

2.5.18 Noise Control

****
NOTE: Where cooling towers are in the proximity of residential, administrative, medical, or similar inhabited facility, the maximum acceptable noise limits for such applications should be determined in NC level or dBA, and coordinated with local code requirements and the cooling tower manufacturer. Indicate maximum NC levels on the drawings.
****

Sound power level data for the cooling tower shall be based on tests conducted in accordance with ANSI S1.13. Maximum acceptable noise limits for a cooling tower cell shall [be as indicated on the drawings.] [not exceed the maximum permitted decibel levels for the designated octave band as set forth in the following tables. Sound power levels in decibels shall be based on a reference pressure of 0.0002 microbar.

Octave Band (in Hz)	63	125	250	500	1000	2000	4000	8000
Sound Power Level in dB	[_____]	[_____]	[_____]	[_____]	[_____]	[_____]	[_____]	[_____]]

2.6 FABRICATION

****
NOTE: For equipment to be installed outdoors, adequate protection will be specified.

Manufacturers must submit evidence that unit specimen have passed the specified salt spray fog test. A 125 hour test will be specified in a noncorrosive environment and a 500 hour test will be specified in a corrosive environment.

****

Unless otherwise specified, equipment and component items, when fabricated from ferrous metal, shall be factory finished with the manufacturer's standard finish, except that items located outside of buildings shall have weather resistant finishes that will withstand [125] [500] hours exposure to the salt spray test specified in ASTM B 117 using a 5 percent sodium chloride solution. Immediately after completion of the test, the specimen shall show no signs of blistering, wrinkling, cracking, or loss of adhesion and no sign of rust creepage beyond 3 mm 1/8 inch on either side of the scratch mark. Cut edges of galvanized surfaces where hot-dip galvanized sheet steel is used shall be coated with a zinc-rich coating conforming to ASTM D 520, Type I.

2.7 SUPPLEMENTAL COMPONENTS/SERVICES

2.7.1 Condenser Water Piping and Accessories

Condenser water piping and accessories shall be provided and installed in accordance with Section 15181 CHILLED, CHILLED-HOT, AND CONDENSER WATER PIPING SYSTEMS.

2.7.2 Water Treatment

Water treatment shall be provided and installed in accordance with Section 15181 CHILLED, CHILLED-HOT, AND CONDENSER WATER PIPING SYSTEMS.

PART 3 EXECUTION

3.1 INSTALLATION

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NOTE: Designer will determine in the initial stages of design the approximate distances required for maintenance clearances of all new equipment. The maintenance clearances will be used in determining the final layout of the equipment.

****

Work shall be performed in accordance with the manufacturer's published diagrams, recommendations, and equipment warranty requirements. Equipment and piping arrangements shall fit into space allotted and allow adequate acceptable clearances for installation, replacement, entry, servicing, and maintenance. Equipment shall be properly leveled, aligned, and secured in place in accordance with manufacturer's instructions. Field painting is required for surfaces not otherwise specified, and finish painting of items only primed at the factory; paints are specified in Section 09900 PAINTS AND COATINGS.

3.2 CLEANING AND ADJUSTING

Equipment shall be wiped clean, with all traces of oil, dust, dirt, or paint spots removed. System shall be maintained in this clean condition until final acceptance. Bearings shall be properly lubricated with oil or

grease as recommended by the manufacturer. Belts shall be tightened to proper tension.

3.3 PERFORMANCE TESTS

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NOTE: Cooling towers which meet this specificaton are required to be certified by the Cooling Tower Institue (CTI). This certification assures that towers offered for sale by a specific manufacturer will perform thermally in accordance with the manufacturer's published ratings. These certifications are performed each year. As a result, field performance tests as defined in this paragraph are not typically necessary.

Delete this paragraph unless a cooling tower serves an extremely critical application.

****

After a cooling tower has been found acceptable under a visual and dimensional examination, a field performance test shall be performed in accordance with ASME PTC 23 or CTI ATC-105. The [electromagnetic interference suppression test] [and the] [salt spray test] is not required. The cooling tower test shall be performed in the presence of a Government representative. Water and electricity required for the tests will be furnished by the Government. Any material, equipment, instruments, and personnel required for the test shall be provided by the Contractor. The services of a qualified technician shall be provided as required to perform all tests and procedures indicated herein. Field tests shall be coordinated with Section 15990A TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS.

3.4 DEMONSTRATIONS

Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total [_____] hours of normal working time and start after the system is functionally completed but prior to final acceptance tests. The field posted instructions shall cover all of the items contained in the approved Operation and Maintenance Manuals as well as demonstrations of routine maintenance operations.

-- End of Section --