

SECTION 15712
COOLING TOWER, PACKAGED

SPEC WRITER NOTES:

1. DELETE BETWEEN //---// if not applicable to project. Also delete any other item or paragraph not applicable in the section and renumber the paragraphs. Specify packaged cooling towers except in the rare cases where field assembled type has been selected.
2. This specification has links connected to other documents in VA "Technical Information Library (TIL)." These links are to facilitate designers to look into related documents while edited this specification. These links must be deleted before the specification is finalized for a particular project. To delete these links make sure **macros** are installed on your system, and if not do the following:
Click on Tools.
Go to Macro and click on Security.
Check the Medium Security Level.
Close the specification, if open.
Open the specification (again) and follow the prompts on the screen.
Click on Enable Macros when first prompt appears.
Delete the links only if specification is ready to be included in the project.
3. Discuss the use of stainless steel material for casing with the VA prior to its inclusion.
4. Coordinate VA Standard Details with this specification and show the applicable details on H drawings.
5. Typical Piping Connections to Single Cell Cooling Tower, Detail No. [15705-39.DWG.](#)
6. Typical Piping Connections to Multi-cell Cooling Tower, Detail No. [15705-40.DWG.](#)

PART 1 - GENERAL**1.1 DESCRIPTION**

Packaged, // induced draft // forced draft // closed circuit // cooling tower complete with fill, fan, louvers and associated accessories and equipment.

1.2 RELATED WORK

- A. [Section 03300](#), CAST IN PLACE CONCRETE: Requirements for concrete inertia bases.
- //B. Seismic Restraint for Equipment: Section 13081, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.//
- C. [Section 15050](#), BASIC METHODS AND REQUIREMENTS (MECHANICAL): General mechanical requirements and items, which are common to more than one item.
- D. [Section 15200](#), NOISE AND VIBRATION CONTROL: Requirements for vibration isolation.
- E. [Section 15704](#), WATER TREATMENT: Requirements for condenser water treatment.
- F. Section 15705, HVAC PIPING SYSTEM: Requirements for water piping and fittings.
- G. [Section 15840](#), DUCTWORK AND ACCESSORIES: Requirements for sheet metal ductwork.

1.3 QUALITY ASSURANCE

- A. Refer to Article, QUALITY ASSURANCE, in specification [Section 15050](#), BASIC METHODS AND REQUIREMENTS (MECHANICAL).
- B. Design Criteria:

SPEC WRITER NOTE: Normal wind load 1436 Pa (30 psf) equivalent to 177 km/h (110 mph) wind. Specify wind load as required by "Natural Disasters Non-Structural Resistive Design (CD-54)" for natural disaster areas.

1. Design to withstand _____Pa (___ psf) wind load.
2. Free water drift loss shall not be greater than five hundredths of one percent of the water circulated to tower.

SPEC WRITER NOTE: Adjust dB(A) level to suit the site.

3. Sound levels at 15 meters (50 feet) in any direction from the tower shall not exceed _____dB(A). Provide sound attenuators if necessary to meet the noise criteria.

C. Performance Criteria:

1. Manufacturer shall certify that performance of cooling towers will meet contract requirements, stating entering air wet bulb temperature, entering and leaving condenser water temperatures, water flow rates, fan kW (horsepower), and pump head at base of tower. Certification shall be made at the time of submittal.

SPEC WRITER NOTE: CTI certification under Standard 201 applies only to selections with entering water temperature of 51.7 degrees C (125 degrees F) or less, temperature ranges of 2.2 degrees C (4 degrees F) or more, temperature approaches of 2.8 degrees C (5 degrees F) or more, and wet bulb between 15.5 degrees C to 29.5 degrees C (60 degrees F to 85 degrees F).

2. Cooling Tower Institute (CTI) Certified Towers: These towers shall have been tested, rated, and certified in accordance with Cooling Tower Institute (CTI) Standard 201, and shall bear the CTI certification label, and shall be listed in the CTI directory of certified cooling towers.
3. Non-CTI certified Cooling towers: If CTI certification is not available, manufacturer for towers of 700 kW (200 tons) or larger, shall submit curves showing predicted performance as required in ASME PTC-23, or CTI Bulletin ATC-105 for Water Cooling Towers, and CTI Bulletin ATC-105S for Closed Circuit Cooling Towers. These towers shall be tested in the field as specified in Section 3 of this specification.
4. The alignment and balancing of the fans, motors and drive shaft as installed shall operate within the vibration tolerance specified in specification [Section 15200](#), NOISE AND VIBRATION CONTROL.

1.4 SUBMITTALS

- A. Submit in accordance with specification [Section 01340](#), SAMPLES AND SHOP DRAWINGS.

B. Shop Drawings

1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
2. Include rated capacities, pressure drop, fan performance and rating curves, dimensions, weights, mounting details, front view, side view, equipment and device arrangement.
3. Include electrical rating, detail wiring for power, signals and controls.
- //4. Pump characteristic curve for the closed loop cooling tower. //
5. Sound curves and characteristics of sound attenuators if required to meet the noise criteria.

C. Certification:

1. Submit four copies of performance curves, for CTI certified cooling towers, showing compliance with actual conditions specified, to the Resident Engineer two weeks prior to delivery of the equipment.
2. Two weeks prior to final inspection, submit four copies of the following to the Resident Engineer:

SPEC WRITER NOTE: Specify seismic zone factor "Z" value so cooling tower manufacturers can check/design seismic strength of their equipment. Delete the following paragraph if the cooling tower(s) is located outside the seismic zone.

- a. Certification from the manufacturer that the cooling tower(s), accessories, and components will withstand the seismic forces (Z= --) and that the unit will be fully operational after the seismic event at the project site.
- b. Certification by the manufacturer that the cooling towers conform to the requirements of the drawings and specifications.
- c. Certification by the Contractor that the cooling towers have been properly installed, adjusted, and tested.

1.5 APPLICABLE PUBLICATIONS

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

- B. American National Standard Institute (ANSI):
- A10.18-83.....Construction and Demolition Operations -
Temporary Floor and Wall Openings, Flat
Roofs, Stairs, Railings, and Toeboards -
Safety E
- C. American Society of Mechanical Engineers (ASME):
- PTC 23-R97.....Atmospheric Water Cooling Equipment
Requirements (Performance Test Codes)
- D. American Society for Testing Materials (ASTM):
- A385-00.....Standard Practice for Providing High-
Quality Zinc Coatings (Hot-Dip)
- B117-97.....Standard Practice for Salt Spray (Fog)
Testing
- B209-00.....Standard practice for Aluminum and
Aluminum Alloy Sheet and Plate
- E84-Rev A00.....Standard Test methods for Surface Burning
Characteristics of Building Materials
- E. Cooling Tower Institute (CTI):
- ATC-105-00.....Acceptance Test Code for Water-Cooling
Towers (CTI Code Tower Standard
Specifications)
- ATC-105S-96.....Acceptance Test Code for Closed Circuit
Cooling Towers (CTI Code Tower Standard
Specifications)
- 201-96.....Standard for Certification of Water
Cooling Tower Performance (CTI Code Tower
Standard Specifications)
- F. National Electrical Manufacturers Association (NEMA):
- MG1-98.....Motors and Generators (Revision 1-2000)
- 250-97.....Enclosure for Electrical Equipment (1000
Volts Maximum)
- G. National Fire Protection Association (NFPA):
- 70-02.....National Electrical Code

PART 2 - PRODUCTS**2.1 // FORCED DRAFT // INDUCED DRAFT // COOLING TOWER:**

- A. Casing: Heavy gage // Galvanized Steel // Stainless Steel // Fiberglass Reinforced Plastic (FRP). //
- //1. Galvanized Steel: Hot-dip galvanized steel complying with ASTM A653/A653M, and having G235 (Z700) coating. //
- //2. Stainless Steel: ASTM A666, Type 304.//
- //3. Fiberglass Reinforced Plastic: FRP with maximum flame spread rating of five according to ASTM E84. //
4. Fasteners: Zinc or cadmium coated bolts or tapping screws for assembly. Use stainless steel washers with neoprene backing where required for preventing leaks.
5. Joints: Sealed watertight.
6. Welded connections continuous and watertight.
- B. Framing:
1. Rolled structural steel shapes, hot-dip galvanized after fabrication or structural shapes cold formed from galvanized steel sheets or plates, complying with ASTM A653/A653M, and having G235 (Z700) coating.
- C. Louvers:
1. Minimum splash out type. Material for the louvers shall be similar to the casing or may be PVC if formed integral with the fill material.
- //2. 25 mm (1 inch) inlet screen, hot dipped // galvanized steel or copper // stainless steel. // Attach the screen securely to air intakes.
- D. Fill:
1. // PVC // FRP // resistant to rot, decay and biological attack; with a maximum flame spread rating of five per ASTM E84 and fabricated, formed and installed by manufacturer to ensure that water breaks up into droplets.
- E. Drift Eliminators: Same as fill material. Eliminators shall ensure a maximum drift rate of 0.002 percent of recirculated water.

SPEC WRITER NOTE: Eliminate the combustible materials when cooling tower is located 12 meters (40 feet) or closer to hazards such as

chimneys, and incinerators, or when roof mounted.

- F. Hot Water Distribution System: Open basin, flume and troughs, or a pipe system with nozzles spaced for even distribution of water over fill material. Provide access door. System shall be self-draining and non-clogging. Spray nozzles, if used, shall be cleanable stainless steel, bronze or high impact plastic, non-clog, removable type properly spaced for even distribution. Provide cover for entire nozzle area or flume/trough area. // Provide manufacturer's standard pre-strainer assembly and butterfly or globe valve, for cross flow tower, to balance the water flow to each basin. //
- G. Collecting Basin: Material same as the unit casing or concrete in accordance with manufacturer's standard details. Outlet pump may also be of heavy glass-reinforced polyester (GRP) for depressed side outlet type. Provide a bronze make-up water float valve, overflow, drain not less than 50-mm (2 inches) suction connections, and outlet sump of size and depth to prevent cavitation and air entrainment in pump. Provide the following accessories:
1. // Manufacturer's standard bronze make up water float valve with an adjustable linkage // Electric float switch and a solenoid operated make-up valve. //
 2. Removable basin strainer, constructed of 304 stainless steel, shall have openings smaller than nozzle orifices.
 3. Make-up water, overflow and drain connections.
 - //4. Equalizer connection (multiple cooling tower systems).//
 - //5. Flume plate between adjacent cells (multi-cell units only).//
- H. Fans: Centrifugal or propeller type constructed of hot-dip galvanized steel, cast aluminum or aluminum alloy, glass fiber reinforced polyester or glass reinforced epoxy, statically and dynamically balanced at factory for quiet, and efficient operation. Forced-draft towers shall be centrifugal type only. Fans for induced-draft towers of 350 kW (100 tons) and less, and for forced-draft towers shall be belt driven.

1. For induced draft towers larger than 350 kW (100 tons), fan shall be driven through a gear reducer, or driven by a special V belt.
2. Gear reducer drive: Specially designed for cooling tower operation, with dynamically balanced drive shaft assembly or shock absorbent flexible coupling requiring no lubrication, cast iron case with readily accessible oil drum and fill, and self-contained oil reservoir sealed against water entrance.
3. Fan shall be driven by a one-piece, multi-groove, neoprene/polyester belt, where this is the manufacturer's standard.
4. The alignment and balancing of the fans, motors and drive shaft as installed shall operate within the vibration tolerance specified in specification [Section 15200](#), NOISE AND VIBRATION CONTROL.

SPEC WRITER NOTE: Coordinate motor and starter requirements with ELECTRICAL.

5. Motors and Motor Controllers: Provide variable speed motors and controllers, if shown on drawings for cooling tower fans. See specification [Section 15050](#), BASIC METHODS AND REQUIREMENTS (MECHANICAL).
6. In addition to the requirements of Section, BASIC METHODS AND REQUIREMENTS (MECHANICAL). The following shall apply:
 - a. Motors: Totally enclosed, epoxy encapsulated or totally enclosed fan cooled (TEFC) conforming to NEMA 250.
 - b. Lubrication fittings shall be readily accessible outside the wet air stream. Provide access doors for inspection and cleaning.
 - c. Fans over 1500 mm (60 inches) in diameter include a vibration cutout switch located in a protected position to effectively monitor fan vibration. Vibration switch shall be solid-state with adjustable time delay in NEMA 250, Type 4 enclosure. It shall stop fan motor under excessive fan vibration.

SPEC WRITER NOTE: Designer shall show handrails, ladders, and

platforms required for maintenance of cooling towers on drawings. Discuss these items with the VA medical center.

- I. Safety: Provide fan guards, ladders, handrails and platform in conformance with the ANSI A10.18 as follows:
1. Fan Guard: Removable fan discharge with a rigid framed screen guard, installed over the fan cylinder.
 2. Ladders: Vertical hot-dip galvanized steel or aluminum ladder for each tower located outdoors. Ladders higher than 3.6 meters (12 feet) shall have safety cage. Ladders shall extend to within 300 mm (one foot) of the grade or the roof deck surface.
 3. Hand Railing: Steel or aluminum hand railings not less than 1070 mm (42 inches) high around perimeter of each fan-deck, or working surface 3.6 meters (12 feet) or more above ground, roof or other supporting construction. Handrails shall meet OSHA Standards.
 4. Platform: Galvanized steel with a bar grating floor.

SPEC WRITER NOTE: Delete paragraph J and K when winter operation is not required.

- J. Electric Basin Heater: Provide electric immersion heater with water-tight junction boxes mounted in the basin with sufficient capacity to maintain plus 4 degrees C (40 degrees F) water in the basin at _____degrees C (____degrees F) ambient. Heater shall be complete with control thermostat, control circuit transformer, contactor, and low water level heater protection.

SPEC WRITER NOTE: Specify electric heat tracing if cooling tower is specified independent of HVAC Piping Systems.

- K. Electric Heat Tracing: Provide in specification [Section 15705](#), HVAC PIPING SYSTEMS.

SPEC WRITER NOTE: Specify discharge hood, if necessary, to increase leaving air velocity to avoid recirculation.

- //L. Discharge Hood: // Hot-dip galvanized steel, same as the casing // stainless steel // with access door. //

SPEC WRITER NOTE: Specify sheet metal ducts, if cooling tower is to be installed indoors.

//M. Sheet Metal Ducts: Provide in specification [Section 15840](#),
DUCTWORK AND ACCESSORIES.//

2.2 LIQUID COOLERS

- A. Casing: Heavy gage // Galvanized Steel // Stainless Steel // Fiberglass Reinforced Plastic (FRP). //
- //1. Galvanized Steel: Hot-dip galvanized steel complying with ASTM A653/A653M, and having G235 (Z700) coating. //
- //2. Stainless Steel: ASTM A666, Type 304. //
- //3. Fiberglass Reinforced Plastic: FRP with maximum flame spread rating of five according to ASTM E84. //
4. Fasteners: Zinc or cadmium coated bolts or tapping screws for assembly. Use stainless steel washers with neoprene backing where required for preventing leaks.
5. Joints: Sealed watertight.
6. Welded connections continuous and watertight.
- B. Framing: Rolled structural steel shapes hot-dip galvanized after fabrication, or structural shapes cold formed from galvanized steel plates or sheets, complying with ASTM A653/A653M, and having G235 (Z700) coating.
- C. Louvers:
1. Minimum splash out type. Louver materials shall be similar to the casings or may be polyvinyl chloride (PVC) if formed integral with the fill material.
2. 12.7 mm (1/2 inch) // hot-dip galvanized-steel or copper // stainless steel // Attach screens securely to air intakes.
- D. Drift Eliminators: Effectively trap water droplets entrained in discharge air stream and limit drift loss to less than 0.001 percent of the total water circulated. Sections shall be assembled into easily removable racks of the same material as the casing. Eliminators can be PVC neoprene honeycomb type.

SPEC WRITER NOTE: Specify discharge hood, if necessary, to increase leaving air velocity to avoid recirculation.

//E. Discharge Hood: // Hot-dip galvanized steel, same as the casing // stainless steel // with access door. //

SPEC WRITER NOTE: Specify sheet metal ducts, if liquid cooler is to be installed indoor.

//F. Sheet Metal Ducts: Provide in specification [Section 15840](#), DUCTWORK AND ACCESSORIES. //

- G. Cold Water Basin: Heavy gauge zinc-coated or hot-dip galvanized steel, same as the casing // stainless steel //. Provide bronze make-up water float valve, overflow, drain not less than 50 mm (2-inches), and a strainer assembly with built-in vortex baffling to prevent cavitation and air entrainment in the water basin circulating pump.
- H. Cooling Coil Sections: Prime surface steel or annealed copper tubes, tested at 2410 kPa (350 psig) air pressure under water. Slope tubes to permit free drainage of fluid. Design coil and casing housing section for easy removal of coil. Coil section shall be of the serpentine design type with coil tubing welded into service pipe connection header.
- I. Water Distribution System: Open gravity type or spray nozzle type and specifically designed that each trough or spray nozzle extends the entire length of the cooling coil section to complete wetting of the cooling coil at all times. Construct water distribution system of hot-dip galvanized steel or Schedule 40 PVC.
- J. Tower Water Distribution Circulating Pump: Close coupled bronze fitted centrifugal circulating pump with mechanical seal. Pump shall be completely piped to suction strainer and water distribution system, mounted to drain completely when tower basin is drained. Include a bleed line with valve between pump discharge and overflow pipe. For pump motor, see specification [Section 15050](#), BASIC METHODS AND REQUIREMENTS (MECHANICAL).
- K. Fans: Centrifugal or propeller type constructed of hot-dip galvanized steel, cast aluminum or aluminum alloy, glass reinforced polyester or glass reinforced epoxy. Dynamically balance centrifugal type fans at factory for quiet, efficient operation. Statically balance propeller type fans at the factory.

Fans shall be belt driven by single speed motor. Belt drives shall be "V" type as specified in specification [Section 15050](#), BASIC METHODS AND REQUIREMENTS (MECHANICAL). The fan drive and moving parts shall be completely enclosed by hot-dip galvanized screens and panels.

1. The alignment and balancing of the fans, motors and drive shaft as installed shall operate within the vibration limits specified in specification [Section 15200](#), NOISE AND VIBRATION CONTROL.
2. In addition to the requirements of specification [Section 15050](#), BASIC METHODS AND REQUIREMENTS (MECHANICAL), the following shall apply:
 - a. Motors: Totally enclosed or epoxy encapsulated NEMA 250. Protect fan, bearings, and appurtenances from damage by weather, corrosion, water spray and grit.
 - b. Lubrication fittings shall be readily accessible outside the wet air stream. Provide access doors for inspection and cleaning.

SPEC WRITER NOTE: Delete paragraph L and M when winter operation is not required.

- L. Electric Basin Heater: Furnish electric immersion heater with watertight junction boxes mounted in the basin with sufficient capacity to maintain plus 4 degrees C (40 degrees F) water in the basin at ___degrees C (___degrees F) ambient.

SPEC WRITER NOTE: Specify electric heat tracing if cooling tower is specified independent of HVAC Piping Systems.

- M. Electric Heat Tracing: Refer to specification [Section 15705](#), HVAC PIPING SYSTEMS.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install cooling tower according to equipment manufacturer's written instruction.
- B. Install cooling towers plumb, level and anchored on structure provided. Coordinate steel structure with cooling tower mounting

requirements. If installed on concrete base, refer to Division 3 of specification for concrete materials and installation requirements.

- C. Install vibration controls according to manufacturer's recommendations.
- D. Maintain recommended clearances for service and maintenance.
- E. Piping:
 - 1. Install piping, including flanges or union adjacent to cooling towers to allow for service and maintenance.
 - 2. Install flexible pipe connectors at connections to cooling towers mounted on vibration isolators.
 - 3. Install shutoff/balancing valves at cooling tower inlet connections.
 - 4. Connect overflow drain and blow down lines to sanitary sewage system.
 - //5. Connect sheet metal ducts to inlet and outlet of liquid coolers if installed indoor. Refer to specification [Section 15840](#), DUCTWORK AND ACCESSORIES, for compliance with material and installation requirements. //
- //F. Seismic Restraints: Provide in accordance with Section 13081, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.//
- G. Electrical Wiring: Install electrical devices, components and accessories furnished loose by manufacturer, including remote flow switches and variable frequency drives.

3.2 FIELD QUALITY CONTROL

- A. Provide the services of an independent testing and inspection agency to perform the field tests and inspections of non-CTI certified cooling towers, 700 kW (200 tons) and larger, according to // ASME PTC-23 "Performance Test Code on Cooling Tower Equipment" // Cooling Tower Institute ATC-105 for Cooling Towers // Cooling Tower Institute ATC-105C for Liquid Coolers.// Submit qualification of the independent testing agency to the Resident Engineer two weeks prior to the inspection for approval.
- B. If the cooling tower does not meet the specified performance, the Contractor shall make the tower corrections necessary to bring the tower into compliance with the specified performance including

replacing the tower if necessary. Additional tests will be required until the tower meets the specified performance. Costs for the tower corrections or replacement, and tests shall be borne by the Contractor. However, the VA will pay for the initial test, when requested, if the cooling tower of less than 200 tons meets the specified performance.

3.3 STARTUP AND TESTING

- A. Provide the services of a factory-authorized and qualified representative to perform start up service.
- B. Inspect field-assembled components and equipment installation, including piping and electrical connections.
- C. Obtain and review performance curves and tables.
- D. Perform startup checks, according to manufacturer's written instructions, and as noted below:
 - 1. Check clearances for airflow and tower servicing.
 - 2. Check for vibration isolation and structural support.
 - 3. Verify fan rotation for correct direction. Correct rotation if needed.
 - 4. Adjust belts to proper alignment and tension.
 - 5. Lubricate rotating parts.
 - 6. Operate equipment controls and safeties.
 - 7. Verify that tower discharge is high enough and it does not recirculate into air intake. Recommend corrective action.
- E. Adjust water level for proper operating level and balance condenser water flow to each tower inlet.
- F. Check water treatment water system, including blow down for proper operation of the tower.
- G. Start cooling tower, including condenser water pumps and verify the tower operation.
- H. Prepare and submit a written report of startup and inspection service to the Resident Engineer.

3.4 TRAINING:

- A. Furnish the services of a competent, factory-trained engineer or technician for a 2-hour period for instructing VA personnel in operation and maintenance of the equipment, including review of the operation and maintenance manual, on a date requested by the

Resident Engineer. Coordinate this training with that of the
chiller, if furnished together.

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