SECTION 236500

COOLING TOWERS

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**NOTE TO SPECIFIER**

*Use this Specification Section for Mail Processing Facilities.*

***This is a Type 1 Specification with completely editable text; therefore, any portion of the text can be modified by the A/E preparing the Solicitation Package to suit the project.***

*For Design/Build projects, do not delete the Notes to Specifier in this Section so that they may be available to Design/Build entity when preparing the Construction Documents.*

*For the Design/Build entity, this specification is intended as a guide for the Architect/Engineer preparing the Construction Documents.*

*The MPF specifications may also be used for Design/Bid/Build projects. In either case, it is the responsibility of the design professional to edit the Specifications Sections as appropriate for the project.*

*Text shown in brackets must be modified as needed for project specific requirements.* *See the “Using the USPS Guide Specifications” document in Folder C for more information.*

*The last date that USPS revised this standard specification section occurs in two places, at the end of this section and in the Table of Contents. If the date in this section matches the date in the Table of Contents, then you are using the latest version. Do not delete or revise the “last revised” date at the end of the section during the development of the Project Manual.*

*The footer in this section should be edited to replace the text, “USPS MPF SPECIFICATION” with the project name, and the blank date in the center should be replaced with the submission date, for interim design reviews, or the issue date of the completed Project Manual.*

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1. GENERAL
   1. SUMMARY
      1. Section Includes:
         1. Closed-circuit, forced-draft, counterflow cooling towers.
         2. Open-circuit, induced-draft, crossflow cooling towers.
         3. Open-circuit, induced-draft, counterflow cooling towers.
   2. SUBMITTALS
      1. Product Data: For each type of product indicated. Include rated capacities, pressure drop, fan performance data, rating curves with selected points indicated, furnished specialties, and accessories.
      2. Shop Drawings: Complete set of manufacturer's prints of cooling tower assemblies, control panels, sections and elevations, and unit isolation.
      3. Startup service reports.
      4. Operation and maintenance data.
      5. Warranty.
   3. QUALITY ASSURANCE
      1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
      2. ASHRAE/IESNA 90.1-2004 Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6 - "Heating, Ventilating, and Air-Conditioning."
      3. Retain first paragraph below if heat-exchanger coil of closed-circuit cooling towers requires ASME Boiler and Pressure Vessel Code construction.
      4. ASME Compliance: Fabricate and label heat-exchanger coils to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
   4. WARRANTY
      1. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace the following components of cooling towers that fail in materials or workmanship within specified warranty period:
         1. Fan assembly including fan, drive, and motor.
         2. Warranty Period: Five years from date of Substantial Completion.
2. PRODUCTS

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**NOTE TO SPECIFIER**

Verify manufacturer information, Product numbers, and availability at time of Project Manual preparation for Project. Preference is to utilize induced-draft crossflow towers; however, additional tower types have been included below which may be required based upon available space where towers are located. Specifier shall delete products not to be used or considered.

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* 1. CLOSED-CIRCUIT, FORCED-DRAFT, COUNTERFLOW COOLING TOWERS
     1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
        1. Baltimore Aircoil Company; Models VFL and VF1.
        2. Delta Cooling Towers, Inc.; Model Pioneer.
        3. Evapco Inc.; Models LSWA and LRW.
        4. SPX Cooling Technologies.

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**NOTE TO SPECIFIER**

Retain first paragraph below for projects in seismic areas.

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* + 1. Fabricate cooling tower mounting base with reinforcement strong enough to resist cooling tower movement during a seismic event when cooling tower is anchored to field support structure.
    2. Casing:
       1. Casing Material: [FRP with UV inhibitors] [Polymer-coated galvanized steel] [Stainless steel].

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**NOTE TO SPECIFIER**

Retain first subparagraph below and delete option in subparagraph heading above if frame material is different than casing.

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* + - 1. Frame Material: Stainless steel.
      2. Fasteners: Stainless steel.
      3. Joints and Seams: Sealed watertight.
      4. Welded Connections: Continuous and watertight.
    1. Collection Basin:
       1. Material: Stainless steel.
       2. Strainer: Removable stainless-steel strainer with openings smaller than nozzle orifices.
       3. Overflow and drain connections.
       4. Makeup water connection.
    2. Mechanically Operated, Collection Basin Water-Level Control: Manufacturer's standard adjustable, mechanical float assembly and valve.
    3. Electric Basin Heater:

Stainless-Steel Electric Immersion Heaters: Installed in a threaded coupling on the side of the collection basin.

Heater Control Panel: Mounted on the side of each cooling tower cell.

Enclosure: NEMA 250, Type 4X.

Magnetic contactors controlled by a temperature sensor/controller to maintain collection basin water-temperature set point. Water-level probe shall monitor cooling tower water level and de-energize the heater when the water reaches low-level set point.

Control-circuit transformer with primary and secondary side fuses.

Terminal blocks with numbered and color-coded wiring to match wiring diagram.

Single-point, field-power connection to a fused disconnect switch and heater branch circuiting complying with NFPA 70.

Factory Wiring Method: Metal raceway for factory-installed wiring outside of enclosures, except make connections to each electric basin heater with liquidtight conduit.

* + 1. Water Distribution Piping: Main header and lateral branch piping designed for even distribution over fill throughout the flow range without the need for balancing valves and for connecting individual, removable, nonclogging spray nozzles.

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**NOTE TO SPECIFIER**

In first subparagraph below, PVC is manufacturer's most common standard offering. Other requirements may require use of other materials.

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* + - 1. Pipe Material: PVC.
      2. Spray Nozzle Material: [Plastic] [Polypropylene] [PVC].
      3. Piping Supports: Corrosion-resistant hangers and supports designed to resist movement during operation and shipment.
    1. Spray Pump: Close-coupled, end-suction, single-stage, bronze-fitted centrifugal pump; with suction strainer and flow balancing valve, and mechanical seal suitable for outdoor service.
       1. General Requirements for Spray Pump Motor: Comply with NEMA designation and temperature-rating requirements specified in Division 23 Section "Common Motor Requirements for HVAC Equipment" and not indicated below.
       2. Motor Enclosure: Totally enclosed fan cooled (TEFC)
       3. Energy Efficiency: NEMA Premium Efficient.
       4. Service Factor: 1.15.
    2. Heat-Exchanger Coils:
       1. Tube and Tube Sheet Materials: [Copper tube with stainless-steel sheet] [Stainless-steel tube and sheet].
       2. ASME Compliance: Designed, manufactured, and tested according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, and bearing ASME "U" stamp; and sloped for complete drainage of fluid by gravity.
       3. Field Piping Connections: Vent, supply, and return[ suitable for mating to ASME B16.5, Class 150 flange].
    3. Centrifugal Fan: Double-width, double-inlet, forward-curved blades, and statically and dynamically balanced at the factory after assembly.
       1. Number of Fans: Each cooling tower cell shall have a single fan or multiple fans connected to a common shaft.
       2. Fan Wheel and Housing Materials: Galvanized steel.
       3. Fan Shaft: Steel, coated to resist corrosion.
       4. Protective Enclosure: Removable, galvanized-steel, wire-mesh screens complying with OSHA regulations.
       5. Fan Shaft Bearings: Self-aligning, grease-lubricated ball or roller bearings with moisture-proof seals and premium, moisture-resistant grease suitable for temperatures between minus 20 and plus 300 deg F. Bearings designed for an L-10 life of 50,000 hours.
       6. Bearings Grease Fittings: Extended lubrication lines to an easily accessible location.
    4. Belt Drive:
       1. Belt-Drive Service Factor: 1.5 based on motor nameplate horsepower.
       2. Sheaves: Fan and motor shafts shall have taper-lock sheaves fabricated from corrosion-resistant materials.
       3. Belt: One-piece, multigrooved, solid-back belt.
       4. Belt Material: Oil resistant, nonstatic conducting, and constructed of neoprene polyester cord.
       5. Belt-Drive Guard: Comply with OSHA regulations.

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**NOTE TO SPECIFIER**

Retain subparagraph below if Project requires functionality of a single fan with two motors. Feature is proprietary.

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* + 1. Two-Motor, Single-Fan Drive:
       1. Two single-speed motors per fan, one sized for full speed and load, and the other sized for [67] percent of full-load speed.
       2. Belt Drives: Each motor shall have belt drive complying with requirements for belt drives and configured for operation when other motor fails.
       3. Motor controller and wiring same as two-speed, two-winding motor.
    2. Fan Motor:
       1. General Requirements for Fan Motors: Comply with NEMA designation and temperature-rating requirements specified in Division 23 Section "Common Motor Requirements for HVAC Equipment" and not indicated below.
       2. Motor Enclosure: Totally enclosed air over (TEAO) or Totally enclosed fan cooled (TEFC)] with epoxy or polyurethane finish.
       3. Energy Efficiency: NEMA Premium Efficient.
       4. Service Factor: 1.15.
       5. Insulation: Class F.
       6. Variable-Speed Motors: Inverter-duty rated per NEMA MG-1, Section IV, "Performance Standard Applying to All Machines," Part 31, "Definite-Purpose, Inverter-Fed, Polyphase Motors."
    3. Controls: Comply with requirements in Division 23 Section "Instrumentation and Control for HVAC."
    4. Personnel Access Components:
       1. Doors: Large enough for personnel to access cooling tower internal components from cooling tower end walls.
       2. External Ladders with Safety Cages: Aluminum, galvanized- or stainless-steel, fixed ladders with ladder extensions to access external platforms and top of cooling tower from adjacent grade without the need for portable ladders. Comply with 29 CFR 1910.27.
       3. External Platforms with Handrails: Aluminum, FRP, or galvanized-steel bar grating at cooling tower access doors when cooling towers are elevated and not accessible from grade.
       4. Handrail: Aluminum, galvanized steel, or stainless steel complete with kneerail and toeboard at platforms and around top of cooling tower. Comply with 29 CFR 1910.23.
       5. Internal Platforms: Aluminum, FRP, or galvanized-steel bar grating.
       6. Spanning the collection basin from one end of cooling tower to the other and positioned to form a path between the access doors. Platform shall be elevated so that all parts are above the high water level of the collection basin.
  1. OPEN-CIRCUIT, INDUCED-DRAFT, CROSSFLOW COOLING TOWERS
     1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
        1. Amcot Cooling Tower Corp.; Models LRC-H, LRC-LNS Series.
        2. Baltimore Aircoil Company; Series 1500 and 3000.
        3. Marley Cooling Technologies, an SPX Corporation; Models Aquatower, AV series, NC Class, Primus.
     2. Fabricate cooling tower mounting base with reinforcement strong enough to resist cooling tower movement during a seismic event when cooling tower is anchored to field support structure.
     3. Cooling tower designed to resist wind load of 30 lbf/sq. ft.
     4. Casing and Frame:
        1. Casing and Frame Material: Stainless steel.
        2. Frame Material: Stainless steel.
        3. Fasteners: Stainless steel.
        4. Joints and Seams: Sealed watertight.
        5. Welded Connections: Continuous and watertight.
     5. Collection Basin:
        1. Material: Stainless steel.
        2. Removable stainless-steel strainer with openings smaller than nozzle orifices.
        3. Overflow and drain connections.
        4. Makeup water connection.
        5. Outlet Connection: ASME B16.5, Class 150 flange.

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**NOTE TO SPECIFIER**

If project has a multiple-cell cooling tower or multiple cooling towers, retain the subparagraph below.

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* + - 1. Equalizer connection for field-installed equalizer piping.
    1. Mechanically Operated, Collection Basin Water-Level Control: Manufacturer's standard adjustable, mechanical float assembly and valve.
    2. Electric Basin Heater (where required):
       1. Stainless-Steel Electric Immersion Heaters: Installed in a threaded coupling on the side of the collection basin.
       2. Heater Control Panel: Mounted on the side of each cooling tower cell.
       3. Enclosure: NEMA 250, Type 4X.
       4. Magnetic contactors controlled by a temperature sensor/controller to maintain collection basin water-temperature set point. Water-level probe shall monitor cooling tower water level and de-energize the heater when the water reaches low-level set point.
       5. Control-circuit transformer with primary and secondary side fuses.
       6. Terminal blocks with numbered and color-coded wiring to match wiring diagram.
       7. Single-point, field-power connection to a fused disconnect switch and heater branch circuiting complying with NFPA 70.
       8. Factory Wiring Method: Metal raceway for factory-installed wiring outside of enclosures, except make connections to each electric basin heater with liquid tight conduit.
    3. Gravity Water Distribution Basin: Nonpressurized design with head of water level in basin adequate to overcome spray nozzle losses and designed to evenly distribute water over fill throughout the flow range indicated.
       1. Material: Stainless steel.
       2. Removable Panels: Same material as basin to completely cover top of basin. Secure panels to basin with removable stainless-steel hardware.
       3. Valves: Manufacturer's standard valve installed at each inlet connection and arranged to balance or shut off flow to each gravity distribution basin.
    4. Fill:
       1. Manufacturers standard fill.
    5. Drift Eliminator:
       1. Manufacturers standard drift eliminator.
    6. Air-Intake Louvers:
       1. Material: FRP or PVC.
       2. UV Treatment: Inhibitors to protect against damage caused by UV radiation.
       3. Louver Blades: Arranged to uniformly direct air into cooling tower, to minimize air resistance, and to prevent water from splashing out of tower during all modes of operation including operation with fans off.
    7. Axial Fan: Balanced at the factory after assembly.
       1. Blade Material: Aluminum.
       2. Hub Material: Aluminum.
       3. Protective Enclosure: Removable, galvanized-steel, wire-mesh screens complying with OSHA regulations.
       4. Bearings Grease Fittings: Extended lubrication lines to an easily accessible location.

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**NOTE TO SPECIFIER**

Retain paragraph below if belt drive is used.

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* + 1. Belt Drive:
       1. Sheaves: Fan and motor shafts shall have taper-lock sheaves fabricated from corrosion-resistant materials.
       2. Belt Material: Oil resistant, nonstatic conducting, and constructed of neoprene polyester cord.
       3. Belt-Drive Guard: Comply with OSHA regulations.

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**NOTE TO SPECIFIER**

Retain paragraph below if gear drive is used.

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* + 1. Gear Drive: Right angle, reduced speed, and designed for cooling tower applications according to CTI STD 111. Motor and gear drive shall be aligned before shipment.
       1. Housing: Cast iron, with epoxy or polyurethane finish, beveled high-strength steel gears continuously bathed in oil, and with lubrication to other internal parts at all operating speeds.
       2. Mounting: Directly mounted to fan hub and connected to motor so motor shaft is in horizontal position.
       3. Operation: Able to operate both forward and in reverse.
       4. Drive Shaft Material: Stainless steel, and fitted with flexible couplings on both ends. Provide exposed shaft and couplings with guards according to OSHA regulations.
       5. Extend oil fill, drain, and vent to outside of cooling tower casing using galvanized-steel piping. Provide installation with oil-level sight glass.
    2. Fan Motor:

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**NOTE TO SPECIFIER**

Edit first paragraph below based upon requirements of project.

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* + - 1. Motor Enclosure: Totally enclosed air over (TEAO) or Totally enclosed fan cooled (TEFC).
      2. Energy Efficiency: NEMA Premium Efficient.
      3. Insulation: Class F.
      4. Variable-Speed Motors: Inverter-duty rated per NEMA MG-1, Section IV, "Performance Standard Applying to All Machines," Part 31, "Definite-Purpose, Inverter-Fed, Polyphase Motors."

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**NOTE TO SPECIFIER**

Retain first subparagraph below if Project requires specific motor location.

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* + - 1. Motor Location: Mounted outside of cooling tower casing and cooling tower discharge airstream.

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**NOTE TO SPECIFIER**

Retain subparagraph below for belt-drive units.

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* + - 1. Motor Base: Adjustable, or other suitable provision for adjusting belt tension.
    1. Controls: Comply with requirements in Division 23 Section "HVAC Instrumentation and Controls."
    2. Personnel Access Components:

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**NOTE TO SPECIFIER**

Retain applicable subparagraphs, based on Project conditions, to require these components.

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* + - 1. Doors: Large enough for personnel to access cooling tower internal components from both cooling tower end walls. Doors shall be operable from both sides of the door.
      2. External Ladders with Safety Cages: Aluminum, galvanized- or stainless-steel, fixed ladders with ladder extensions to access external platforms and top of cooling tower from adjacent grade without the need for portable ladders. Comply with 29 CFR 1910.27.
      3. External Platforms with Handrails: Aluminum, FRP, or galvanized-steel bar grating at cooling tower access doors when cooling towers are elevated and not accessible from grade.
      4. Handrail: Aluminum, galvanized steel, or stainless steel complete with kneerail and toeboard, around top of cooling tower to safeguard personnel while accessing components located on top of cooling tower. Comply with 29 CFR 1910.23.
      5. Internal Platforms: Aluminum, FRP, or galvanized-steel bar grating.
         1. Spanning the collection basin from one end of cooling tower to the other and positioned to form a path between the access doors. Platform shall be elevated so that all parts are above the high water level of the collection basin.
         2. Elevated internal platforms with handrails accessible from fixed vertical ladders to access the fan drive assembly when out of reach from collection basin platform.
  1. OPEN-CIRCUIT, INDUCED-DRAFT, CounterFLOW COOLING TOWERS
     1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
        1. Amcot Cooling Tower Corp.; Model ST.
        2. Delta Cooling Towers, Inc.; Model Paragon, Premier, TM Series.
        3. Evapco Inc.; Models AT, ICT, REP, UBT, and USS.
        4. Protec Cooling Towers, Inc.; Model PTC.
        5. Recold; Model MT.
        6. Thermal Care, Inc., a division of MFRI, Inc.; Models FC and FT.
     2. Fabricate cooling tower mounting base with reinforcement strong enough to resist cooling tower movement during a seismic event when cooling tower is anchored to field support structure.
     3. Cooling tower designed to resist wind load of 30 lbf/sq. ft. (1.44 kPa).
     4. Casing and Frame:
        1. Casing and Frame Material: Stainless steel.
        2. Frame Material: Stainless steel.
        3. Fasteners: Stainless steel.
        4. Joints and Seams: Sealed watertight.
        5. Welded Connections: Continuous and watertight.
     5. Collection Basin:
        1. Material: Stainless steel.
        2. Removable stainless-steel strainer with openings smaller than nozzle orifices.
        3. Overflow and drain connections.
        4. Makeup water connection.
        5. Outlet Connection: ASME B16.5, Class 150 flange.

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**NOTE TO SPECIFIER**

If project has a multiple-cell cooling tower or multiple cooling towers, retain the subparagraph below.

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* + - 1. Equalizer connection for field-installed equalizer piping.
    1. Mechanically Operated, Collection Basin Water-Level Control: Manufacturer's standard adjustable, mechanical float assembly and valve.
    2. Electric Basin Heater (where required):
       1. Stainless-Steel Electric Immersion Heaters: Installed in a threaded coupling on the side of the collection basin.
       2. Heater Control Panel: Mounted on the side of each cooling tower cell.
       3. Enclosure: NEMA 250, Type 4X.
       4. Magnetic contactors controlled by a temperature sensor/controller to maintain collection basin water-temperature set point. Water-level probe shall monitor cooling tower water level and de-energize the heater when the water reaches low-level set point.
       5. Control-circuit transformer with primary and secondary side fuses.
       6. Terminal blocks with numbered and color-coded wiring to match wiring diagram.
       7. Single-point, field-power connection to a fused disconnect switch and heater branch circuiting complying with NFPA 70.
       8. Factory Wiring Method: Metal raceway for factory-installed wiring outside of enclosures, except make connections to each electric basin heater with liquid tight conduit.
    3. Pressurized Water Distribution Piping: Main header and lateral branch piping designed for even distribution over heat-exchanger coil or fill throughout the flow range without the need for balancing valves and for connecting individual, removable, nonclogging spray nozzles.
       1. Pipe Material: Fiberglass or PVC.
       2. Spray Nozzle Material: [Plastic] [Polypropylene] [PVC].
       3. Piping Supports: Corrosion-resistant hangers and supports to resist movement during operation and shipment.
    4. Fill:
       1. Manufacturers standard fill.
    5. Drift Eliminator:
       1. Manufacturers standard drift eliminator.
    6. Air-Intake Louvers:
       1. Material: FRP or PVC.
       2. UV Treatment: Inhibitors to protect against damage caused by UV radiation.
       3. Louver Blades: Arranged to uniformly direct air into cooling tower, to minimize air resistance, and to prevent water from splashing out of tower during all modes of operation including operation with fans off.
    7. Axial Fan: Balanced at the factory after assembly.
       1. Blade Material: Aluminum.
       2. Hub Material: Aluminum.
       3. Protective Enclosure: Removable, galvanized-steel, wire-mesh screens complying with OSHA regulations.
       4. Bearings Grease Fittings: Extended lubrication lines to an easily accessible location.

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**NOTE TO SPECIFIER**

Retain paragraph below if belt drive is used.

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* + 1. Belt Drive:
       1. Sheaves: Fan and motor shafts shall have taper-lock sheaves fabricated from corrosion-resistant materials.
       2. Belt Material: Oil resistant, nonstatic conducting, and constructed of neoprene polyester cord.
       3. Belt-Drive Guard: Comply with OSHA regulations.

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**NOTE TO SPECIFIER**

Retain paragraph below if gear drive is used.

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* + 1. Gear Drive: Right angle, reduced speed, and designed for cooling tower applications according to CTI STD 111. Motor and gear drive shall be aligned before shipment.
       1. Housing: Cast iron, with epoxy or polyurethane finish, beveled high-strength steel gears continuously bathed in oil, and with lubrication to other internal parts at all operating speeds.
       2. Mounting: Directly mounted to fan hub and connected to motor so motor shaft is in horizontal position.
       3. Operation: Able to operate both forward and in reverse.
       4. Drive Shaft Material: Stainless steel, and fitted with flexible couplings on both ends. Provide exposed shaft and couplings with guards according to OSHA regulations.
       5. Extend oil fill, drain, and vent to outside of cooling tower casing using galvanized-steel piping. Provide installation with oil-level sight glass.
    2. Fan Motor:

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**NOTE TO SPECIFIER**

Edit first paragraph below based upon requirements of project.

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* + - 1. Motor Enclosure: Totally enclosed air over (TEAO) or Totally enclosed fan cooled (TEFC).
      2. Energy Efficiency: NEMA Premium Efficient.
      3. Insulation: Class F.
      4. Variable-Speed Motors: Inverter-duty rated per NEMA MG-1, Section IV, "Performance Standard Applying to All Machines," Part 31, "Definite-Purpose, Inverter-Fed, Polyphase Motors."

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**NOTE TO SPECIFIER**

Retain first subparagraph below if Project requires specific motor location.

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* + - 1. Motor Location: Mounted outside of cooling tower casing and cooling tower discharge airstream.

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**NOTE TO SPECIFIER**

Retain subparagraph below for belt-drive units.

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* + - 1. Motor Base: Adjustable, or other suitable provision for adjusting belt tension.
    1. Controls: Comply with requirements in Division 23 Section "HVAC Instrumentation and Controls."
    2. Personnel Access Components:

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**NOTE TO SPECIFIER**

Retain applicable subparagraphs, based on Project conditions, to require these components.

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* + - 1. Doors: Large enough for personnel to access cooling tower internal components from both cooling tower end walls. Doors shall be operable from both sides of the door.
      2. External Ladders with Safety Cages: Aluminum, galvanized- or stainless-steel, fixed ladders with ladder extensions to access external platforms and top of cooling tower from adjacent grade without the need for portable ladders. Comply with 29 CFR 1910.27.
      3. External Platforms with Handrails: Aluminum, FRP, or galvanized-steel bar grating at cooling tower access doors when cooling towers are elevated and not accessible from grade.
      4. Handrail: Aluminum, galvanized steel, or stainless steel complete with kneerail and toeboard, around top of cooling tower to safeguard personnel while accessing components located on top of cooling tower. Comply with 29 CFR 1910.23.
      5. Internal Platforms: Aluminum, FRP, or galvanized-steel bar grating.
         1. Spanning the collection basin from one end of cooling tower to the other and positioned to form a path between the access doors. Platform shall be elevated so that all parts are above the high water level of the collection basin.
         2. Elevated internal platforms with handrails accessible from fixed vertical ladders to access the fan drive assembly when out of reach from collection basin platform.

1. EXECUTION
   1. INSTALLATION
      1. Install cooling towers on support structure indicated.
      2. Install anchor bolts to elevations required for proper attachment to supported equipment.
      3. Maintain manufacturer's recommended clearances for service and maintenance.
      4. Loose Components: Install electrical components, devices, and accessories that are not factory mounted.
   2. CONNECTIONS
      1. Piping installation requirements are specified in other Division 22 and 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
      2. Install piping adjacent to cooling towers to allow service and maintenance.
      3. Install flexible pipe connectors at pipe connections of cooling towers mounted on vibration isolators.
      4. Provide drain piping with valve at cooling tower drain connections and at low points in piping.
      5. Connect cooling tower overflows and drains, and piping drains to sanitary sewage system.
      6. Domestic Water Piping: Comply with applicable requirements in Division 22 Section "Domestic Water Piping." Connect to water-level control with shutoff valve and union, flange, or mechanical coupling at each connection.
      7. Supply and Return Piping: Comply with applicable requirements in Division 23 Section "Hydronic Piping." Connect to entering cooling tower connections with shutoff valve, balancing valve, thermometer, plugged tee with pressure gage, and drain connection with valve. Connect to leaving cooling tower connection with shutoff valve.

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**NOTE TO SPECIFIER**

Retain first paragraph below if external equalizer piping is required.

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* + 1. Equalizer Piping: Piping requirements to match supply and return piping. Connect an equalizer pipe, full size of cooling tower connection, between tower cells. Connect to cooling tower with shutoff valve.
  1. FIELD QUALITY CONTROL
     1. Perform tests and inspections.

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**NOTE TO SPECIFIER**

Retain subparagraph below to require a factory-authorized service representative to assist Contractor with inspections, tests, and adjustments.

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* + - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
    1. Cooling towers will be considered defective if they do not pass tests and inspections.
  1. STARTUP SERVICE
     1. Engage a factory-authorized service representative to perform startup service.
     2. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assemblies, installations, and connections.
     3. Obtain performance data from manufacturer.
        1. Complete installation and startup checks according to manufacturer's written instructions and perform the following:

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**NOTE TO SPECIFIER**

Edit subparagraphs below based upon requirements of project.

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* + - * 1. Clean entire unit including basins.
        2. Verify that accessories are properly installed.
        3. Verify clearances for airflow and for cooling tower servicing.
        4. Check for vibration isolation and structural support.
        5. Lubricate bearings.
        6. Verify fan rotation for correct direction and for vibration or binding and correct problems.
        7. Adjust belts to proper alignment and tension.
        8. Verify proper oil level in gear-drive housing. Fill with oil to proper level.
        9. Operate variable-speed fans through entire operating range and check for harmonic vibration imbalance. Set motor controller to skip speeds resulting in abnormal vibration.
        10. Check vibration switch setting. Verify operation.
        11. Verify water level in tower basin. Fill to proper startup level. Check makeup water-level control and valve.
        12. Verify operation of basin heater and control.
        13. Verify that cooling tower air discharge is not recirculating air into tower or HVAC air intakes. Recommend corrective action.
        14. Replace defective and malfunctioning units.
    1. Start cooling tower and associated water pumps. Follow manufacturer's written starting procedures.
    2. Prepare a written startup report that records the results of tests and inspections.
  1. ADJUSTING
     1. Set and balance water flow to each tower inlet.
     2. Adjust water-level control for proper operating level.
  2. DEMONSTRATION
     1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain cooling towers.

END OF SECTION

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