
Part 1 General

1.1 RELATED REQUIREMENTS

- .1 Section 23 05 00 - Common Work Results for HVAC
- .2 Section 23 05 49.01 - Seismic Protection Systems
- .3 Cooling towers should be selected together with chillers to optimize the energy efficiency of the chiller – cooling tower system.

1.2 PRODUCTS SUPPLIED BUT NOT INSTALLED UNDER THIS SECTION

- .1 Anchor bolts: size anchor bolts to withstand seismic acceleration and velocity forces as defined in 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

1.3 REFERENCES

- .1 ASTM International
 - .1 ASTM A48/A48M, Standard Specification for Gray Iron Castings.
 - .2 ASTM A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .3 ASTM A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - .4 ASTM B117, Standard Practice for Operating Salt Spray (Fog) Apparatus.
 - .5 ASTM C67, Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.
 - .6 ASTM D520, Standard Specification for Zinc Dust Pigment.
- .2 CSA Group
 - .1 CSA B52, Mechanical Refrigeration Code.
 - .2 CAN/CSA-Z809, Sustainable Forest Management.
- .3 Cooling Technology Institute (CTI)
 - .1 CTI-ATC-105, Acceptance Test Code.
 - .2 CTI-STD-201, Standard for the Certification of Commercial Water Cooling Tower Thermal Performance.
- .4 Forest Stewardship Council (FSC)
 - .1 FSC-STD-01-001, FSC Principle and Criteria for Forest Stewardship.
- .5 National Electrical Manufacturers Association (NEMA)
 - .1 NEMA MG 1, Motors and Generators.
- .6 Sustainable Forestry Initiative (SFI)
 - .1 SFI Standard.

- .7 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102.2, Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for condensers, coolers and cooling towers and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Performance criteria shall demonstrate that the proposed operating temperatures of the chiller - cooling tower system maximizes energy efficiency.
 - .3 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Canada, member of OIQ.
 - .2 Indicate on drawings:
 - .1 Connections, piping, fittings, valves, strainers, control assemblies and ancillaries, identifying factory and field assembled.
 - .2 Wiring as assembled and schematically.
 - .3 Dimensions, construction details, recommended installation and support, mounting bolt hole sizes and locations and point loads.
 - .4 Vibration and seismic control measures.
 - .5 Manufacturers recommended clearances.
- .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5 Test reports:
 - .1 Submit certified test reports for cooling towers, closed circuit coolers from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
- .6 Manufacturer's Field Reports:
 - .1 Submit manufacturer's field reports specified.
- .7 Wood Certification: submit Chain-of-Custody Certificate number for CAN/CSA-Z809 or FSC or SFI certified wood.

1.5 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for condensers, coolers and cooling towers for incorporation into manual.
- .3 Include:
 - .1 Description of equipment giving manufacturers name, type, model year, capacity.
 - .2 Start-up and commissioning procedures.
 - .3 Details of operation, servicing and maintenance.
 - .4 Recommended spare parts list.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- .1 Where materials or products are specified by their trademark, consult the Instructions to Tenderers document for the procedures to follow regarding the request for approval for materials or product replacement.
- .2 Extra Materials:
 - .1 Furnish spare parts data for each different item of equipment specified, after approval of detail drawings and not later than 2 months prior to date of occupancy.
 - .2 Include with data complete list of parts and supplies, with current unit prices, source of supply, recommended spare parts list for 1 year of operation, and list of parts recommended by manufacturer to be replaced on routine basis.

1.7 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: company or person specializing in cooling towers, closed circuit coolers installations approved by manufacturer.
- .2 Regulatory Requirements: work to be performed in compliance with applicable Provincial/Territorial regulations.

1.8 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements or with manufacturer's written instructions, the most restrictive.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect condensers and cooling equipment from nicks, scratches, and blemishes.

- .3 Replace defective or damaged materials with new.

Part 2 Products

2.1 PERFORMANCE REQUIREMENTS

- .1 Performance certified in accordance with CTI-STD-201.
- .2 Cooling tower:
- .1 Puissance : permettant de refroidir 350 kW de charge de climatisation par refroidisseur plus le dégagement de chaleur de ceux-ci. Les températures seront sélectionnées afin d'optimiser l'efficacité énergétique du système refroidisseur – Tour de refroidissement.
- .3 Sound pressure level measured at 1.5 m of all side of the device: maximum 80 dBA.
- .4 Table of maximum sound pressure level at 1.5 m (5 ft.):

Localisation	Sound pressure (dB) by frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
Fan input	77	77	72	71	71	70	68	68
Surrounding	82	77	72	72	71	70	68	68
Fan output	75	75	75	72	71	70	68	68

- .5 Acceptable products: Evapco LSTE, Marley MCW or or substitute approved by addendum in accordance with the Instructions to tenderers.

2.2 GENERAL

- .1 Factory assembled forced draft counterflow vertical discharge cooling tower.
- .2 Ensure major equipment including cooling towers, cooling tower gear drive assemblies, fans, and motors have manufacturer's name, address, style, model and serial number, on plate secured to item of equipment.
- .3 Plates: durable and legible throughout equipment life. Fix plates in prominent locations with nonferrous screws or bolts.

2.3 SIZE AND WEIGHT

- .1 Dimensions: approximately 3.35 m (11 ft.) x 1.25 m (4 ft.) x 3.35 m (11ft.) maximum height.
- .2 Operating weight: maximum 3,000 kg.

2.4 MATERIALS

- .1 Steel: components fabricated of zinc-coated steel not lighter than 1.5 mm thick steel, protected against corrosion by zinc coating.

- .1 Zinc coating: to ASTM A153/A153M and ASTM A123/A123M, with extra heavy coating of not less than 0.76 kg per square meter of surface.
- .2 Coat galvanized surfaces damaged due to welding with zinc rich coating conforming to ASTM D520, Type 1.
- .2 Fibre glass reinforced plastic, (FRP) components: inert, corrosion resistant, and fire-retardant with thickness of 3.66 kg/square meter.
- .3 Polyvinyl chloride, (PVC) with flame spread rating of 25, smoke developed of 50, to CAN/ULC-S102.2.
- .4 Stainless steel: type 304.
- .5 Plastic: polypropylene.
- .6 Concrete: to Section 03 30 00 - Cast-in-Place Concrete.
 - .1 Exposed concrete: rub-finished for smooth and uniform surfaces free of form marks and defects.
 - .2 Honeycomb concrete: not permitted.
- .7 Hardware: Type 304 stainless steel.
 - .1 Bolts: provided with neoprene washers under heads.
 - .2 Nails: silicon bronze.
 - .3 Hardware: meet salt-spray fog test as defined by ASTM B117.

2.5 CASING AND FRAMEWORK

- .1 Materials: galvanized steel sheet, angles and channels.
- .2 Access doors or panels: on both end walls for servicing and maintenance.
- .3 Access to spray nozzles: permanent galvanized steel ladder and access platforms.
- .4 Provide straight-rung ladders of standard design, starting at ground level and extending as high as required to gain access to fan decks and water distribution systems.
 - .1 Stairways and ladders: hot-dip, zinc-coated steel.

2.6 COLD WATER BASIN

- .1 Construct basin watertight from Type 304 stainless steel.
- .2 Construct and install basin to ensure that air will not entrained in outlets when operating and no water will overflow on shutdown.
- .3 Provide individual sump with individual outlet.
- .4 Equip outlets with 12.7 mm mesh, zinc-coated steel wire securely mounted to prevent trash from entering outlet.
- .5 Equip basins with:
 - .1 Overflow and valved drain connections.
 - .2 Float-controlled, makeup water valve as indicated.

- .6 Makeup water: discharge not less than 50 mm or two pipe diameters, whichever is greater, above top of basin.
- .7 Pour basin floor slab as one continuous pour.
- .8 Locate continuous water-stop stripping of 150 mm molded polyvinyl plastic on centerline position of basin wall and at other cold pour joints.
- .9 Construct basin wall sections in second continuous pour, reinforced in accordance with manufacturer's requirements, to interlock with water-stop seal in floor slab, forming completely waterproof basin.

2.7 HOT WATER DISTRIBUTION

- .1 Water distribution: pressurized-flow type system which distributes waters evenly over entire fill surface.
- .2 Design tower cells so that water flow of 140% capacity will not cause overflowing or splashing.
- .3 Include with distribution system for each cell, adjustable flow control valves.
- .4 Ensure distribution system is self-draining and non-clogging.
- .5 Piping: PVC, Schedule 40 corrosion resistant.
- .6 Gravity-Flow System: provided with open basins which include splash box and baffles to minimize splashing of incoming hot water and holes that evenly distribute water over entire decking area.
 - .1 Equip water basin holes with ceramic or plastic orifice inserts.
- .7 Pressurized-Flow System: includes piping, fittings, branches, and spray nozzles.
 - .1 Spray nozzles: stainless steel, bronze, polypropylene or high-impact plastic.
 - .2 Nozzles: cleanable, non-clogging, removable, and spaced for even distribution.
- .8 Recirculating pump: close-coupled bronze fitted centrifugal with mechanical seal.
- .9 Size and capacity: selected by manufacturer.
- .10 Provide hot water distribution basins with tower manufacturer's standard removable, zinc-coated steel, covers to prevent airborne debris from entering basin.

2.8 COIL SECTION

- .1 Tube bundle: copper, type M, isolated from steel support with poly propylene spacers or steel tubing and supporting steel framework hot-dip galvanized after fabrication.
- .2 Factory test to 2.4 MPa under water.

2.9 FILL, ELIMINATORS AND LOUVRES

- .1 Tower fill: splash or film, type.
 - .1 Fill material: free to expand or contract without warping or cracking
 - .2 Do not use plasticized wood cellulose for fill material.

- .3 Ensure fill is removable or otherwise made accessible for cleaning.
- .4 Space supports: corrosion resistant, designed to prevent warping, sagging, misalignment, or vibration of fill material.
- .5 Design fill material and supports to provide for even mixing of air and water.
- .6 Construct fill material of stainless steel or PVC formed sheets in pattern, and of sufficient height to meet performance specifications.
- .7 The exchange body must be self-extinguishing and have a flame propagation rating of less than 5. Must be resistant to mold and biological infiltration
- .8 Tile fill: minimum crushing strength of 13.8 MPa over gross area of tile when load is applied parallel to cells as tested in accordance with ASTM C67.
- .9 Cast iron tee section lintels supporting tile fill: to ASTM A48M, Class 25, 3.2 mm additional thickness for corrosion.
- .10 Design lintels with safety factor of 2 minimum.
- .2 Provide eliminators in tower outlet to limit drift loss to not over 0.005% of circulating water rate.
 - .1 Construct eliminators of minimum 10 mm polyvinyl chloride (PVC).
 - .2 Eliminators: multi-pass zigzag type, assembled into sections making strong, stable unit.
 - .3 Support eliminators sections on PVC 6.35 tee sections. Suspend Tee sections with mm brass rods connected to stainless steel clips embedded in bottom side of roof deck at time of casting.
 - .4 Supply stainless steel clips for installation at time of roof deck pour.
 - .5 Support eliminators directly on concrete beams.
- .3 Provide air inlets for each cooling tower with individually removable louvers arranged to prevent escape of water. Louvers: Type 304 stainless steel.
 - .1 Provide compatible materials casings and louvers.
 - .2 One material not to produce stains on other materials.
 - .3 Provide air intakes with 25 mm zinc-coated steel mesh.

2.10 FAN

- .1 Fan: forward curved, centrifugal type, statically and dynamically balanced. Housing: inlet ring and four sided discharge cowl extended into pan.
- .2 Fan drive: V-belt designed for minimum 150% of motor nameplate ratings.
- .3 Motor: variable speed, totally enclosed, insulation Class F, continuous-rated type which conforms to NEMA MG 1.
 - .1 Fan motors: totally enclosed enclosures; locate outside discharge airstream.
 - .2 Mount motors in accordance with manufacturer's recommendations.
 - .3 Two-speed motors: single winding with variable torque characteristics.
- .4 Long-life autoaligning ball bearings with extended lubrication lines for easy access lubrication.

- .5 Drives, fans, and moving parts: protected by galvanized wire guards.

2.11 ACCESSORIES

- .1 Fill valve for the water basin with adjustable floating switch.
- .2 Temperature controller: in pan, set at 60 degrees C with sensor to cycle fans.
- .3 Time delay relay: to limit fan motor starts to not more than 6 /h.
- .4 Capacity control: scroll damper and modulating electronic damper motor, controlled by temperature controller. Sensor in pan set at 60 degrees C.

2.12 VIBRATION ISOLATORS

- .1 To Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

Part 3 Execution

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for condensers, coolers and cooling tower installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 GENERAL

- .1 Mount on structural supports and vibration isolators as indicated and to manufacturer's recommendations.
- .2 Ensure clearance for servicing and maintenance as recommended by manufacturer.
- .3 Manufacturers field service representative to approve installation, to supervise start up and to instruct operators.

3.3 FIELD QUALITY CONTROL

- .1 Site Tests:
 - .1 Test under actual operating conditions in accordance with CTI-ATC-105 to verify specified performance.
- .2 Manufacturer's Field Services:

- .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
- .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.4 ADJUSTING

- .1 Lubricate bearings with oil or grease as recommended by manufacturer.
- .2 Tighten belts to manufacturer's specified tension.

3.5 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Wipe equipment clean, and remove traces of oil, dust, dirt, or paint spots.
- .3 Maintain system in clean condition until final acceptance.
- .4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION