

Part 1 **GENERAL**

1.1 **REFERENCES**

- .1 ASTM International
 - .1 ASTM A 48/A 48M-03(2012), Standard Specification for Gray Iron Castings.
 - .2 ASTM A 123/A/123M-2012, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .3 ASTM A 153/A 153M-09, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - .4 ASTM B 117-11, Standard Practice for Operating Salt Spray (Fog) Apparatus.
 - .5 ASTM C 67-12, Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.
 - .6 ASTM D 520-00(2011), Standard Specification for Zinc Dust Pigment.
- .3 CSA Group
 - .1 CSA B52-05, Mechanical Refrigeration Code.
 - .2 CAN/CSA-Z809-08, Sustainable Forest Management.
- .4 Cooling Technology Institute (CTI)
 - .1 CTI-ATC-105-00, Acceptance Test Code.
 - .2 CTI-STD-201-11, Standard for the Certification of Commercial Water Cooling Tower Thermal Performance.
- .5 Forest Stewardship Council (FSC)
 - .1 FSC-STD-01-001-2004, FSC Principle and Criteria for Forest Stewardship.
- .6 National Electrical Manufacturers Association (NEMA)
 - .1 NEMA MG 1-2011, Motors and Generators.
- .7 Sustainable Forestry Initiative (SFI)
 - .1 SFI-2010-2014 Standard.
- .8 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102.2-10, Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies.

1.2 **SUBMITTALS**

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings: submit drawings stamped and signed for approval by Departmental Representative.
- .3 Submit shop drawings and product data for following items:
 - .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 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.
 - .1 Departmental Representative will make available 1 copy of systems supplier's installation instructions.
- .5 Closeout Submittals:
 - .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals

1.3 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra Materials:
 - .1 Furnish spare parts data for each different item of equipment specified, after approval of detail drawings.
 - .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.

1.4 QUALITY ASSURANCE

- .1 . Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 02 41 13 Selective Site Demolition

Part 2 **PRODUCTS**

2.1 **PERFORMANCE REQUIREMENTS**

- .1 Modular VRF air-cooled condensing unit: to CSA B52.
 - .1 Capacity: 42.2 kW heat rejection, operating with R410A refrigerant at 35 degrees C condensing temperature, and 19.4 degrees C design wet bulb temperature.
- .2 Electrical: maximum overcurrent protection amps 30.
- .3 Sound pressure level measured at anechoic room: maximum 61.0 dBA.

2.2 **GENERAL**

- .1 Factory assembled forced draft counterflow vertical discharge evaporative condenser.
- .2 Ensure major equipment including condenser, 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 and made of anodized aluminum.
- .4 Fix plates in prominent locations with nonferrous screws or bolts.

2.3 **SIZE AND WEIGHT**

- .1 Dimensions: approximately 1.75 m x 0.74 m x 1.65 m maximum height.
- .2 Operating weight: maximum 350 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 A 153/A 153M and ASTM A 123/A 123M, 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 D 520, 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 10, smoke developed of 25, to CAN/ULC-S102.2.
- .6 Plastic: polypropylene.
- .8 Hardware: zinc-coated steel
 - .1 Bolts: provided with cadmium-plated steel washers under heads.
 - .2 Hardware: meet salt-spray fog test as defined by ASTM B 117.

2.5 CASING AND FRAMEWORK

- .1 Materials: galvanized steel, bonderized and finished with a powder coated baked enamel, angles and channels. Shall be able to withstand 960 hours of Salt Spray in accordance with JRA9002 (Japanese Refrigeration and Air-conditioning) testing criteria.
- .2 Structure: designed for wind loads of 1.45 kN/m² on projected area and transmission of loads to anchorage.
 - .1 Include 15% increased loading for ice or snow load.

2.6 COIL SECTION

- .1 The outdoor coil shall be of the wrap around configuration with nonferrous construction with lanced or corrugated plate fins on copper tubing. A minimum clearance of 34mm shall be allowed between modular units to facilitate sufficient air flow across the wrap around condenser coils. The coil fins shall have a factory applied corrosion resistant cellulose and polyurethane-resin coating treatment. The outdoor coil shall include four (4) circuits with two position valves for each circuit, except for the last stage. The coil shall be protected with an integral metal guard. Refrigerant flow from the outdoor unit shall be controlled by means of an inverter driven compressor.

2.7 FAN

- .1 Fan: direct drive, inverter driven, variable speed propeller type fan.
- .2 Outdoor unit shall be manufactured and factory set for operating under 0 'WG external static, but capable of operation under a maximum of 60 Pa external static via a dipswitch setting.
- .3 Motor: inherent protection, permanently lubricated bearings, and completely variable speed
 - .1 The fan motor shall be mounted for quiet operation.
- .4 The fan shall be provided with a raised guard to prevent contact with moving parts.
- .5 The outdoor unit shall have vertical discharge airflow.

2.8 VARIABLE SPEED SCROLL COMPRESSOR

- .1 Air-cooled outdoor units shall be provided complete with inverter driven scroll hermetic compressors (twin fans).
- .2 The compressor motor shall be of DC Brushless configuration with AUTO TUNING INVERTER control to achieve optimum compressor/motor performance levels particularly during off design conditions.
- .3 Non inverter-driven compressors shall not be deemed acceptable for this application.
- .4 Compressors driven by induction are not allowed in this instance.
- .5 Crankcase heaters shall be factory mounted on the compressors.

- .6 Each compressor shall be capable of modulation down to 19% of rated capacity.
- .7 The compressors shall be equipped with an internal thermal overload.
- .8 The compressor shall be mounted to avoid the transmission of vibration.

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 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