**15XXX- Closed-circuit Cooling Tower**

**PART I-GENERAL**

1. General

1.0 Provide a cross-flow induced draft, cooling tower conforming to all specifications, schedules and as shown on the plans. The tower shall have \_\_\_ cells and be capable of cooling \_\_\_\_\_\_\_ gpm of water from \_\_\_°F to \_\_\_°F with a \_\_\_°F ambient air wet bulb temperature. Deviations from the design conditions in any respect are not acceptable. The total connected horsepower of the tower fans shall not exceed \_\_\_ HP (nominal motor nameplate horsepower) or \_\_\_ HP per motor, and the total connected horsepower of the spray pumps shall not exceed\_\_\_\_HP.

The tower shall be equal to MESAN Model MXC-\_\_-\_ or approved equal. Alternate cooling towers shall include whatever costs required for alterations to the electrical system, architectural enclosures, concrete foundations or structural steel required for different tower configurations or sizes.

1.1 The cooling tower performance shall be certified by the Cooling Tower Institute in accordance with CTI STD-201. Alternate towers that are not certified by CTI shall include in their bid cost for a third party certification test to be performed during the warranty period, as per CTI ATC-105. Manufacturer’s performance warranty alone shall not be accepted.

1.2 The cooling tower manufacturer shall have a minimum of 40 years of experience in cooling tower manufacturing and shall have a Quality Management System certified by an accredited institution as complying with the requirements of ISO-9001 – 2008, in order to ensure consistent quality of its products and services. Cooling tower manufacturers that are not ISO-9001 certified shall not be accepted.

1.3 For field-assembled towers the manufacturer shall provide comprehensive field-assembly instructions in video format (DVD format), in addition to written instructions. Written instructions alone shall not be accepted.

**PART II- PRODUCTS**

**2.1 Tower Construction**

2.1.a The casing of the cooling tower(s) shall be made of hand-laid FRP (fiberglass reinforced polyester) with UV-resistant white gelcoat (*alternatively HDGS, SS-304 or SS-316, please indicate)*, with internal framing and base frame made of heavy gauge hot dip galvanized steel (*alternatively SS-304 or SS-316, please indicate*).

2.1.b Cooling coils.- Standard material for the coils shall be SS-304 fully welded and tested at 375 psi, as per ASME guidelines. Hot-Dipped-Galvanized Steel coils shall not be accepted. Towers offering SS-304 coils as an upgrade shall not have any capacity de-rating as noted on the foot notes of their CTI certification documentation. **De-rated towers shall not be accepted**. Coils shall be designed to completely drain by gravity and shall be fitted with manual air vent valves at their highest point.

2.1.c The cold water basin shall be made of FRP fiberglass with UV-resistant white gel coat *(alternatively HDGS, SS-304 or SS-316, please indicate)* and supported by heavy gauge hot-dipped galvanized steel structure. (*alternatively SS-304 or SS-316, please indicate*). The basin sections underneath the fill area shall be sloped toward the center sump tank to ease cleaning. Cold water basin shall be fitted with ANSI-125 flanges (3” diameter and above) for field piping connections (*SS304 flanges also available as an alternative*). A brass float valve with stainless steel float shall be provided *(Alternatively, electronic water level control)*. Make-up and overflow piping connections shall be NPT threaded type. Spray pumps shall be supplied by the tower manufacturer. When fitted with optional electronic water level control, all components of such system shall have a lifetime warranty

2.1.d The hot water distribution system shall be open gravity type, with fixed calibrated orifices and without nozzles, The hot water basin and basin covers shall be constructed of FRP with UV-resistant gel coat *(alternatively, SS-304 and SS-316)*. The hot water basin covers shall be designed to withstand a 50 psf live load or a 200 pound concentrated load. ANSI-125 flanges shall be provided on top of each hot-water basin, and fitted with anti-splash devices made of FRP *(alternatively, SS-304 or SS-316)*. The distribution fill shall be made of vacuum formed PVC *(alternatively, flame-retardant ASTM Polypropylene)* with a minimum thickness of 10 mils (0.27 mm) after vacuum forming, rated for up to 45C water temperature (*alternatively, high temperature CPVC)*, designed to ensure the even distribution of water over the entire wet deck surface. Fill shall be arranged in several staggered layers over the height of the air intake opening. Single-height sheet fills shall not be accepted. Fill sheets shall have built-in 45° air intake louvers and built-in integral primary drift eliminators.

2.1.g Separate secondary drift eliminators with at least three changes of direction made of PVC, shall limit drift losses to 0.005% or less of the design water flow rate, *Drift eliminators panels shall be* at least 5.5” deep. The secondary drift eliminators shall run from top to bottom of the tower plenum (full height), in order to contain drift from the fill section and from the coil section too. Integral drift eliminators alone (as part of the fill sheets) shall not be accepted.

2.1.h The fan deck and fan cylinder shall be FRP with UV-resistant gelcoat *(alternatively, HDGS, SS-304 or SS-316)*. The fan deck shall be designed to withstand a 50 psf live load or a 200 pound concentrated load. The top of the fan cylinder shall be equipped with an OSHA-compliant removable fan guard made of hot dip galvanized steel (*SS-304 or SS-316 also available, choose one*) with openings not larger than 1.25” x 1.25”.

**2.2 Mechanical Equipment**

2.2.a Fan shall be axial type with airfoil blades made of extruded aluminum with adjustable pitch. Each fan blade shall be fitted with an aerodynamic blade tip, designed to eliminate vortexes and minimize air spillage from the high pressure side of the blade to the low pressure side of it.

2.2.b Fan hub to be made of a single billet steel piece, CNC-machined to integrate the blade shafts cradles, the center bushing shall have a conical shaft hole (tapered lock type) to ensure perfect centering of the complete assembly. Fan hubs with welded or bolted cradles shall not be accepted. Aluminum fan hubs shall not be accepted. Fan hubs using set screws to attach to the fan shaft shall not be accepted

2.2.c Fan motor(s) shall be totally-enclosed, air-over (TEAO), reversible, ball bearing type, designed specifically for cooling tower service. The motor shall be furnished with special moisture protection on winding, shafts and bearings, shall comply with IP55 enclosure and insulation class F standard.

2.2.d The fan(s), fan shaft(s), bearings, speed reducer and fan motor shall be warranted against defects in materials and workmanship for a period of five (5) years from date of shipment, FOB point of delivery of original order

2.2.e The fan drive shall be V-belt type with pulleys designed for 150% of the motor nameplate HP rating (*Amarillo or Sumitomo gear reducers also available, please indicate)* The belt material shall be neoprene reinforced with polyester cord and specifically designed for cooling tower service. Fan sheaves(s) shall be cast iron construction with corrosion protective coating. Aluminum pulleys shall not be accepted. The fan and fan pulleys shall be mounted on the shaft with special tapered bushing to provide maximum torque and prevent wobbling. Fan assemblies using set screws shall not be accepted. Bearings must be NSK brand or equivalent rated for L10 80,000 hours of service life, sealed type, **permanently lubricated** and enclosed inside a steel cylinder with bolted on caps and two automotive-grade radial shaft seals, to isolate them from the airstream. Pillow block bearings shall not be accepted. Bearings exposed to the airstream, shall not be accepted

2.2.f For towers equipped with gear drives (*optional)*, the motor, drive and transmission shaft shall be factory assembled and laser aligned and shipped as a single piece. Drives requiring field alignment and field assembly shall not be accepted.

**2.3 Water Outlet**

2.3.a The cooling tower outlet shall be provided with ANSI-125 flanged connections. The outlet shall be provided with large area removable FRP strainer *(SS-304 available as an option)* and an anti vortex device to prevent air entrainment. The strainer shall match the materials of construction of the cold-water basin. Tower manufacturers that do not supply integral strainers in their cold water basins shall include in their pricing an additional full flow basket strainer to be installed in the condenser water piping.

**2.4** **Access and maintenance**. To extend the lifespan of the tower by easing the accessibility and maintenance of the tower, the following must be provided and shall not be excluded by any cooling tower manufacturer. Exclusions to this section shall not be considered as equal.

2.4.a An OSHA-compliant access ladder made of hot dip galvanized steel (*SS-304 or SS-316 also available)* shall be provided for access to the fan deck.

2.4.b. Two hinged access doors per each cell shall be provided, dimensions of each door not to be less than 39” high x 25” wide each for easy access of maintenance personnel

2.4.c. An internal walkway made of FRP and HGDS structure (*SS-304 or SS-316 also available)*, with anti-skid surface shall be provided. Internal walkways with open spaces shall not be accepted. All working surfaces shall be designed to withstand 50 psf or 200 lbs live load. Other components of the cooling tower, i.e. basin floor and fill/drift eliminators, shall not be considered an internal working surface. Cooling tower manufacturers that require that these surfaces be used, as a working platform shall provide a two year extended warranty to repair any damage to these surfaces caused by routine maintenance.

**2.5 Cooling Tower Accessories**

2.5.a (Optional) **Handrail:** *An OSHA-compliant* hot dip galvanized steel (*SS-304 or SS-316 also available)* handrail shall be provided around the perimeter of the cooling tower. The handrails shall be provided with knee and toe rails.

2.5.b (Optional) **Ladder Safety Cage:** An OSHA-compliant heavy-gauge galvanized steel *(alternatively SS-304 or SS-316)* ladder safety cage shall be supplied

2.5.c (Optional) **Vibration Cutout Switch**: Provide electronic vibration cut-off switch with contact for BAS monitoring. Wiring shall be by the installing contractor. The electronic vibration cut off switch shall be guaranteed to trip at a setpoint of 0.6 in/sec.

2.5.d (Optional ) SS-304 or SS-316 **Stainless steel hardware**: including bolts, nuts, washers, shall be provided (choose one)

2.5.e Standard Warranty shall cover manufacturing defects for a period of 12 months from start-up date, or 18 months from invoice date, whichever occurs first. Warranty covers parts replacement only FOB port of origin of the original order. An exception to this policy are those moving components (motor, speed reducer, bearings and pulleys) covered by an optional extended  5-year warranty, for which the delivery point, FOB terms and freight costs coverage remain the same as for the standard warranty.

END OF SECTION