Engineering Specifications for HXV Closed Circuit Hybrid Cooling Tower

1.0 Closed Circuit Hybrid Cooling Tower

1.1 General: Furnish and install, as shown on the plans, ___ factory-assembled closed circuit hybrid cooling tower(s) of induced draft design with vertical air discharge. The unit shall be able to operate in combined dry/wet, adiabatic and dry modes for plume abatement and minimum water consumption. Overall dimensions shall not exceed approximately ___ ft (m) x ___ ft (m), with an overall height not exceeding approximately ___ ft (m). Operating weight shall not exceed _____ lbs (kg). The closed circuit hybrid-cooling tower shall be Baltimore Aircoil Company Model HXV-___.

1.2 Thermal Capacity (water as heat transfer fluid): The closed circuit cooling tower shall be warranted by the manufacturer to have capacity to cool _______ GPM (lps) of water from _______°F (°C) to _______°F (°C) at _______°F (°C) entering wet-bulb temperature. Coil pressure drop shall not exceed ________ psi (kPa).

1.3 Quality Assurance: The tower manufacturer shall have a Management System certified by an accredited registrar as complying with the requirements of ISO-9001 to ensure consistent quality of products and services.

2.0 Construction Details

2.1 G-235 (Z700 metric) Hot-Dip Galvanized Steel Structure: All steel panels and structural elements shall be constructed from heavy-gauge, G-235 (Z700 metric) hot-dip galvanized steel, with cut edges given a protective coat of zinc-rich compound.

(Alternate) 2.1 Corrosion Resistant Construction: Unless otherwise noted in this specification, all steel panels and structural members shall be protected with a thermosetting hybrid polymer system. The system shall consist of G-235 (Z700 metric) hot-dip galvanized steel prepared in a four-step (clean, pre-treat, rinse, dry) process with an electrostatically sprayed, thermosetting, hybrid polymer fuse-bonded to the substrate during a thermally activated curing stage and monitored by a 23-step quality assurance program. Coatings other than a thermosetting hybrid polymer must be submitted to the engineer for pre-approval. Approved equals must have undergone testing, resulting in the following results as a minimum:

1. When X-scribed to the steel substrate it shall be able to withstand 6000 hours of 5% salt spray per ASTM B117 without blistering, chipping, or loss of adhesion;

2. When X-scribed to the steel substrate it shall be able to withstand 6000 hours of exposure to acidic (pH=4.0) and alkaline (pH=11.0) water solutions at 95°F (35°C) without signs of chemical attack;

3. Shall withstand impact of 160 in-lbs per ASTM D2794 without fracture or delamination of the polymer layer;

4. Shall withstand 6000 hours of ultraviolet radiation equivalent to 120,000 hours of noontime sun exposure without loss of functional properties;

5. Shall withstand 200 thermal shock cycles between -25°F and +180°F (-32°C and 82°C) without loss of adhesion or other deterioration;
6. Shall withstand 6000 hours of exposure to 60 psi (42,184 kg/m²) water jet without signs of wear or erosion.

(Alternate) 2.1 Optional Stainless Steel Construction: All steel panels and structural elements shall be constructed from heavy-gauge, Type 304 stainless steel.

2.2 Coil Sections: The dry finned coil shall consist of copper tubes with rippled edge, aluminum flat plate fins, and headers of seamless copper tubes installed in a heavy-gauge galvanized steel casing. Fins shall have full drawn collars to maintain consistent fin spacing and a continuous surface contact over the entire tube for maximum heat transfer. The coil shall have a design pressure of 250 psig (1,725 kPa) and be pneumatically tested at 320 psig (2,205 kPa). Staggered tube coil arrangement and fin density shall be optimized for maximum sensible heat transfer during all operation modes with minimum airside pressure drop. The coil shall be designed for free drainage of fluid.

The prime surface coil shall be encased in a heavy-gauge galvanized steel casing. The coil shall be constructed of continuous serpentine all prime surface steel, be pneumatically tested at 375 psig (2,685 kPa), and be hot-dip galvanized after fabrication. The coil shall be designed for free drainage of fluid and shall be ASME B31.5 compliant. Maximum allowable working pressure shall be 300 psig (280 psig for coils supplied with a CRN).

2.3 Cold Water Basin: The cold water basin shall be constructed of heavy-gauge hot-dip galvanized steel. The basin shall include a depressed section with drain/clean-out connection. Standard accessories shall include large area, lift-out steel strainers with perforated openings sized smaller than water distribution nozzle orifices, an integral anti-vortexing hood to prevent air entrainment, waste water bleed line, and brass make-up valve with large diameter plastic float arranged for easy adjustment.

(Alternate) 2.3 Optional Stainless Steel Cold Water Basin: The cold water basin shall be made of Type 304 stainless steel. All factory seams in the cold water basin shall be welded, leak tested at the factory to ensure watertight assembly and shall be warranted against leaks for five years.

4.0 Fill and Drift Eliminators

4.1 Fill and Drift Eliminators: The fill and integral drift eliminators shall be formed from self-extinguishing (per ASTM-568) polyvinyl chloride (PVC) having a flame spread rating of 5 per ASTM E84 and shall be impervious to rot, decay, fungus and biological attack. The fill shall be manufactured and performance tested by the closed circuit cooling tower manufacturer to provide single source responsibility and assure control of the final product. A separate set of drift eliminators shall be removable in easily handled sections for quick access to the coil. Eliminators shall have a minimum of three changes in air direction.

(Alternate) 4.1 Fill and Drift Eliminators: The high temperature fill and integral drift eliminators shall be formed from self-extinguishing (per ASTM-568) polyvinyl chloride (PVC) having a flame spread rating of 5 per ASTM E84 and shall be impervious to rot, decay, fungus and biological attack. The high temperature fill shall be suitable for water temperatures up to 140°F. The fill shall be manufactured, tested and rated by the cooling tower manufacturer and shall be elevated above the cold water basin to facilitate cleaning.

5.0 Air Inlet Louvers

5.1 Air Inlet Louvers: Air inlet louvers shall be wave-formed, fiberglass-reinforced polyester (FRP), spaced to minimize air resistance and prevent water splash-out.
6.0 Mechanical Equipment

6.1 Fan(s): Fan(s) shall be heavy-duty, axial flow, with aluminum alloy blades. Air shall discharge through a fan cylinder designed for streamlined air entry and minimum fan blade tip clearance for maximum fan efficiency. Fan(s) and shaft(s) shall be supported by heavy duty, self-aligning, grease-packed ball bearings with moisture-proof seals and integral slinger rings, designed for minimum L10 life of 40,000 hours. Fan(s) shall be driven by a one-piece, multi-groove neoprene/polyester belt designed specifically for evaporative cooling service. Fan and motor sheave(s) shall be fabricated from cast aluminum.

6.2 Fan Motor: Fan motor(s) shall be totally enclosed air over (TEAO), reversible, squirrel cage, ball bearing type with 1.15 service factor, designed specifically for evaporative cooling duty on ____ volt/ ____ hertz/ ____ phase electrical service. The motor shall be furnished with special moisture protection on windings, shafts, and bearings. Each motor shall be mounted on an easily adjusted, heavy-duty motor base.

(Alternate) 6.2 Fan Motor: Fan motor(s) shall be totally enclosed air over (TEAO), reversible, squirrel cage, ball bearing type designed specifically for evaporative cooling duty on ____ volt/ ____ hertz/ ____ phase electrical service. The motor shall be furnished with special moisture protection on windings, shafts, and bearings. Fan motors shall be inverter duty type designed per NEMA Standard MG1, Section IV, Part 31.

6.3 Mechanical Equipment Warranty: The fan(s), fan shaft(s), sheaves, bearings, mechanical equipment support and fan motor shall be warranted against defects in materials and workmanship for a period of five (5) years from date of shipment.

6.4 BALTIGUARD™ Fan System (optional): Two single-speed fan motors, one sized for full speed and load, the other sized for 2/3 speed and approximately 1/3 the full load horsepower, shall be provided for capacity control and stand-by protection from drive or motor failure. Two-speed motor(s) are not an acceptable alternative.

(Alternate) 6.5 BALTIGUARD PLUS™ Fan System: Two single speed fan motors, one sized for full load, the other sized for 1/3 of the full load horsepower shall be provided in each cell for capacity control and standby protection from drive or motor failure. The manufacturer of the equipment shall supply controls for the larger motor, a VFD for the smaller motor and factory programmed logic controller to maximize energy saving for off peak load and wet bulb conditions.

7.0 Access

7.1 Plenum Access: A large, hinged access door shall be provided on each end wall for access to the prime surface coil, drift eliminators, and fan plenum section. The water make-up valve, float ball, and suction strainer shall be easily accessible.

8.0 Sound

8.1 Sound Level: To maintain the quality of the local environment, the maximum sound pressure levels (dB) measured 50 ft from the tower operating at full fan speed shall not exceed the sound levels detailed below.

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9.0 Accessories

9.1 Basin Heater(s): The cooling tower cold water basin shall be provided with electric heater(s) to prevent freezing in low ambient conditions. The heater(s) shall be selected to maintain 40°F (4.4°C) basin water temperatures at _____°F ambient. The heater(s) shall be ______V/____phase/___Hz electric and shall be provided with low water cutout and thermostat.

(Alternate) 9.1 Basin Heaters: A steam coil shall be factory installed in the cooling tower depressed sump of the cold water basin to prevent freezing during cold weather shutdown. The steam coil shall be capable of maintaining 40°F (4.4°C) basin water temperature at a –20°F (-28.9°C) ambient temperature given 5 psig at the coil inlet connection.

(Alternate) 9.1 Basin Heaters: A hot water coil shall be factory installed in the cooling tower depressed sump of the cold water basin to prevent freezing during cold weather shutdown. The hot water coil shall be capable of maintaining 40°F (4.4°C) basin water temperature at a –20°F (-28.9°C) ambient using 180°F (82.2°C) entering water temperature and 170°F (76.7°C) leaving water temperature.

9.2 Basin Water Level Control: The cooling tower manufacturer shall provide an electric water level control (EWLC) system. The system shall consist of water level sensing and control units in quantities and locations as indicated on the drawings. Each water level sensing and control unit shall consist of the following: NEMA 4 enclosure with gasketed access cover; solid state controls including all necessary relays and contacts to achieve the specified sequence of operation; stainless steel water level sensing electrodes with brass holder; Schedule 40 PVC standpipe assembly with vent holes, and all necessary stainless steel mounting hardware. Provide PVC union directly below the control enclosure to facilitate the removal and access of electrodes and control enclosure.

The number and position of water level sensing electrodes shall be provided to sense the following: high water level, low water level, high water alarm level, low water alarm, and heater safety cutout.

9.3 Vibration Cutout Switch: Provide mechanical local reset vibration switch. The mechanical vibration cut out switch will be guaranteed to trip at a point so as not to cause damage to the cooling tower. To ensure this, the trip point will be a frequency range of 0 to 3,600 RPM and a trip point of 0.2 to 2.0 g's.

(Alternate) 9.3 Vibration Cutout Switch: Provide electronic remote reset vibration switch with contact for BAS monitoring. Wiring shall be by the installing contractor. The electronic vibration cut out switch shall be set to trip at a point so as not to cause damage to the cooling tower. The trip point will be 0.45 in/sec.

9.4 Basin Sweeper Piping: The cold water basin of the cooling tower shall be equipped with PVC sump sweeper piping with plastic educator nozzles. The piping should create a grid under the fill section and force all dirt and debris to the center depressed section of the cold water basin

9.5 Air intake Option: Provide removable hot dip galvanized steel 1”x1” mesh air intake screens.

(Alternate) 9.5 Air intake Option: Provide removable hot dip galvanized steel 1”x1” mesh air intake screens protected with a thermosetting hybrid polymer or Type 304 stainless steel.
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(Alternate) 9.5 Air Intake Option: The unit shall be equipped with intake sound attenuators consisting of fiberglass acoustical baffles encased in steel to further reduce sound levels.

9.6 Discharge Option: The discharge plenum shall be equipped with sound absorbing material.

9.7 Access Door Platform: A galvanized steel platform and aluminum ladder to grade shall be provided at all access doors to access the plenum section of the cooling tower. All working surfaces shall be able to withstand 50 psf live load or 200 pound concentrated load.

9.8 Internal Platform: An internal platform shall be provided in the plenum section to provide for inspection and maintenance. All working surfaces shall be able to withstand 50 psf live load or 200 pound concentrated 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 the Owner to repair any damage to these surfaces caused by routine maintenance.

9.9 Heat Loss: The heat loss shall be no greater than _____________. If the heat loss is greater than the specified limit, positive closure dampers or insulation on the hood/casing provided.

9.10 Flow Control Package: The manufacturer shall provide a flow control package consisting of a 3-way flow control valve arrangement with actuator, and all interconnecting piping between the finned coil and the prime surface coil. The package will be designed to maximize plume control and water savings.