1. **FORCED DRAFT EVAPORATIVE CONDENSER**
	1. **General**

Furnish and install factory assembled evaporative condenser of forced draft counterflow design with a horizontal single air side entry and a vertical air discharge. The unit shall be completely factory assembled and conform to the specifications and schedules.

The total fan power should not exceed …. kW and the total overall unit dimensions should not exceed the following :

Length: …..mm

Width: …. mm

Height: … mm

The unit will be delivered in two parts: the section (pan-fan) and the top section (heat transfer).

The unit (top and bottom section) shall be joined together with elastic sealer and bolted together with corrosion resistant fasteners.

Approved manufacturer: Evapco – model PMCQ \_\_\_\_\_

 Evapco – model PMCE\_\_\_\_\_\_

* 1. **Thermal Performance – Performance Warranty**

The evaporative condenser shall be capable of performing the thermal duties as shown in the schedule and on drawings, and its design thermal rating shall be guaranteed by the manufacturer.

* 1. **Applicable Standards**
1. Directive 2006/42/EC on Machinery
2. Directive 2014/30/EC Electromagnetic Compatibility
3. CTI STD 201 Standard for Thermal Performance Certification of Evaporative Heat Rejection Equipment.
4. Eurovent Certification operation manual OM-4-2016 CT and Rating Standard RS 9C 001 for Cooling Towers.
5. Directive 2014/68/EU Pressure Equipment Directive.
	1. **Submittals**
6. The manufacturer shall submit a five year history of the proposed type of evaporative condenser with a minimum of 10 installations for similar sized equipment.
7. Shop drawings: submit shop drawings indicating dimensions, weight loadings and required clearances.
8. Product data: submit manufacturer’s technical product data, original selection printouts and clearance requirements.
9. Complete noise data sheet for the selected evaporative condenser.
10. Maintenance data for the evaporative condenser and accessories.
11. The evaporative condenser manufacturer shall provide factory test run certificates of the fans and fan motor.
	1. **Product Delivery – Storage and Handling**
12. The contractor shall make the provisions for proper storage at site before installation and handle the product per the instructions of the manufacturer.
13. Once installed provide the necessary measures that the units remain clean and protected from any dust and mechanical damage.
	1. **Quality Assurance**
14. The manufacturer shall have a quality assurance system in place which is certified by an accredited registrar and complying with the requirements of ISO 9001:2008. This is to guarantee a consistant level of product and service quality.
15. Manufacturers without ISO 9001:2008 certification are not acceptable.
	1. **Warranty**
16. The products will be warranted for a period of minimum of two years from the date of shipment.
17. **PRODUCT**
	1. **Construction – Corrosion Resistance**

**STANDARD EXECUTION – GALVANIZED STEEL Z725**

1. The structure and all steel elements of the pan and casing shall be constructed of Z-725 hot dip galvanized steel for long life and durability. Alternatives with lower zinc layer thickness and external paint or coating are not accepted as equal.
2. The strainer shall be made of stainless steel type 304L or 316L.
3. During fabrication all panel edges shall be coated with a 95 % pure zinc compound.
4. Casing materials shall be of non flammable construction.

**OPTIONAL EXECUTION – BASIN IN SST 304L or 316L**

1. The structure and all steel elements of the pan up to the water level shall be made of SST 304L or 316L.
2. Alternatives with hot dip galvanized steel and epoxy coatings in lieu of the SST 304L or 316L are not considered equal and will not be accepted.
3. All other steel components and the casing shall be constructed of Z-725 hot dip galvanized steel for long life and durability. Alternatives with lower zinc layer thickness and external paint or coating are not accepted as equal.
4. The strainer shall be made of stainless steel type 304L or 316L.
5. During fabrication all galvanized steel panel edges shall be coated with a 95 % pure zinc compound.
6. Casing materials shall be of non flammable construction.

**OPTIONAL EXECUTION – COMPLETE UNIT IN STAINLESS STEEL SST 304L or 316L (except moving parts)**

1. The structure and all steel elements shall be made of SST 304L or 316L.
2. Alternatives with hot dip galvanized steel and epoxy coatings to replace the SST 304L or 316L are not considered equal and accepted.
3. Casing materials shall be of non flammable construction.
	1. **Construction – Seismic and wind load resistance**
4. The structural design must be designed in accordance with IBC2015 with and Importance factor (Ip) of \_\_\_\_\_, a seismic factor (SDS) up to \_\_\_\_ g a wind load up to \_\_\_\_ kN/m²
	1. **Pan/Fan Section**
5. The heat transfer section shall be removable from the pan to provide easy handling and rigging.
6. The pan – fan section shall include fans and drives mounted and aligned in the factory. These items shall be located in the dry air stream.
7. Standard pan accessories shall include circular access doors, strainer(s) of anti vortex design, brass make up valve with unsinkable, foam filled plastic float arranged for easy adjustment.
8. PMCE: Optional man-sized rectangular access door.

PMCQ: A man-sized rectangular access door shall be located above the basin to allow for easy access to the pan interior.

* 1. **Mechanical Equipment**
		1. **PMCE Fan(s) – Power-Mizer Fan Drives**

Fans shall be vane-axial type constructed of cast aluminum alloy blades. They shall be arranged in a two-stage system installed in a closely fitted cowl with venture air inlet and air stabilizing vanes. Fan shaft bearings shall be a heavy-duty self aligning ball type with grease fittings extended to the outside of the unit. The fan drive shall be solid backed Power-Band constructed of neoprene with polyester cords designed for 150% motor nameplate horsepower. Drives are to be mounted and aligned at the factory.

Each fan shall be driven individually by a dedicated fan motor. Fan motors may be cycled independently without harmful moist air bypass.

* + 1. **PMCQ Fan(s)**
1. Type and material: axial propeller, one piece heavy-duty FRP hub and blade construction. Galvanized steel closely fitted fan cowl with venturi air inlet for maximum fan efficiency, covered with a heavy gauge hot-dip galvanized steel fan guard (Optional type 304 stainless steel).
2. Fan housing: the complete drive system, including the electric motor, belts, bearings, fan and drives shall be completely enclosed in a protective housing which covers the drive system and provides sound reduction.
	* 1. **Bearings and Drive**
3. The fan shaft(s) shall be supported by heavy duty, self aligning pillow block bearings with cast iron housings and lubrication fittings for maintenance.
4. The fan drives shall be V belt type with taper lock sheaves designed for 150 % of the motor nameplate horsepower.
5. The bearings shall be rated for an L-10 life of 75.000 hours.
	* 1. **Motor**
6. The fan motor shall be Totally Enclosed, Fan Cooled (TEFC), squirrel cage, ball bearing type motor.
7. The motor shall be minimum IP 55 degree of protection, Class F insulation, Service Factor 1 and selected for the appropriate evaporative condenser duty and the correct ambient temperature but minimum 40 °C.
8. Motor bearings shall be greased for life or external grease lines shall be provided.
9. The motor shall be mounted on an adjustable heavy duty steel motor base.
10. The motor power supply shall be …… volts, ….. Hertz and ….. Phase.
	* 1. **Water Circulation Pump**
11. The pump(s) shall be a close coupled, centrifugal type with mechanical seal , installed vertically at the factory to allow free drainage on shut down.
12. A \_\_\_\_ kW totally enclosed motor(s) suitable for outdoor service shall be furnished.
13. The motor shall be suitable for the following power supply:

\_\_\_\_volts, \_\_\_\_hertz and \_\_\_\_ phase and \_\_\_\_ kW.

* 1. **Casing Section**
		1. **Heat transfer Coil**
1. The evaporative condenser shall use internally enhanced heat exchange coils of an elliptical tube design to obtain lower air flow resistance and allow higher water loadings around the tubes.
2. The heat transfer coil(s) shall be made of all prime surface, encased in a steel framework and hot dip galvanized after fabrication as a complete assembly.
3. The tubes shall be arranged in a self spacing, staggered pattern in the direction of air flow for maximum heat transfer efficiency and minimum pressure drop.
4. The heat exchange coils shall be air pressure tested under water.
5. The design and manufacturing process shall be approved and in accordance with the “Pressure Equipment Directive” – PED 2014/68/EU.
6. The manufacturer shall be responsible for the manufacturing and performance testing of the entire heat transfer coil. This is to assure single source responsibility.
7. The casing shall totally encase the complete coil section to protect the complete coil from direct atmospheric contact.

**OPTIONAL - Heat Transfer Coil in SST 304L or 316L**

1. The evaporative condenser shall use heat exchange coils of an elliptical tube design to obtain lower air flow resistance and allow higher water loadings around the tubes.
2. The heat transfer coil(s) shall be made of SST 304L or 316L or 316L encased in an SST 304L or 316L or 316L framework and externally passivated after fabrication as a complete assembly.
3. The tubes shall be arranged in a self spacing, staggered pattern in the direction of air flow for maximum heat transfer efficiency and minimum pressure drop.
4. The heat exchange coils shall be air pressure tested under water.
5. The design and manufacturing process shall be approved and in accordance with the “Pressure Equipment Directive” – PED2014/68/EU.
6. The manufacturer shall be responsible for the manufacturing and performance testing of the entire heat transfer coil. This is to assure single source responsibility.
7. The casing shall totally encase the complete coil section to protect the complete coil from direct atmospheric contact.
	* 1. **Water Distribution**
8. The spray header and branches shall be constructed of Schedule 40, Polyvinyl Chloride (PVC) pipe for corrosion resistance and shall have a steel connection to attach the external piping.
9. The internal condenser water distribution piping shall be easily removable for cleaning purposes.
10. The water shall be distributed over the fill by precision molded ABS spray nozzles with large minimum 25 mm orifice openings and integral sludge ring to eliminate clogging.
11. The nozzles shall be threaded into the water distribution piping to assure positive positioning.
	* 1. **Drift Eliminators**
12. The drift eliminators shall be constructed entirely inert polyvinyl chloride (PVC) that has been specially treated to resist ultra violet light.
13. Assembled in easily handled sections, the eliminator blades shall be placed on 25 mm centers and shall incorporate three changes in air direction to assure efficient removal of entrained moisture from the discharge air stream.
14. The maximum drift rate shall not exceed 0,001 % of the circulating water rate.
15. The Drift Eliminators shall be certified according to Eurovent Standard OM-14-2014.
	1. **Sound Levels**

The maximum sound pressure levels (dB) measured 15m from the evaporative condenser operating at full fan speed shall not exceed the sound levels detailed below.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Location | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | dB(A) |
| Hz | Hz | Hz | Hz | Hz | Hz | Hz | Hz | Hz |
| Discharge |  |  |  |  |  |  |  |  |  |
| Air inlet |  |  |  |  |  |  |  |  |  |

Measurement in accordance with ISO 3744.

**3. ACCESSORIES (optional)**

* 1. **Electric Heaters**
1. The evaporative condenser cold water basin shall be provided with an electric heater package to prevent freezing of the water in the cold water basin.
2. The electric heater package includes: electric heater elements and a combination of thermostat and low water level cutoff.
3. The heaters shall be selected to maintain 4 °C basin water temperature at …..°C ambient
4. The heater(s) shall be ……V / …… phase / ….. Hz electric power supply.
	1. **Five Probe Electric Water Level Control Package**
5. The evaporative condenser manufacturer shall provide an electric water level control package instead of the mechanical float valve arrangement.
6. The package consist of the following elements :
* Multiple heavy duty stainless steel SST-316 static probes mounted in a stilling chamber outside the unit. Electrodes or sensors mounted inside the unit are not accepted as their operation will be disturbed by the moving water in the basin.
* An ABS, IP 56 case contains all the contactors for the different level probes and will provide a output signal of a relay for automatic filling and two relays for alarm levels.
* The power supply to the control package is 24 Vac / 230 Vac - ….. Hz.
* A weather protected solenoid valve for the water make up ready for piping to a water supply with pressure between 140 kPa and 340 kPa.
	1. **Vibration Switch**

1. A vibration limit switch shall be installed on the mechanical equipment support and wired into the control panel. The purpose of this switch is to interrupt the power to the motor in the event of excessive vibration.
2. The switch shall be adjustable for sensitivity, and shall require manual reset.