Paharpur Cooling Towers Ltd

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PAHARPUR SERIES CF3 PULTRUDED FRP COUNTERFLOW COOLING TOWER

Paharpur’s Series CF3 induced draught cooling tower represents the culmination of more than 50 years of cooling tower design experience. With polynyl chloride fill pultruded FRP structure, moulded FRP basin and casing, the series CF3 continues a tradition of excellence. Improvements and innovations in structure and component designs produce in the series CF3 a heavy-duty, energy efficient and dependable cooling tower unrivalled in the industry. Perhaps most importantly, all major components responsible for this breakthrough have been developed, manufactured, applied and guaranteed by one single source - Paharpur. Without question, the series CF3 establishes a new state of the art in counter flow cooling tower design.

The Paharpur Series CF3 is certified for thermal performance by the Cooling Technology Institute (CTI), Houston, USA as per CTI certification standard STD-201. Details are available at www.cti.org.

PAHARPUR’S INTEGRATED SYSTEM DESIGN

Although Paharpur’s original motivation in the design and manufacture of all major cooling tower components was to assure dependability and longevity, a secondary benefit quickly became of prime importance. That benefit was the ability to coordinate a variety of components of known design characteristics into a cooling tower of assured thermal performance predictability. Paharpur’s philosophy of component design has been and continues to be to assess the value of a development only in terms of its effect upon the total cooling tower system. Particular fill, fans, fan cylinders, etc., tend to optimize within a very narrow range of tower configurations and design parameters. Consequently, a considerable variety of individual components is required in order to achieve a near-ideal combination for any operating circumstance. And it is imperative that these components be designed and rated within a cooling tower system context.

FILL
Vacuum formed polynyl chloride (PVC) sheets are solvent welded into a cross corrugated configuration to provide maximum heat transfer surface with minimum pressure drop.

ELIMINATOR
Drift eliminators are formed from PVC sheets into a cellular configuration which forces exhaust air into three complete directional changes to eliminate water droplets from the airflow. The 3-pass eliminator provides maximum efficiency in drift elimination at minimum power consumption.

SPEED REDUCER
Designed and manufactured to furnish extended service life, the Paharpur Series 20T and 22.2 gear reducers used in CF3 towers have an overall mechanical efficiency of 94 - 97%. Their rugged design has been proven by years of field operational experience worldwide.

FAN
Designed, tested and manufactured by Paharpur, fan blade material is cast aluminium alloy. Fan sizes and materials are selected to provide the most efficient solution to any cooling tower application requirement. The entire fan assembly is statically balanced prior to shipment.
**DRIVE SHAFT**
Utilizing floating tubular shafts and neoprene flexible elements, Paharpur designed and manufactured drive shafts do not require lubrication and are dynamically balanced prior to shipment.

**DISTRIBUTION SYSTEM**
Uniform hot water distribution is guaranteed by Paharpur's injection moulded polypropylene nozzles, incorporating a unique diffusion ring for spray development distribution. This nozzle system is specially designed to function under low operating heads for greater energy efficiency. Large diameter orifices contribute to overall reduced maintenance costs.

**FAN CYLINDER**
Fan cylinders are Paharpur designed and manufactured fibre reinforced plastic (FRP), moulded to provide a large entrance flap smooth approach to the fan and close lip clearances for maximum efficiency and reduced operating costs.

**STRUCTURE**
Structural components are pultruded FRP composites. Columns are 65 mm X 65 mm nominal box section with minimum 5 mm wall thickness and carry loads to anchor castings. Columns are spaced on no greater than 1520 mm centres both longitudinally and transversely. Diagonal and other structural connectors are through-bolted.

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**TYPICAL TOWER SCHEMATICS - PLAN VIEW AND ELEVATION (SINGLE CELL) FOR DETAILED ENGINEERING DATA SEE TABLE 1 ON NEXT PAGE**
### Table 1: Tower Engineering Data

<table>
<thead>
<tr>
<th>Model No.</th>
<th>Dimensions (mm)</th>
<th>No. of MW inlet/Outlet (N)</th>
<th>Fan Type (Dia.)</th>
<th>Fan RPM</th>
<th>Motor HP (kW)</th>
<th>Gearbox Series</th>
<th>Gearbox Ratio</th>
<th>Drive Shaft Series</th>
<th>Flow (LPM)</th>
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<td>H-3</td>
<td>535</td>
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<td>20T</td>
<td>2.71</td>
<td>6Q</td>
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<tr>
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<td>1/1</td>
<td>H-3</td>
<td>535</td>
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<tr>
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<td>305 305</td>
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<td>20T</td>
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</tbody>
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* For models with 1 hot water inlet, the inlet flange is to the right of tower center. Multi-cell models also available. Details available on request.
OPERATIONAL AND ENVIRONMENTAL CONSIDERATIONS

ENCLOSURES
Occasionally, cooling towers are located inside architectural enclosures for aesthetic reasons. Although Paharpur cooling towers adapt well to enclosures, the designer must realize the potential impact of a poorly arranged enclosure on the tower's performance and operation. The designer must take care to provide generous air inlet paths, and the minimum distance specified should be observed.

NOISE LEVEL
Sound produced by a series CF3 tower operating in an unobstructed environment will meet all but the most restrictive noise limitations and will react favorably to natural attenuation. Where the tower has been designed to operate within an enclosure, the enclosure itself will usually have a dampening effect on sound. Sound also declines with distance by about 5 dBA each time the distance doubles. Where noise at a critical point is likely to exceed an acceptable limit, you have several options listed below in ascending order of cost impact:

- In many cases, noise concerns are limited to nighttime, when ambient noise levels are lower. Such situations are tackled by using two (2) speed motors in either 1500/7500 or 1500/750 rpm configuration, and operating the fans at reduced speed instead of “cycling” at full speed. Typical sound reductions are 9 dBA at two-thirds fan speed or 15 dBA at half-speed. This is a relatively inexpensive solution and pays for itself quickly in reduced energy costs.
- Where noise is a concern at all times (for example, near a hospital) the best solution is to oversize the tower so it can operate continuously at reduced motor horse power.
- Extreme cases may require inlet and discharge sound attenuator sections; however, the static pressure loss imposed by attenuators may necessitate an increase in tower size. This is the least desirable approach because of significant cost impact and because of obstruction to normal maintenance procedures.

APPROPRIATE CF3 APPLICATIONS

TYPICAL APPLICATIONS
Although CF3 is a premium-value cooling tower targeted for those applications that demand a high degree of corrosion resistance as well as an aesthetically pleasing appearance, it is routinely applied in virtually all normal systems requiring cold water for the dissipation of heat. Some common applications include:

- Condenser water service for air conditioning and refrigeration systems. (They are especially adaptable to Free Cooling applications).
- Jacket water cooling for engines and air compressors.
- Chemical and industrial processes.
- Batch cooling.
- Welding cooling.
- Plastic industry processes.
- Dairy, citrus, and other food industry processing where water contamination is not likely to occur.
PAHARPUR SERIES CF3
COOLING TOWER SPECIFICATIONS

DESCRIPTION
Supply and install a CTI Certified (as per CTI STD-200) induced draught, counterflow, field-erected cooling tower of cells, as shown on plans. Tower shall be similar and equal in all respects to Paaharpur Series CF3 model ________.

PERFORMANCE
The tower shall be capable of cooling ________ CMH of water from ________°C to ________°C at a design wet bulb temperature of ________°C. The cooling tower manufacturer shall guarantee the performance of the tower as installed according to plans.

CONSTRUCTION
The cold water basin, fan deck and fan cylinder shall be formed of insert fibre-reinforced plastic (FRP). All hardware shall be fabricated of HDG Steel. Structural columns will be of pultruded FRP. Mechanical equipment support structure, fan guards will be of HDG steel.

MECHANICAL EQUIPMENT
Fan(s) shall be axial propeller type, incorporating heavy duty blades of cast aluminium alloy. Blade pitch angle shall be individually adjustable. Fan(s) shall be driven through a right angle, industrial-duty, oil-lubricated, geared speed reducer. Speed reducers employing pulleys and belts shall not be acceptable. Motor(s) shall be HP, TEFC weather proof, squirrel cage induction type. Speed and electrical characteristics shall be ________ RPM, single winding, 3 phase, ________ hertz ________ volts. Motor shall be located outside the humid interior of tower, in a corner on the fan deck. The motor shall be connected to the gear reducer by a dynamically balanced HDG steel driveshaft equipped with neoprene flexible coupling elements. A neoprene oil gauge and drain line shall extend from the gear reducer to the motor enclosure, and shall be equipped with an easily visible oil sight glass. The mechanical equipment for each cell shall rest on a rigid HDG steel support that resists misalignment between the motor and the gear reducer.

FILL & DRIFT ELIMINATORS
Fill shall be film-type vacuum-formed PVC sheets with a flute size of 12 mm, solvent welded into a cross-compartment configuration to provide maximum heat transfer surface with minimum pressure drop. Air inlet faces of the tower shall be free of water splash-out, and guaranteed drift losses shall not exceed 0.005% of the design water flow rate. Drift eliminators shall be formed from PVC sheets into a cellular configuration which forces exhaust air into three complete directional changes i.e. 3-pass to eliminate water droplets from the air stream. Louvers shall be of FRP.

HOT WATER DISTRIBUTION SYSTEM
Hot water shall be distributed over the fill by injection moulded polypropylene nozzles and diffuser rings. Nozzles shall have a threaded connection to PVC distribution pipes. Distribution piping rests on traverse beams.

COLD WATER BASIN & ACCESSORIES
The FRP cold water basin shall be sealed watertight and shall include a float-operated mechanical make-up valve, a 100 NB diameter drain-overflow connection and an HDG steel debris screen with side outlet for cold water.

WARRANTY
The manufacturer shall warrant the entire tower (including the motor) against deficiency in performance and failure due to defects in materials and workmanship for a period of at least eighteen (18) months following shipment to the site or 12 months after the date of startup, whichever is sooner.

SCOPE OF WORK
The cooling tower manufacturer shall be responsible for the design, fabrication, and delivery of materials to the project site, and for the erection of the tower over new foundation provided by others.

Note: FRP cold water basin can be substituted by an extended concrete basin (by purchaser). In this case, basic accessories will also be delivered from Paaharpur's scope and therefore not be required.