



Series 9KF



PULTRUDED FRP INDUCED DRAFT COUNTERFLOW COOLING TOWERS



PAHARPUR SERIES 9KF FIBREGLASS COUNTERFLOW COOLING TOWER

Paharpur's series 9KF induced draft cooling tower represents the culmination of more than 50 years of counter flow design experience. With polyvinyl chloride fill and glass reinforced polyester structural, basin and casing, the series 9KF continues a tradition of excellence.

Improvements and innovations in structure and component designs produce in the series 9KF a heavy-duty, energy efficient and dependable cooling tower unrivaled in the industry. Perhaps most importantly, all major components responsible for this breakthrough have been developed, manufactured, applied and guaranteed by one single source company – Paharpur. Without question, the series 9KF establishes a new state of the art in counter flow cooling tower design.

PAHARPUR'S INTEGRATED SYSTEMS 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 fills, 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.

Paharpur has all such variety of components. Their capabilities are well known because they were designed and manufactured by Paharpur.

STRUCTURE: Structural components are glass fibre pultruded composite. Columns are 65 X 65 nominal box section with a 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.

Structure is designed based on wind load of 150 kg/m² and in accordance with CTI standard ESG-152.

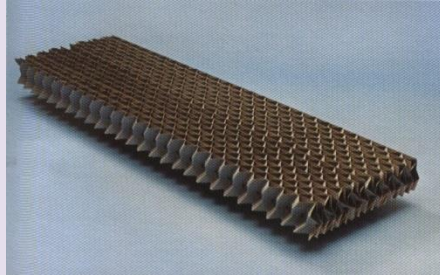
Pultruded FRP is far superior to HDG steel in terms of corrosion-resistance and, therefore, life of the cooling tower. In fact, FRP is ideal for wet, corrosive conditions encountered during cooling tower operation. The pultrusion process produces fibreglass components of extremely high standard, with consistent strength and performance, and a strength-weight ratio much higher than that of steel in the length-wise direction. The final strength in compression and tension is approximately equal to that of steel. FRP also reduces the hazard of electrical shock compared with steel structure towers. Finally, for the environmentally conscious, the carbon footprint of the pultruded FRP production process is lower than that of steel's.

Pultruded FRP structure cooling towers are now the standard worldwide and especially in USA. We have multiple installations in India and countries across the world, such as UAE (Dubai), Saudi Arabia, Kazakhstan, Chile and New Caledonia.

FILL: Vacuum formed 0.3 mm thick polyvinyl chloride (PVC) sheets with a flute size of 12 mm are solvent welded into a cross corrugated configuration to provide maximum heat transfer surface with minimum pressure drop and pump head. These have a flame spread rating less than 25 mm as per ASTM D635.



ELIMINATOR: Drift eliminator panels are formed from 0.5 mm thick PVC sheets into a cellular configuration which forces exhaust air into three complete directional changes to eliminate water droplets from the air stream. The 3-pass eliminator provides maximum efficiency in elimination up to 0.005% of circulating water flowrate at the very minimum in horse power consumption. These also have a flame spread rating less than 25 mm as per ASTM D635.



SPEED REDUCER: Designed and manufactured to furnish extended service life in industrial water cooling applications, Paharpur gear reducers have an overall mechanical efficiency of 95%. They are rated in accordance with CTI STD-111 and have a service factor of over 2.0. Their rugged design has been proven by years of field operational experience worldwide.



FAN: Designed, tested and manufactured by Paharpur. Fan materials include cast aluminium alloy, glass reinforced polyester, and glass reinforced epoxy. Fan sizes and materials are selected to provide the most efficient solution to any cooling tower application requirement. Fan assembly is balanced per balance quality grade G 6.3 as mentioned in the standard ISO 1940.



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.

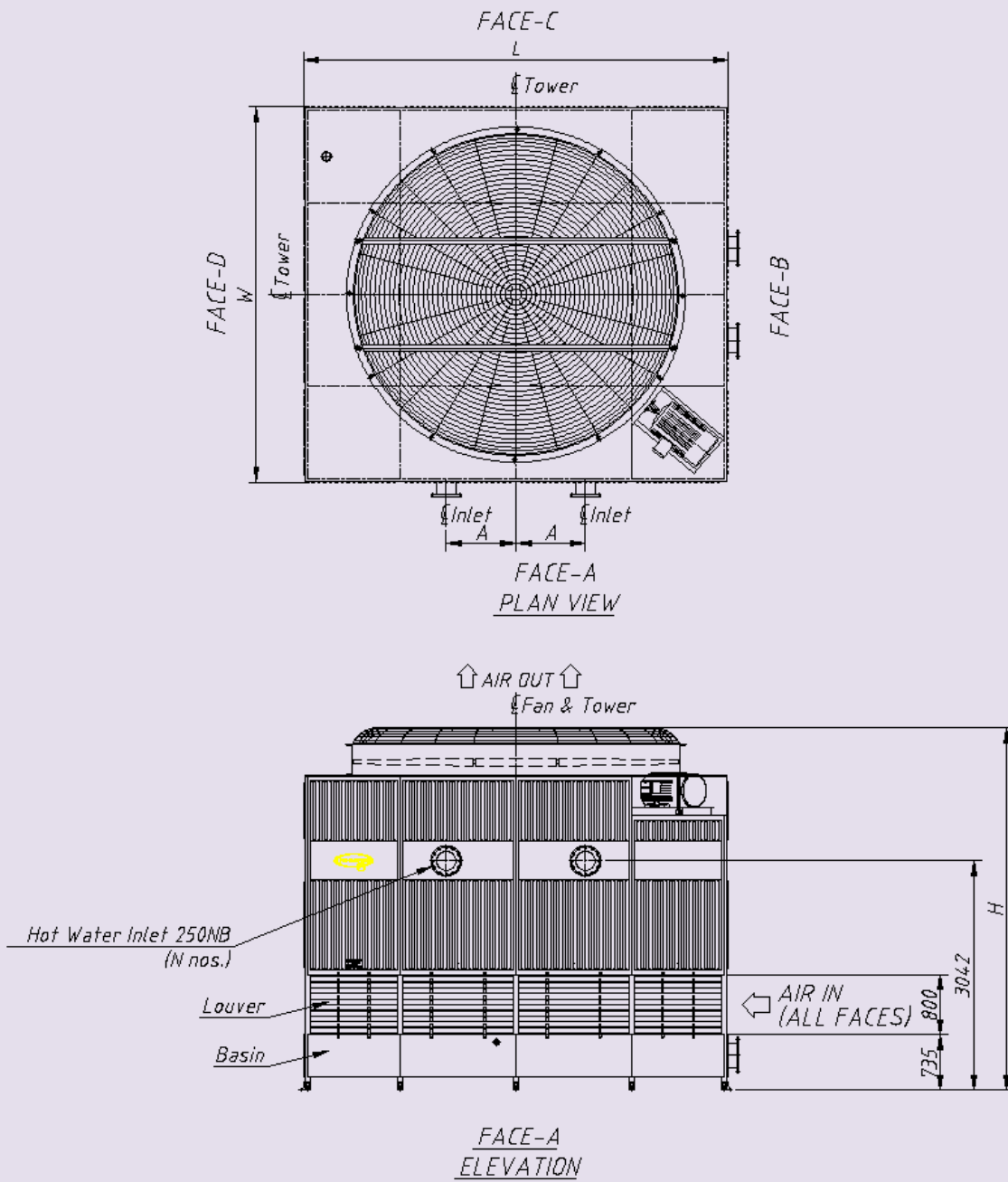


DISTRIBUTION SYSTEM: Uniform hot water distribution is guaranteed by Paharpur's injection moulded polypropylene nozzle, incorporating a unique diffusion ring for spray development distribution. This nozzle system is specially designed to function under low operating heads for greater energy efficiency.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



FAN CYLINDER: Fan cylinders are Paharpur designed and manufactured glass reinforced polyester (GRP), molded to provide a large entrance flair, smooth approach to the fan, and close tip clearances for maximum efficiency and reduced operating costs.





Typical tower schematic
(Single Cell)

For detailed engineering data refer Table 1

Table 1
Tower Engineering Data

Tower Model (Only TB)	Length (mm)	Width (mm)	Height up to fan deck (mm) H ₁	Total Height up to fan guard (mm) H ₂	Motor HP	Fan				Gear box		Drive Shaft	No. of water distribution nozzles	No. of inlets & outlets
						Type	Dia (Inch)	No. of blades	Speed (rpm)	Sr.	Ratio			
91441	2546	2546	4181	4702	7.5	H-3	72	6	535	20T	2.71	6Q	16	1
91442					10			8						
91443					15									
91451	3146	2546	4181	4702	7.5	H-3	72	8	535	20T	2.71	6Q	20	1
91452					10									
91453					15									
91454					20									
91552	3146	3146	4181	4733	10	H-3	96	8	444	20T	3.27	6Q	25	1
91553					15									
91554					20									
91555					25									
91562	3766	3146	4181	4733	10	H-3	96	8	444	20T	3.27	6Q	30	1
91563					15									
91564					20									
91565					25									
91566					30									
91662	3766	3766	4181	4733	10	H-3	120	9	266	22.2	5.50	6Q	36	1
91663					15									
91664					20									
91665					25				320		4.56			
91666					30									
91667					40									
91672	4366	3766	4181	4733	10	H-3	120	9	266	22.2	5.50	6Q	42	2
91673					15									
91674					20									
91675					25				320		4.56			
91676					30									
91677					40									
91772	4366	4366	4181	4812	10	H-3	144	9	320	22.2	4.56	6Q	49	2
91773					15									
91774					20									
91775					25									
91776					30									
91777					40									
91778					50									
91782	4986	4366	4181	4812	10	H-3	144	9	320	22.2	4.56	6Q	56	2
91783					15									
91784					20									
91785					25									
91786					30									
91787					40									
91788					50									
91882	4986	4986	4181	4812	10	H-3	168	12	266	22.2	5.50	175	64	2
91883					15									
91884					20									
91885					25									
91886					30									
91887					40									

Tower Model (Only TB)	Length (mm)	Width (mm)	Height up to fan deck (mm) H ₁	Total Height up to fan guard (mm) H ₂	Motor HP	Fan				Gear box		Drive Shaft	No. of water distribution nozzles	No. of inlets & outlets
						Type	Dia (Inch)	No. of blades	Speed (rpm)	Sr.	Ratio			
91888	4986	4986	4181	4812	50	H-3	168	12	266	22.2	5.50	175	64	2
91889					60									
91892	5586	4986	4181	4812	10	H-3	168	12	266	22.2	5.50	175	72	2
91893					15									
91894					20									
91895					25									
91896					30									
91897					40									
91898					50									
91899					60									
91992	5586	5586	4181	4812	10	H-3	168	12	266	22.2	5.50	175	81	2
91993					15									
91994					20									
91995					25									
91996					30									
91997					40									
91998					50									

Tower Only ('TO') models are also available. Multi cell models are available in both 'TO' and 'TB' configurations. Details are available on request.

Optional Extras:

- 1) Fixed type HDG steel ladder.
- 2) Lube line with sight gauge options.
- 3) Vibration Limit Switch.
- 4) Low Oil Level Switch for Gear Reducers.
- 5) Perimeter Handrail.
- 6) SS304/SS316 Structural Hardware.
- 7) FRP fan blade in lieu of cast aluminium alloy fan blade.

OPERATING AND ENVIRONMENTAL CONSIDERATIONS

ENCLOSURES

Occasionally, cooling towers are located inside architectural enclosures for aesthetic reason. Although the Paharpur cooling towers adapt well to enclosures, the designer must realise 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 9KF tower operating in an unobstructed environment will meet all but the most restrictive noise limitations and will react favourably 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 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 night-time, when ambient noise levels are lower. Such situations are tackled by using two (2) speed motors in either 1500/1000 or 1500/750 rpm configuration; and operating the fans at reduced speed without cycling "after hours". 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 (1000 or 750 rpm) motor speed. Typical sound reductions are 7 dBA at two-third fan speed or 10 dBA at half speed.
- 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 9KF APPLICATIONS

TYPICAL APPLICATIONS

Although the 9KF 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.
- Welder cooling.
- Plastic industry processes.
- Dairy, citrus, and other food industry processing where water contamination is not likely to occur.

PAHARPUR 9KF COOLING TOWER SPECIFICATIONS

DESCRIPTION

Supply and install an induced draught, counterflow, field-erected FRP cooling tower of cells, as shown on plan. Tower shall be similar and equal in all respect to Paharpur 9KF model.....

PERFORMANCE

The tower shall be capable of cooling..... USGPM 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, fan cylinder and access door shall be formed of inert fibre-reinforced polyester (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 propeller type, incorporating heavy duty blades of cast aluminium alloy or high strength, inert composite material (FRP). Blades 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 will not be acceptable. Minimum service factor of speed reducers should be 2. Motor(s) shall be..... HP, TEFC weather proof, squirrel cage induction type. Speed and electrical characteristics shall be 1500 RPM, single winding, 3 phase, hertz volts. Motor shall be located outside the humid interior of tower, in a corner on the fan deck. Dual speed motor(s) should be offered as an option at extra price. 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 are solvent welded into a cross corrugated configuration to provide maximum heat transfer surface with minimum pressure drop and pump head. These have a flame spread rating less than 25 mm as per ASTM D635. 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 eliminator panels are 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

The FRP hot water distribution basin shall be equipped with metering orifice-type polypropylene nozzles to deliver incoming water by pressure to the fill. Nozzles shall be easily removable and replaceable.

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 mm diameter drain-cum-overflow connection and an HDG steel debris screen with side outlet.

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 RCC foundation provided by others.

Note: FRP cold water basin can be substituted by concrete basin (by purchaser). In this case, basin accessories will also be deleted from Paharpur's scope and Louvers will be deleted and the purpose of the same will be served by extended RCC basin (not in Paharpur's scope).

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