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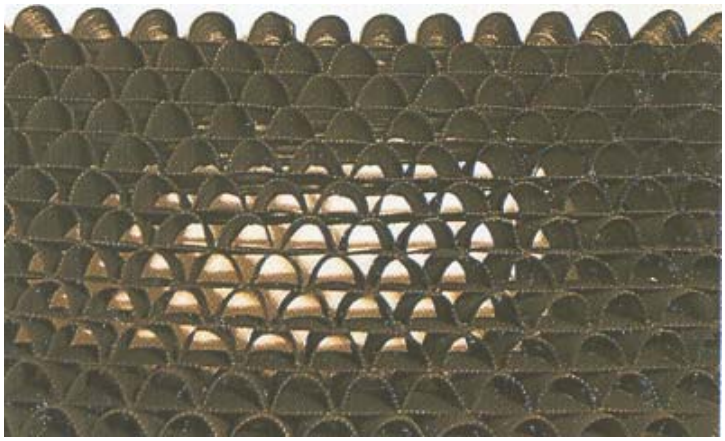
MAINTENANCE SOLUTIONS FOR YOUR COOLING TOWERS



HEAT-EXCHANGE FILLS AND DRAFT ELIMINATORS

RALCO'S FILM FILL

A determinant component of the thermal and energetic efficiency of a cooling tower is the wet deck surface, where the heat exchange takes place.

A cooling tower fill shall enhance the heat dissipation. This is achieved by increasing the contact time between the water and the air. The presence of large wet surfaces, formed for example by thin water films, enhances the contact time.

The wet deck surface should be formed of a low cost material and should be easy to install. In addition to yield a good heat-exchange, the fill has to facilitate the air flow to minimize the pressure drop. Moreover, the fill has to keep a uniform distribution of the water and air along its lifetime. Great decay resistance is another required parameter for a fill.

RALCO's film fill fulfils each and every requirement that shall be expected to the most efficient heat-exchange fill. The deck surface shall avoid:

- The easy clogging and fouling of the fills formed of crisscrossed waved surfaces. This design presents many sites were the fouling can accumulate, it is difficult to clean and has a high air pressure drop.
- The fragility and mechanical instability of the deck surfaces manufactured with very thin films and assembled with a gluing procedure. This fills are easy to destroy, even by the fall of the water.
- The aging of the fill due to an increase of the fragility, caused by temperature changes, cleanings, etc.
- The small thermal efficiency due to small characteristic heat-exchange surface.

Moreover, the fill shall be adaptable to any type of cooling tower.

1. MANUFACTURE

RALCO's fill is manufactured with grating film, which provides the support for water. The film is welded mechanically forming channels of triangular section. The final fill block is a compact packing with triangular flutes.

The grating film of the deck surface is of high density polyethylene, following the Spanish norm UNE 62.001. Polyethylene threads with a diameter of 0.7 mm are crisscrossed to form a rhombus type mesh, where the size of the rhombus is 2.0 x 3.0 mm.

RALCO's film fill is manufactured in blocks of standard dimensions of 1000 x 500 x 200 mm (other sizes are optional). The blocks have a great mechanical stability and a high capacity to support weights, due to the specific resistance of the mesh and of the vertical welds.

2. PRINCIPLE OF OPERATION

The mesh with rhomboid intersections has been designed in order to fill the mesh holes with water due to the interface tension between the water and the polyethylene. In this way, a continuous film of water is formed and the wetability is guaranteed on both sides of the mesh. This continuous water film maximizes the air/water interphase area, yielding a high cooling capacity and the complete usage of the entire mesh surface.

The wet deck surface is wetted by the falling water, which is in contact with the ascending air that flows through the triangular channels. The channels, due to its large section, are impossible to clog by dirt or other particles.

The experience has shown that the continuous water film remains inalterable in spite of the formation of deposits in the mesh. The fouling, that can be formed either from the

water or from the air, is also permeable and do not prevent the fall of the water. Therefore, the clogging of the mesh holes would not alter the water film.

3. CHARACTERISTICS

RALCO's film fill has achieved the optimization of the following parameters:

Thermal efficiency:	Contact area of 240 m^2/m^3 of fill. The fill blocks can be piled up to a maximum of 2000 mm.
Aerodynamic resistance:	The wide triangular channels, where the air flows, have a small aerodynamic resistance. It should be noticed that additional systems to distribute the water are unnecessary due to the mesh effect. This parameter allows RALCO's fill to be used in any type of cooling tower.
Performance in industrial conditions:	The material used for the fill, high density polyethylene, can not be chemically attacked in normal industrial conditions, either from the water or from the air. The fill can not get rotted, and it keeps its mechanical rigidity up to the 75 ºC.
Performance stability:	Under normal conditions of water and air, either in industrial or urban environments, the fill keeps its performance for many years due to its mechanical stability.
Installation and maintenance:	The materials and the manufacturing procedure used yield very light and flexible fill blocks. The easy handling of the blocks allow a simple and quick installation in any type of cooling towers. The straight shape of the vertical channels permits the usage of high pressure water to clean the blocks. In many cases, the cooling tower doesn't have to be dismantled. In the worst case, the blocks can be submerged in an acid solution to dissolve the fouling deposits.
Thermal properties:	Vicat softening point at 100 ºC Glass transition temperature at -125 ºC

Chemical properties:	Insoluble in organic solvents Resistant to aqueous solutions in the range of pH between 4 and 12.

4. PERFORMANCE CURVES AND TABLES

The characteristic thermodynamic parameter of the Merkel model (K) has been found in pilot plant, and the values at different fill heights are shown in the Table 1. This table and the Figure 1 allow to calculate the necessary fill height for given operation conditions.

TABLE 1: K values at different fill heights

Height, mm.	600	800	1.000	1.200	1.600	2.000
K	1,59	1,92	2,31	2,66	3,35	4,00

The Table 2 shows the aerodynamic resistance coefficients or of pressure drop P.

TABLE 2: Pressure drop coefficients (P) at different fill heights (in dynamic pressures with a normal air density of 1.1 kg/m^3)

Height, mm.	600	800	1.000	1.200	1.600	2.000
P	10	14	17	20	28	34

Selection example:

It is needed to cool down 240 m^3/h of water from 40 ºC to 30 ºC with 150 Tn/h of air, at a wet-bulb temperature of 24 ºC, using an air velocity inside the tower of 2.8 m/s.

Temperature difference:	R = 40 – 30 = 10 ºC
Approximation:	A = 30 – 24 = 6 ºC
Wet-bulb temperature:	T_H = 24 ºC
Ratio water/air:	L/G = 240 / 150 = 1.6

From R = 10 go horizontally up to the curve of A = 6. From this point go down vertically to the curve of T_H = 24. Go horizontally again to the graph in the right side up the L/G value specified, in this example L/G = 1.6. Read at the lower axis the value of the coefficient K: K= 2.2. For this K value it would be necessary to install a fill height of 1000 mm (see Table 1). The coefficient of pressure drop for this fill height is of 17 dynamic pressures. Therefore, the pressure drop of the air through the deck surface would be of 7.41 mm H_2O.

FIGURE 1. PERFORMANCE GRAPHS OF RALCO'S FILM FILL