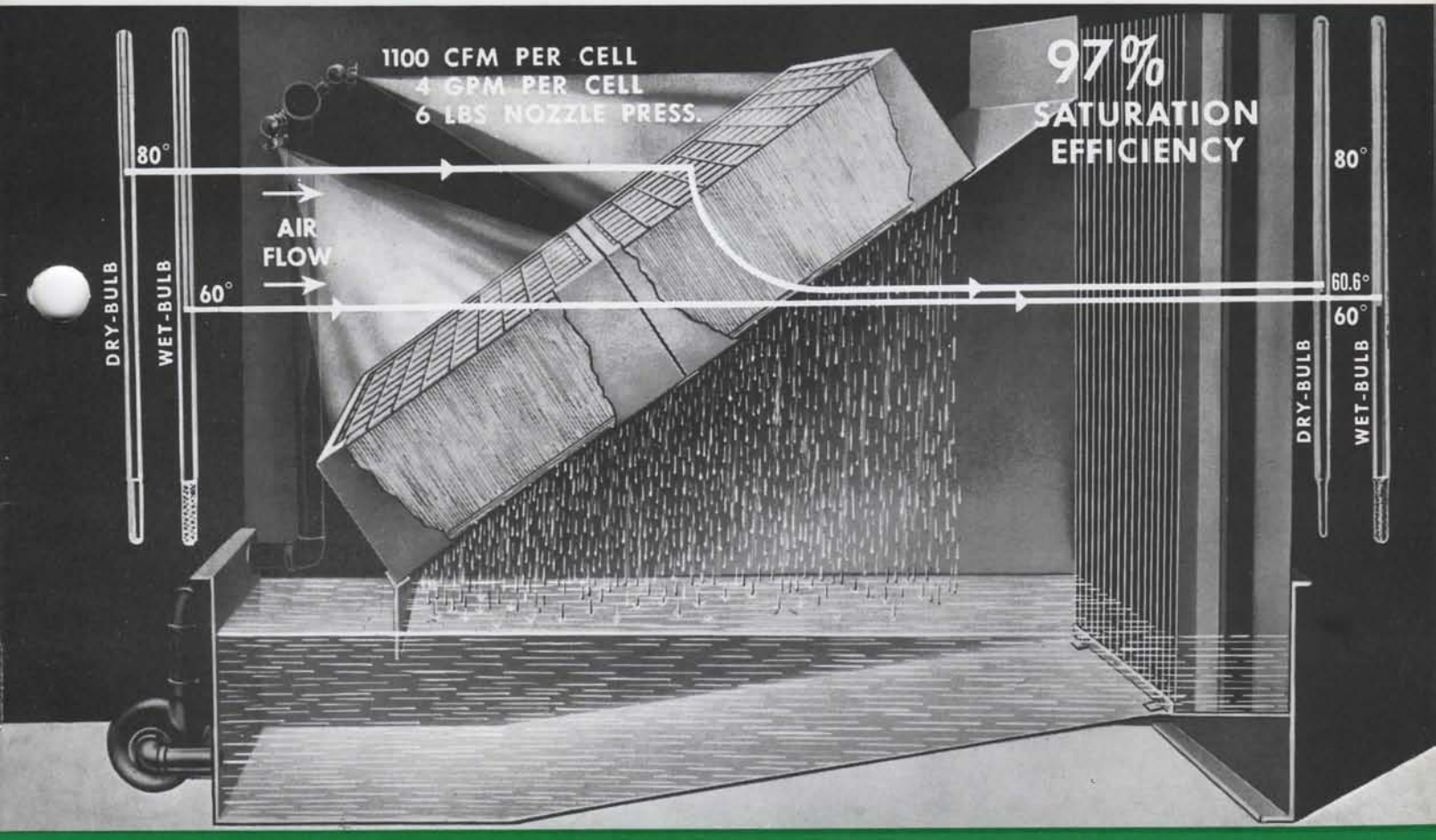
SHELDONS
CAPILLARY®
AIRWASHERS

Catalogue No. 1025



AIR HUMIDIFICATION
AIR CLEANING
AIR COOLING
AIR DEHUMIDIFICATION

SHELDONS ENGINEERING LIMITED
CAMBRIDGE, ONTARIO, CANADA

SHELDONS CAPILLARY® AIRWASHERS

GENERAL

Sheldon Capillary Airwashers represent one of the most outstanding advances made in air-conditioning equipment within recent years. Air and water are brought together in minute quantities that considerably improve upon other methods of mixing air and water for the purposes of washing, humidification and dehumidification.

This results in exceptionally high efficiency. The Capillary Airwasher with its Capillary cells, casing, tank, nozzles and pump, provides a fundamentally superior basic element for airwashing, cooling or humidity control.

APPLICATIONS

Sheldon Capillary Airwashers may be employed as humidifiers or dehumidifiers in standard central station type air-conditioning units. Capillary Airwashers are recommended for all applications where maximum air-cleaning efficiency and high saturation efficiencies are required. Some applications are listed below.

Public building air-conditioning.
Commercial and industrial air-conditioning.
Hospital air-conditioning.
Biological laboratory air-conditioning.
Evaporative cooling.
Motor and generator cooling.

CLASSES OF CAPILLARY AIRWASHERS

CLASS 1—CONCURRENT TYPE

This design requires a minimum length, and with air and water flow passing through cells in the same direction offers extremely low air resistance. The units are normally selected for the rated capacity of 1100 cfm per cell to provide maximum capacity for the most economical space requirements.

Cells are arranged in banks two high as standard, with a drain pan between banks to prevent water from one cell passing on to a lower cell. Smaller size units can also be furnished to meet specific requirements.

The low head spray nozzles provided with Capillary Airwashers permit use of economical pump selections and low operating costs.

CLASS 3—CONCURRENT TYPE (With Cooling Coils)

These units involve the use of cooling or heating coils between the Capiliary cells and the eliminators of the Class 1 washers. the cooling coil may be connected in a closed circuit to a separate cooling supply or alternatively, where a supply of well water is available, a reduction in the number of rows deep in the cooling coil may be achieved if the cooling water is sprayed over the Capillary cells after passing through the coils.

The Capillary cell in advance ot the coil keeps the coil clean, provides economy of evaporative cooling when entering wet bulb conditions permit, and offers year-round humidity control.

THE CAPILLARY CELL

The efficiency of a system for the humidification, dehumidification, cooling or cleaning of air is dependent upon the degree of contact between the air and the humidifying or cooling medium. The Capillary Airwasher is designed to achieve this high efficiency of contact by dividing the air into fine streams, each flowing through low resistance channels between wetted strands of glass fibre.

The basic unit of the Capillary Airwasher is the Capillary cell. Each cell is manufactured with a metal casing, 20" x 20" x 8½" nominal size, fitted with glass filaments .011" diameter and 9" long.

There are approximately 57,000 strands of glass fibre in each cell having a surface contact area of approximately 125 sq. ft. per cell. The airflow is thus divided up into tens of thousands of minute streams, each passing through the interstices of the fibres. As the fibres are continuously wetted, the most intimate contact between the minute quantities of air and water is assured.

Actually, although the fibres appear to fill the cell completely, they occupy only 1½% of the total cell volume. This accounts for the remarkably low air resistance through the washers. (See Table 1 on page 7.

Regardless of the water quantity supplied, a cell will retain approximately 6 pounds of water. This amount, spread over the 125 sq. ft. of glass fibres contact area, furnishes a film less than .01" thick.

RATED AIR AND WATER CAPACITIES OF CAPILLARY CELLS

Capillary cells are designed for a maximum airflow of 1100 cfm per cell and a maximum water flow of 9 USGPM per cell. These values should not be exceeded as water carry-over and cell plugging may occur at greater values.

The quantity of water circulated will vary from 4 GPM per cell for humidifying to a normal maximum of 9 GPM per cell for cooling and dehumidifying.

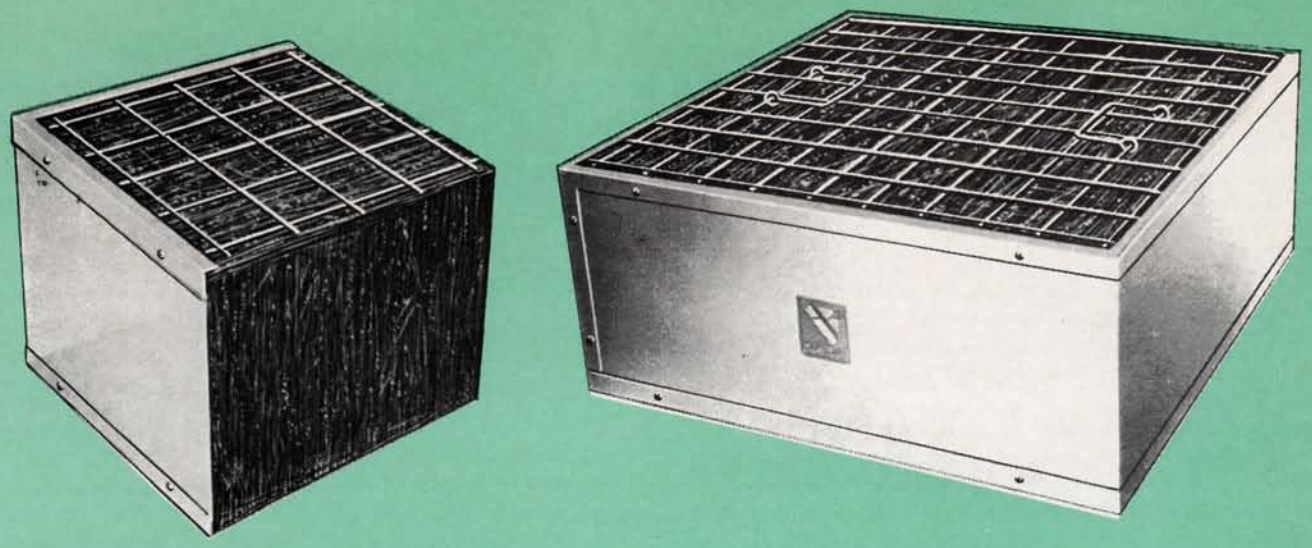


FIG. 1 — Standard Capillary cell. Cut-away view shows the alignment of glass fibres.

SELF-CLEANING CAPILLARY CELLS

The constant flow of water through the Capillary cell, combined with the smooth and parallel arrangement of the filament, carries the dust particles through the cell to a settling tank where they are collected by a strainer or ultimately flushed to the sewer.

Under normal conditions, the self-cleaning action of Capillary cells allows long periods of operation with no measurable increase in resistance to airflow. Where some of the particles arrested by the cell may be of a character to coagulate upon the filament, such as forms of grease or other sticky substances, periodic cleaning procedures have been developed which permit cleaning of the cells in place by the addition of wetting agents in the washer tank water, to meet specific requirements. In such instances, a regular schedule for cleaning may be desirable.

For installations where the air carries large pieces of flying lint as in cotton mills or other industries where similar foreign materials are present, a simple preliminary screen or filter should be used ahead of the Capillary Airwasher to prevent buildup on the cell.

SPRAY NOZZLES

Nozzles are arranged on headers positioned to give uniform coverage over the cells without excessive mist or splashing, two nozzles being used to flood each Capillary cell, thus preventing any appreciable loss in efficiency should one nozzle become plugged. The nozzles used are of a special construction that has been developed to provide a square spray pattern to ensure even water distribution over the entire face of the Capillary cell as shown below. Also, this large orifice ensures a nozzle relatively free from plugging.

Since the air-cleaning efficiency is determined by the wetted surface of the fibres in the cell, the quantity of water flowing may be kept to a minimum as long as the surfaces are thoroughly covered. 3 USGPM/cell gives adequate coverage with well adjusted nozzles. However, to be certain of washing down all dust particles, 5 USGPM/cell is recommended. For extra heavy duty concentrations, 7 to 9 USGPM/cell should be used to keep the cell thoroughly flushed.

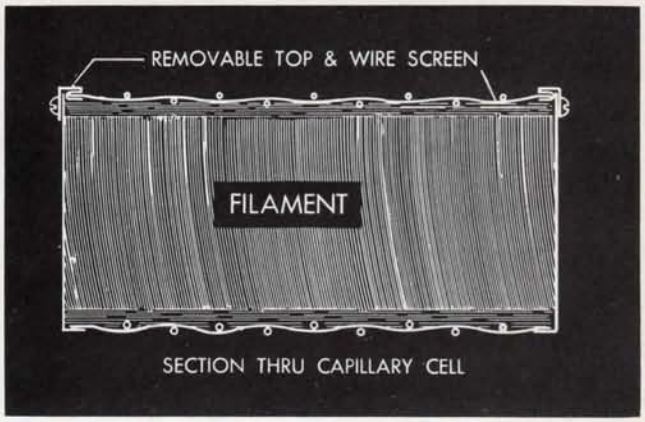


FIG. 2 — Sectional drawing, showing details of construction of Capillary cell.

To accommodate the full range of water capacities mentioned above, a choice of two sizes of nozzles is provided, ½" or ¾" size. The required nozzle size can be selected from the graph indicated on Page 4.

FIG. 3 — View showing square spray pattern obtained with special nozzles.

ELIMINATORS

The spray water leaving the cells is formed into large drops and coalesces into streams without any noticeable mist. This fact makes elimination of entrained moisture extremely simple.

Classes 1 and 3 Airwashers are furnished with galvanized steel eliminators as standard, but stainless steel or copper eliminators can also be provided. Plastic eliminators of rigid PVC can also be furnished where it is necessary to meet specific requirements.

The eliminators have three bends with two hooks for preventing water carry-over and are spaced on 1⅛" centres. Easy maintenance is ensured by designing each eliminator to be individually removable.

MAKE-UP WATER SUPPLY

Sheldon Capillary Airwashers are provided with a make-up water connection regulated by a float valve to supply water lost by evaporation, and an overflow connection. A quick-fill connection for filling the tank after cleaning is also provided. This should be cracked open during operation to provide dilution of spray water to avoid build-up of solids concentrations and dissolved gases.

A strainer is provided over the suction inlet to prevent foreign matter from clogging the nozzles.

AIR CLEANING

A primary requirement of nearly all air-conditioning systems is the removal from the outdoor air, or recirculated air, of as much airborne dust as is economically practicable. Since bacteria and mould spores normally adhere to the larger solid particles, the value of dust and spore-free air is of paramount importance in the air supply to hospitals, food, beverage and drug industries, and pharmaceutical plants.

The photographs show the result of exposing petri dishes containing an incubation agent to the inlet and outlet air of a Capillary Airwasher. All tests were exposed for the same period and were incubated at constant temperature and humidity for 72 hours after exposure. This illustrates the effectiveness of Capillary Airwashers in removing spore and mould-carrying dust particles.

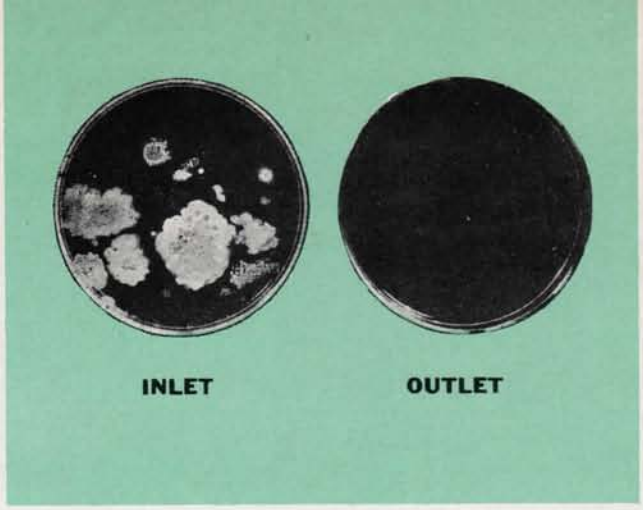


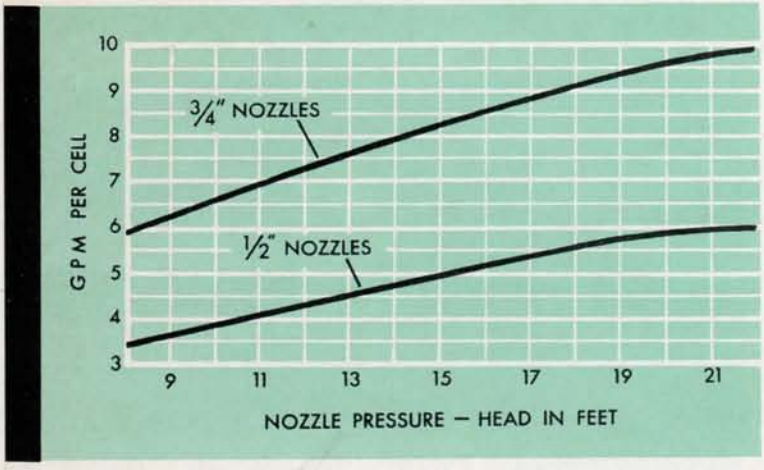
FIG. 5 — Petri dishes with incubating agent exposed to inlet and outlet air of Capillary Airwasher.

Experience with Capillary Airwashers has indicated that, under usual conditions, it can be depended upon to remove practically all normal visible airborne particles.

Many industrial processes involve the discharge of fumes in moderate concentration to the atmosphere where they may be a nuisance to life and property. When such substances are soluble in water, or condensed in contact with water, the use of the Capillary Airwasher offers a simple method of elimination.

Each individual process may have many factors which should be thoroughly studied before a definite recommendation may be made. Our Engineering Department is prepared to co-operate fully on these applications.

FIG. 4 — Nozzle pressures can be selected for various water capacities per cell.



COILS

Class 3 Capillary Airwashers have cooling or heating coils placed between the concurrent Capillary cells (as Class 1) and the eliminators. Coils are copper tube with copper fins, which are of the spiral wound extended surface type.

Coils are suitable for cooling with direct expansion refrigerant, cold water, brine, or heating with hot water or steam.

When using Class 3 Airwashers with well water, it is highly desirable to pass the water in series through the coils and sprays and then to waste. In this way, the cooling effect of the coils is supplemented by the pre-cooling effect of the Capillary cells, while at the same time the air is thoroughly cleaned.

PUMPS

Nozzles do not require high pumping heads and generally operate between 13 and 16 ft. head at the nozzles. To allow for pipe friction, the overall pumping head for pump selection should be approximately 22 ft. plus the height in feet between the tank and top spray header.

HUMIDIFICATION AND EVAPORATIVE COOLING

HUMIDIFICATION

Sheldon Capillary Airwashers are ideally adapted to systems calling for the humidification as well as cleaning of large quantities of outside air, as in air-conditioning installations, hospital operating rooms, textile mills, biological laboratories, and many other applications.

High saturation efficiency is emphasized as an important feature of the Capillary cell and is indicated by the capacity to reduce the temperature of the air to a point essentially the same as the entering wet bulb temperature.

The saturation efficiency does not vary with the amount of water passing through the cell, provided it is sufficient to wet the glass cell fibres thoroughly. Although the saturation efficiency has been maintained with as little as 0.6 USGPM per cell, 5 USGPM is usually employed as a minimum value for air cleaning since it provides a sufficient volume of liquid to flush out the dirt from between the cell fibres.

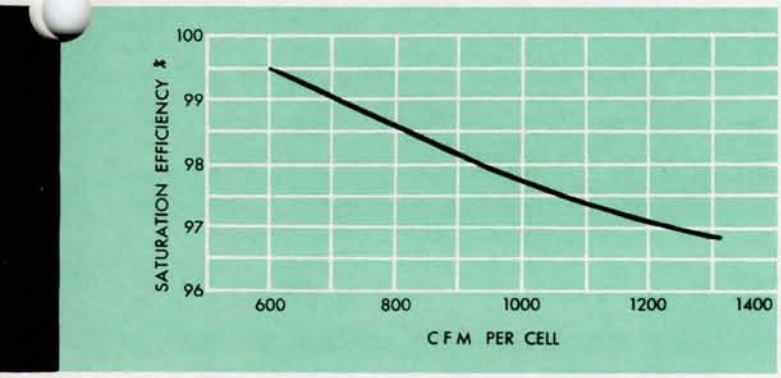


FIG. 6 — Variation of saturation efficiency with air flow.

SATURATION EFFICIENCY

Saturation Efficiency,

$$E_s = \frac{(T_1 - T_3) - (T_2 - T_4)}{T_1 - T_3} \times 100$$

Where T_1 = entering dry bulb temp.
T_2 = final dry bulb temp.
T_3 = entering wet bulb temp.
T_4 = final wet bulb temp.

For adiabatic saturation T_3 and T_4 are approximately equal.

Therefore $T_2 = T_1 - \left[\frac{E_s}{100}(T_1 - T_3)\right]$

By substitution of the value for the saturation efficiency in the above formula, the leaving air condition can be found.

EVAPORATIVE COOLING

Evaporative cooling can often be used to advantage in many places where the prevailing wet bulb temperature is low, and especially in installations where large air changes are involved.

Evaporative cooling is a process of adiabatic saturation in which the sensible heat of the air is used to convert moisture into water vapour. No change in the total heat of the air occurs during this process. The loss in sensible heat is shown as a reduction in the dry bulb temperature to approximately the wet bulb temperature of the entering air.

The Capillary Airwasher with its high saturation efficiency, large reduction in dry bulb temperature, and its excellent cleaning efficiency, is ideally suited for this application.

Example 1: HUMIDIFICATION with heated water

To determine gpm and spray water temperature when heating spray water for humidifying. Air to enter Capillary Airwasher at 45F db and 38F wb, water to be heated to provide 50F wb temperature leaving the Capillary Airwasher. Assume capacity is 1050 cfm/cell.

SOLUTION

Total heat supplied per cell—from Table 3, page 10

$$= \frac{\text{CFM/cell} \times 60}{\text{cfm/lb. air}} \times (\text{total heat lvg. wb} - \text{total heat ent. wb})$$

$$= \frac{1050 \times 60 \times (20.30 - 14.31)}{13.0} = 29{,}100 \text{ BTU/hr.}$$

$\frac{1}{.075} = 13.33$

Referring to Class 1 performance chart on Page 11 enter humidifying side at 29,100 BTU/hr, project vertically upward to intersection of horizontal line from 1050 cfm and 5 gpm/cell assumed. Proceed along line of constant ratio to horizontal reference line. Then vertically to intersection of 38° entering wet bulb temperature line. Project horizontally to right and read required spray water temperature at 65F. (N.B.—A lower spray water temperature could have been obtained if a larger gpm/cell had been used.)

Leaving spray water temperature

$$= \text{spray water inlet temp.} - \frac{\text{BTU/hr./cell}}{500 \times \text{gpm/cell}}$$

$$= 65 - \frac{29{,}100}{500 \times 5} = 53.4\text{F leaving water.}$$

Total gpm would be 5 gpm/cell multiplied by number of cells in the unit.

In the above example, heat was added to the spray water to raise the incoming air to the desired temperature of 50° wb leaving the Airwasher.

The same effect could have been achieved by raising the temperature of the air prior to passing it through the Capillary Airwasher, and allowing the spray water to recirculate without adding heat to it. In this case, the incoming air should be heated to 70F to provide the necessary heat to evaporate sufficient water vapour to maintain the conditions of 50° wb leaving the Airwasher, as shown below.

$$\text{Air temp. rise} = \frac{\text{total heat required per cell}}{\text{cfm/cell} \times \text{density air} \times \text{sp. heat} \times 60}$$

$$= \frac{29{,}100}{1050 \times .075 \times .24 \times 60} = 25.6\text{°F}$$

Final air temperature entering Airwasher
$= 45° + 25.6° = 70.6\text{°F}$.

COOLING AND DEHUMIDIFICATION

DEHUMIDIFYING AND COOLING

Cooling and dehumidification of the air passing through the Capillary Airwasher can be achieved by using a supply of cold water, either from wells or mechanically chilled water. Since this process involves one of heat transfer from one state condition to another, the amount of water required to cool any given amount of air will depend on the mass flow of air, and the air and water temperatures.

The structure of Capillary cells and the efficient contact established between air and fluid is responsible for heat transfer rates not obtainable with the usual spray dehumidifiers.

The maximum water flow, however, is limited to 9 USGPM since above that amount the cell may become clogged. A convenient method of calculating the amount of water required or any other unknown quantity is shown in the figure on Page 11 for Class 1 Capillary Airwashers.

Example 2:
COOLING WITH CHILLED WATER USING CLASS 1 CAPILLARY AIRWASHER

Assume a mixture of outdoor and return air amounting to 1000 cfm per cell is to be cooled from 80° dry bulb and 70° wet bulb to a dew point of 58° leaving the cell. Chilled water is available at 45°. Find the gpm per cell required and the rise in water temperature for a Class 1 Capillary Airwasher.

SOLUTION

From Table 3, Page 10,

Total heat/lb. air at 70° entering wb
=34.09 BTU/lb.

Total heat/lb. air at 58° leaving dew point
=25.12 BTU/lb.

Difference=8.97 BTU/lb.

Wt. of air at 80F=1000/13.9=72 lb./min. per cell.
Heat to be extracted=72x8.97x60=38,750 BTU/hr.

Referring to Class 1 Performance Chart:

1. Project a line from 45° entering water to 70° entering wet bulb line.
2. From the above intersection, drop a vertical line down to horizontal reference line.
3. From this intersection follow a constant ratio line until it intersects with a line projected vertically from 38,750 BTU/hr. on the base line.
4. From this intersection project a horizontal line to the left to intersect with curve for 1000 cfm per cell.
5. From this intersection drop a vertical line to the gpm per cell base line which shows 8.7 USGPM per cell as the water quantity required.

Water temp. rise

$$=\frac{38{,}750}{8.7 \times 8.33 \times 60}=8.9°F.$$

Example 3:
COOLING AND DEHUMIDIFYING WITH CLASS 3 CAPILLARY AIRWASHER

Assume that 1000 cfm per cell of recirculated air is to be washed free of odours and airborne dust particles, using recirculated water in the Airwasher and that air is to be cooled from 80° db and 70° wb to a dew point of 58°. Cooling is to be effected by means of direct expansion cooling coils employing Freon as refrigerant at a suction temperature of 45°F. The saturation efficiency of Airwasher =97.8%.

In this example, the primary purpose of the Capillary Airwasher is to provide purification of the air, not cooling. However, in cleaning the air of odours and dust particles, the Airwasher also reduces the dry bulb temperature of the inlet air by evaporative cooling without altering the total heat of the air.

From the formula on Page 5 with the given saturation efficiency of 97.8%, the final dry bulb temperature of the air

$$=80-\left[\frac{97.8 \times (80-70)}{100}\right]=70.2°F$$

Hence, the air entering the cooling coil is saturated at the inlet wet bulb temperature, and as the process so far has been adiabatic, the cooling load remains unchanged. Thus, from Table 3, Page 10

Total heat/lb. air at 70° ent. wb=34.09 BTU/lb.
Total heat/lb. air at 58° lvg. wb=25.12 BTU/lb.
Difference= 8.97 BTU/lb.

Wt. of air at 80°F and 13.9 cfm/lb.
=1000/13.9=72 lb/min./cell

∴ Heat to be extracted
=72 x 8.97 x 60=38,750 BTU/hr.

Selection of a coil from Aerofin Bulletin D-51 for the above load indicates that a 5 row cooling coil is required.

In this example, a dilution of water into the Airwasher tank would be recommended in order to prevent concentrations of impurities.

The size of the cooling coils applicable to each size of unit is shown in Table 2 on Page 9.

Example 4: COOLING WITH CHILLED WATER USING SERIES FLOW THROUGH CLASS 3 CAPILLARY AIRWASHER

In this example, the chilled water is first passed through a cooling coil built into the Capillary Airwasher (Class 3) and then pumped over the cells. In this way it is possible to reduce the number of rows required for the cooling coil, at the same time providing cleansing of the air.

It is required to cool 1000 cfm (72#/min.) per cell from 80° dry bulb and 70° entering wet bulb temperature to a leaving dew point of 55°. Chilled water at 43° is available and water temperature rise is to be 15°.

This problem, if solved for cooling coil requirements, would indicate that a coil 7 rows deep is required. In this case, a Class 3 Capillary Airwasher might be applied where the water passes through a coil, then over the cells, while the air passes first through the cells and then through the coils.

SOLUTION

From Table 3 on page 10,

Total heat/lb. air at entering 70° wb = 34.09 BTU/lb.
Total heat/lb. air at 55° dew point = 23.22 BTU/lb.
Difference = 10.87 BTU/lb.

Total load 72# x 10.87 x 60 = 46,960 BTU/hr.

Water quantity required

$$= \frac{46.960}{15^\circ \text{ rise} \times 8.33 \times 60} = 6.27 \text{ gpm.}$$

As a trial, assume that the cells will carry 60% of the load. Determine from Class 1 performance chart whether cell has necessary capacity. If so, then determine coil depth to carry remaining 40%.

If coil carries 40% of load, determine temperature of water leaving coil and entering cell.

$$\frac{46{,}960 \text{ BTU} \times 0.40}{6.27 \text{ gpm} \times 8.33 \times 60} = 6.27^\circ \text{ rise.}$$

Coil leaving water temperature = 43 + 6.27° = 49.27°.

Hence, air entering capillary cell 1000 cfm at 70° wet bulb, water entering cell 6 gpm at 49°. From Class 1 performance chart, cell capacity is found to be 27,000 BTU/hr., which is 60% of total load as required.

The remaining 40% of the load to be absorbed by the coil involves the following conditions:

Total heat per lb. of air leaving cell and entering coil is: 34.09—60% (34.09—23.22) = 27.57 BTU/lb. which corresponds to 61.6° wet bulb. The air entering the coil would be saturated at this temperature and is to be cooled to 55° saturated with entering water at 43° and 6 gpm per 1000 cfm.

Selection of the coil from Aerofin Bulletin C-58 with the above information indicates that a 3-row coil is required; thus effecting a saving of 4 rows in the cooling coil. Furthermore, the resistance through the Airwasher is reduced, with a consequent saving in power requirements.

TABLE 1

AIR RESISTANCE — INCHES WATER GAUGE

Class 1 Capillary Airwashers with either metal or plastic eliminators.

GPM Per Cell	CFM PER CELL					
	600	700	800	900	1000	1100
3	.14	.18	.23	.28	.34	.40
4	.14	.18	.23	.29	.35	.41
5	.14	.19	.24	.29	.36	.42
6	.14	.19	.24	.30	.36	.43
7	.15	.19	.25	.31	.37	.43
8	.15	.20	.25	.31	.38	.44
9	.15	.20	.26	.32	.39	.45

To obtain the air resistance of Class 3 Capillary Airwashers, add the resistance due to the wetted coil to the appropriate figure from the above table.

For data on selection of coils, see Aerofin and Unifin Catalogues.

PERFORMANCE CHARTS

The chart on Page 11 has been arranged so that information of importance to air-conditioning engineers in the selection of Capillary Airwashers can be obtained quickly and accurately. Figure 7 below shows an outline of the chart. The method of using this is explained in Examples 1 and 2 above.

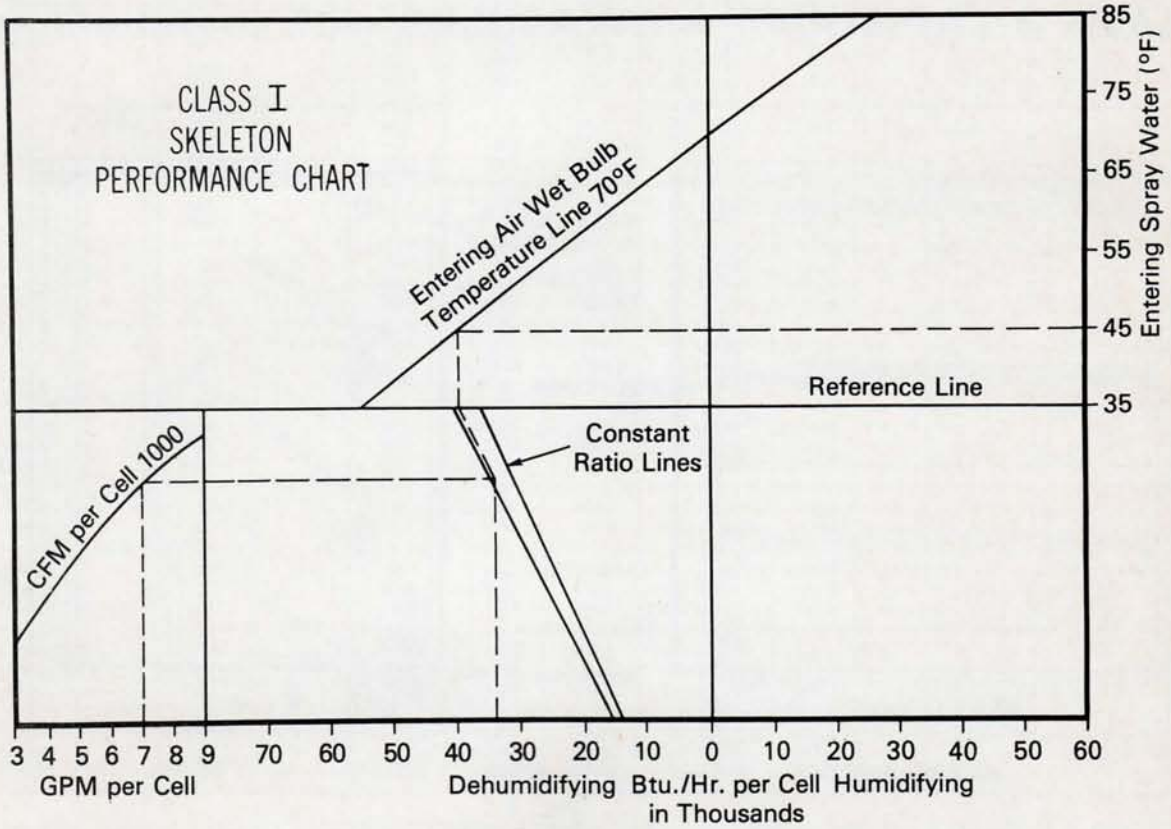


Fig. 7

CLASS 1 CAPILLARY AIRWASHERS with metal eliminators

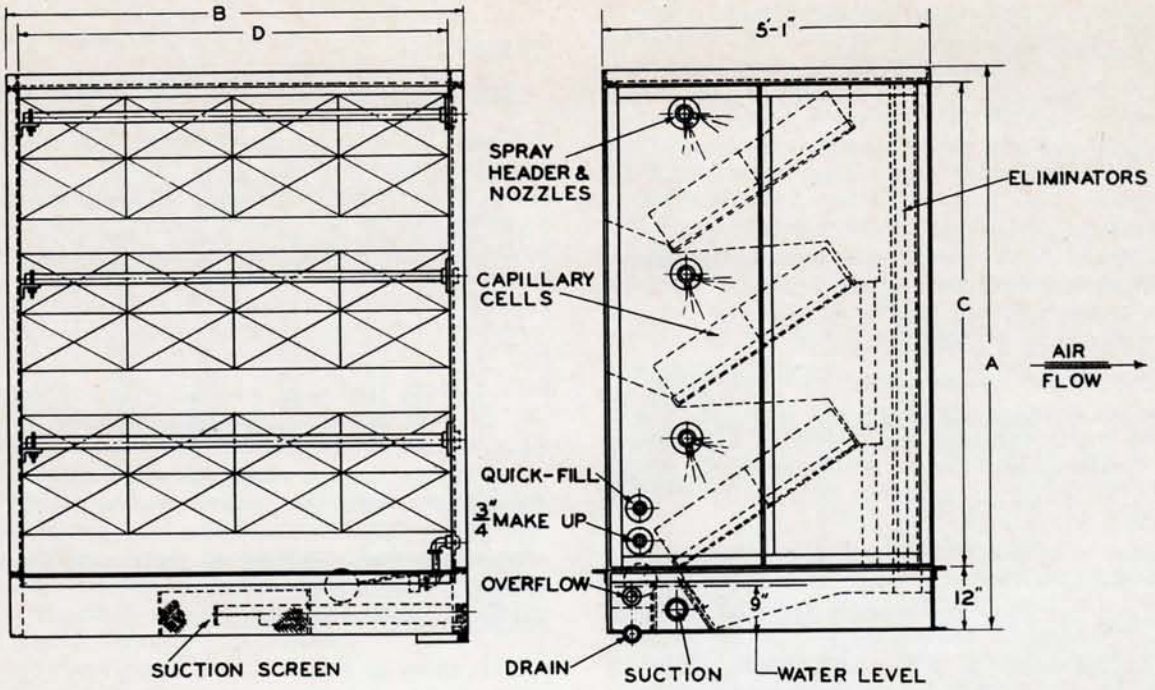


Fig. 8

CLASS 3 CAPILLARY AIRWASHERS with metal eliminators

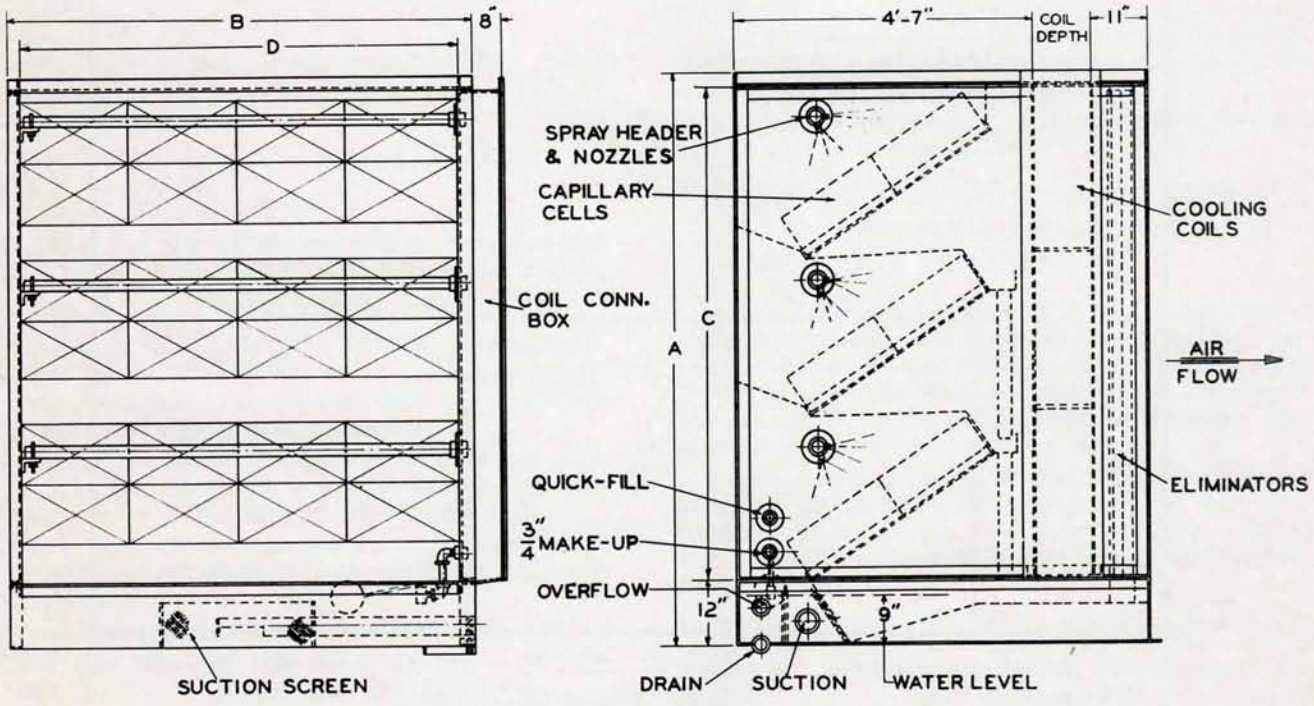


Fig. 9

SHELDONS ENGINEERING LIMITED is licensed to manufacture and sell the Capillary Airwasher under U.S. letters patent 2459802.

CAPILLARY AIRWASHERS Dimensions - Class 1 and Class 3

TABLE 2

UNIT SIZE Cells High x Cells Wide	Maximum CFM	A	B	C	D	OPERATING WEIGHT—LBS. Class 1	OPERATING WEIGHT—LBS. Class 3	COILS—Class 3 only Tube Face x Tube Lgth.	COILS—Class 3 only Face Area Sq Ft	PIPE CONNECTIONS Over-flow	Quick Fill	Drain	Spray Hdr.	Suc-tion
2 - 2	4400	43½"	43"	30"	40"	1320	1450	20 x 38"	7.4	2	1	1½	1½	2
2 - 3	6600		63"		60"	1830	2020	20 x 57"	11.0	2	1	1½	2	2
2 - 4	8800		83"		80"	2360	2570	20 x 78"	15.0	2	1¼	1½	2½	2½
2 - 5	11000		103"		100"	2870	3130	20 x 96"	18.6	2	1¼	1½	2½	3
2 - 6	13200		123"		120"	3360	3860	20 x 117"	22.8	2½	1¼	2	3	3
2 - 7	15400	42"	144"	30"	140"	3950	4300	20 x 128"	25.2	2½	1¼	2	3	3
2 - 8	17600		164"		160"	4460	4800	20 x 150"	28.9	2½	1¼	2	3	4
2 - 9	19800		184"		180"	4920	5300	20 x 170"	32.5	2½	1¼	3	3	4
2 - 10	22000		204"		200"	5460	5900	20 x 192"	36.9	2½	1½	3	3	4
2 - 11	24200		224"		220"	5930	6420	20 x 210"	40.2	2½	1½	3	4	4
2 - 12	26400		244"		240"	6400	7000	20 x 234"	44.8	2½	1½	3	4	4
4 - 2	8800	73½"	43"	60"	40"	1800	1970	40 x 38"	14.8	2	1¼	1½	2½	2½
4 - 3	13200		63"		60"	2450	2730	40 x 57"	22.0	2½	1¼	2	3	3
4 - 4	17600		83"		80"	3100	3500	40 x 78"	30.0	2½	1½	2	3	4
4 - 5	22000		103"		100"	3830	4200	40 x 96"	37.2	2½	1½	3	3	4
4 - 6	26400		123"		120"	4350	4970	40 x 117"	45.6	2½	1½	3	4	4
4 - 7	30800	74"	144"		140"	5200	5800	40 x 128"	50.4	3	1½	3	4	5
4 - 8	35200		164"		160"	5930	6570	40 x 150"	57.8	3	1½	3	4	5
4 - 9	39600		184"		180"	6500	7200	40 x 170"	65.0	3	1½	3	4	5
4 - 10	44000		204"		200"	7200	8030	40 x 192"	73.8	3	1½	3	5	6
4 - 11	48400		224"		220"	7930	8700	40 x 210"	80.4	3	1½	3	5	6
4 - 12	52800		244"		240"	8420	9400	40 x 234"	89.6	3	1½	3	5	6
6 - 2	13200	103½"	43"	90"	40"	2280	2560	60 x 38"	22.2	2½	1¼	2	3	3
6 - 3	19800		63"		60"	3100	3460	60 x 57"	33.0	2½	1¼	3	3	4
6 - 4	26400		83"		80"	3960	4460	60 x 78"	45.0	2½	1½	3	4	4
6 - 5	33000		103"		100"	4790	5370	60 x 96"	56.0	3	1½	3	4	5
6 - 6	39600		123"		120"	5600	6270	60 x 117"	68.5	3	1½	3	4	5
6 - 7	46200	104"	144"		140"	6570	7340	60 x 128"	75.7	3	1½	3	5	6
6 - 8	52800		164"		160"	7400	8200	60 x 150"	86.6	3	1½	3	5	6
6 - 9	59400		184"		180"	8250	9100	60 x 170"	97.6	3	1½	3	5	6
6 - 10	66000		204"		200"	9000	10400	60 x 192"	111.0	3	1½	4	5	6
6 - 11	72600		224"		220"	9900	11000	60 x 210"	121.0	3	2	4	6	8
6 - 12	79200		244"		240"	10600	11900	60 x 234"	134.0	3	2	4	6	8
8 - 2	17600	133½"	43"	120"	40"	2560	2860	80 x 38"	29.7	2½	1¼	2	3	4
8 - 3	26400		63"		60"	3400	3900	80 x 57"	44.0	2½	1½	3	4	5
8 - 4	35200		83"		80"	4520	5120	80 x 78"	60.0	3	1½	3	4	6
8 - 5	44000		103"		100"	5400	6300	80 x 96"	74.4	3	1½	3	5	6
8 - 6	52800		123"		120"	6480	7210	80 x 117"	91.2	3	1½	4	5	6
8 - 7	61600	134"	144"		140"	7560	8650	80 x 128"	101.0	3	1½	4	5	6
8 - 8	70400		164"		160"	8580	9700	80 x 150"	115.5	3	2	4	5	6
8 - 9	79200		184"		180"	9500	10900	80 x 170"	130.0	3	2	4	6	8
8 - 10	88000		204"		200"	10850	12200	80 x 192"	146.0	3	2	4	6	8
8 - 11	96800		224"		220"	11780	13300	80 x 210"	161.0	3	2	4	6	8
8 - 12	105600		244"		240"	12700	14300	80 x 234"	179.0	3	2	4	6	8
10 - 2	22000	163½"	43"	150"	40"	3100	3700	100 x 38"	37.0	2½	1½	3	4	4
10 - 3	33000		63"		60"	4300	4900	100 x 57"	55.0	2½	1½	3	4	5
10 - 4	44000		83"		80"	5540	6350	100 x 78"	75.0	3	1½	3	5	6
10 - 5	55000		103"		100"	6750	7600	100 x 96"	93.0	3	1½	3	5	6
10 - 6	66000		123"		120"	7860	8900	100 x 117"	114.0	3	1½	4	5	6
10 - 7	77000	164"	144"		140"	9100	10400	100 x 128"	126.0	3	2	4	6	8
10 - 8	88000		164"		160"	10700	11750	100 x 150"	144.5	3	2	4	6	8
10 - 9	99000		184"		180"	11400	12900	100 x 170"	162.5	3	2	4	6	8
10 - 10	110000		204"		200"	12800	14500	100 x 192"	184.5	3	2	4	8	10
10 - 11	121000		224"		220"	13900	15800	100 x 210"	201.0	3	2	4	8	10
10 - 12	132000		244"		240"	14950	16960	100 x 234"	223.0	3	2	4	8	10

WEIGHT: The operating weight of both Class 1 and Class 3 Capillary Airwashers includes the weight of water held in the tank at an effective level of 5½", but does not include weight of coils in Class 3.

TABLE 3 — ENTHALPY BTU/LB. DRY AIR: ENTHALPY is the TOTAL HEAT of Dry Air, Water Vapour and Liquid

Wet Bulb Temp. Deg. F.	TENTHS									
	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
35	13.01	13.05	13.09	13.13	13.17	13.21	13.25	13.29	13.34	13.38
36	13.44	13.48	13.52	13.57	13.61	13.65	13.69	13.74	13.78	13.84
37	13.87	13.91	13.96	14.00	14.05	14.09	14.14	14.18	14.23	14.27
38	14.32	14.36	14.41	14.45	14.50	14.54	14.59	14.63	14.68	14.72
39	14.77	14.81	14.86	14.90	14.95	14.99	15.04	15.08	15.13	15.18
40	15.23	15.28	15.32	15.37	15.42	15.46	15.51	15.56	15.60	15.65
41	15.70	15.74	15.79	15.84	15.89	15.93	15.98	16.03	16.08	16.12
42	16.17	16.22	16.27	16.32	16.37	16.41	16.46	16.51	16.56	16.61
43	16.66	16.71	16.76	16.80	16.85	16.90	16.95	17.00	17.05	17.10
44	17.15	17.20	17.25	17.30	17.35	17.40	17.45	17.50	17.55	17.60
45	17.65	17.70	17.75	17.80	17.85	17.91	17.96	18.01	18.06	18.11
46	18.16	18.21	18.26	18.32	18.37	18.42	18.47	18.52	18.58	18.63
47	18.68	18.73	18.79	18.84	18.89	18.95	19.00	19.05	19.10	19.16
48	19.21	19.27	19.32	19.37	19.42	19.48	19.54	19.58	19.64	19.70
49	19.75	19.81	19.86	19.92	19.97	20.03	20.08	20.14	20.19	20.25
50	20.30	20.36	20.41	20.47	20.53	20.58	20.64	20.69	20.75	20.81
51	20.86	20.92	20.98	21.03	21.09	21.15	21.21	21.26	21.32	21.38
52	21.44	21.49	21.55	21.61	21.67	21.73	21.79	21.84	21.90	21.96
53	22.02	22.08	22.14	22.20	22.26	22.32	22.38	22.44	22.50	22.56
54	22.62	22.68	22.74	22.80	22.86	22.92	22.98	23.04	23.10	23.16
55	23.22	23.28	23.34	23.41	23.47	23.53	23.59	23.65	23.72	23.78
56	23.84	23.90	23.97	24.03	24.10	24.16	24.22	24.29	24.35	24.42
57	24.48	24.54	24.61	24.67	24.74	24.80	24.86	24.93	24.99	25.06
58	25.12	25.18	25.25	25.32	25.38	25.45	25.51	25.58	25.64	25.71
59	25.78	25.84	25.92	25.98	26.05	26.12	26.19	26.26	26.32	26.39

Wet Bulb Temp. Deg. F.	TENTHS									
	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
60	26.46	26.53	26.60	26.67	26.74	26.81	26.87	26.94	27.01	27.08
61	27.15	27.22	27.29	27.36	27.43	27.50	27.57	27.64	27.71	27.78
62	27.85	27.92	27.99	28.07	28.14	28.21	28.28	28.35	28.43	28.50
63	28.57	28.64	28.72	28.80	28.87	28.94	29.01	29.09	29.16	29.24
64	29.31	29.39	29.46	29.54	29.61	29.68	29.76	29.84	29.91	29.99
65	30.06	30.14	30.21	30.29	30.37	30.44	30.52	30.60	30.68	30.75
66	30.83	30.91	30.99	31.07	31.15	31.23	31.30	31.38	31.46	31.54
67	31.62	31.70	31.78	31.86	31.94	32.02	32.10	32.18	32.26	32.34
68	32.42	32.50	32.58	32.67	32.75	32.84	32.92	33.00	33.08	33.17
69	33.25	33.33	33.42	33.50	33.59	33.67	33.75	33.84	33.92	34.00
70	34.09	34.18	34.26	34.35	34.43	34.52	34.61	34.69	34.78	34.86
71	34.95	35.03	35.13	35.21	35.30	35.39	35.48	35.57	35.65	35.74
72	35.83	35.92	36.01	36.10	36.19	36.28	36.38	36.47	36.56	36.65
73	36.74	36.83	36.92	37.02	37.11	37.20	37.30	37.38	37.47	37.57
74	37.66	37.76	37.85	37.94	38.04	38.14	38.23	38.32	38.42	38.51
75	38.61	38.71	38.80	38.90	38.99	39.09	39.19	39.28	39.38	39.47
76	39.57	39.67	39.77	39.87	39.97	40.07	40.17	40.27	40.37	40.47
77	40.57	40.67	40.77	40.87	40.97	41.08	41.18	41.28	41.38	41.48
78	41.58	41.68	41.79	41.89	42.00	42.10	42.20	42.31	42.41	42.52
79	42.62	42.72	42.83	42.94	43.04	43.16	43.26	43.37	43.48	43.58
80	43.69	43.80	43.91	44.02	44.13	44.24	44.34	44.45	44.56	44.67
81	44.78	44.90	45.02	45.14	45.26	45.38	45.50	45.62	45.75	45.87
82	45.90	46.01	46.12	46.23	46.34	46.45	46.56	46.67	46.78	46.89
83	47.04	47.16	47.28	47.39	48.51	48.63	48.75	48.87	48.99	49.11
84	48.22	48.34	48.46	48.58	48.70	48.82	48.94	49.06	49.18	49.31

Abstracted by permission from Heating, Ventilating and Air-Conditioning Guide, 1959, Chapter 3. Original data compiled by John A. Goff and S. Gratch.

CAPILLARY AIR CONDITIONING UNITS

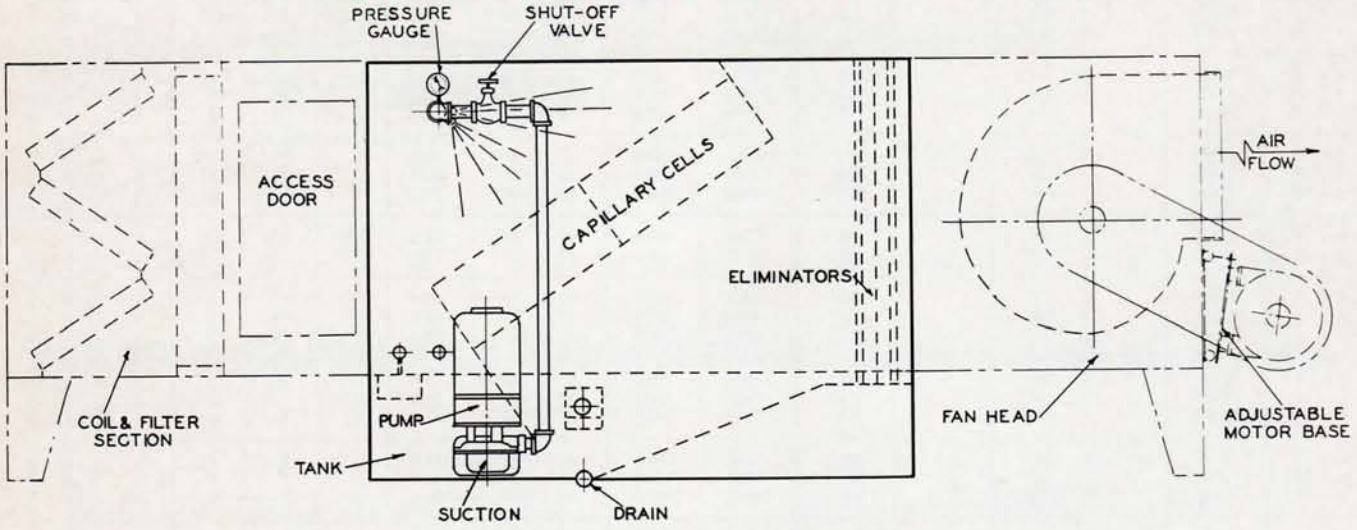


FIG. 10 — Typical Capillary air conditioning unit.

In addition to the range of Capillary Airwashers listed in the previous pages, Sheldons Engineering Limited also manufacture Unitary Capillary Cell Airwashers for use with their regular Air-Conditioning Units. These Capillary Units are employed usually when air volume requirements are moderate and where high saturation efficiencies and purification are of the utmost importance, as in hospitals, food and drug industries, etc.

Each Capillary Conditioner has the same performance and cleaning effectiveness as the regular Capillary Airwasher described in detail in this catalogue and is selected in the same manner. Used in conjunction with such accessories as fan sections, cooling and heating coil sections, filter sections, mixing boxes, etc., available with Sheldons Air-Conditioning Cabinets, it provides a convenient method of arranging for all Air-Conditioning needs to be met in one compact design.

Capillary Conditioners are made available in a range of sizes designed to handle from 600 cfm up to 27,000 cfm. Special large sizes can also be fabricated to suit unusual job layouts. Each Capillary Conditioner is supplied with the equipment listed as follows:

Fan Section — Choice of forward or backward inclined wheels for quietness and economy of operation with adjustable belt drive and motor base.

Capillary Section — With Capillary Cells in banks 1, 2, or 3 high, low pressure nozzles for low pumping heads; concurrent air and water flow.

Eliminators — To remove mist and water droplets from the air stream.

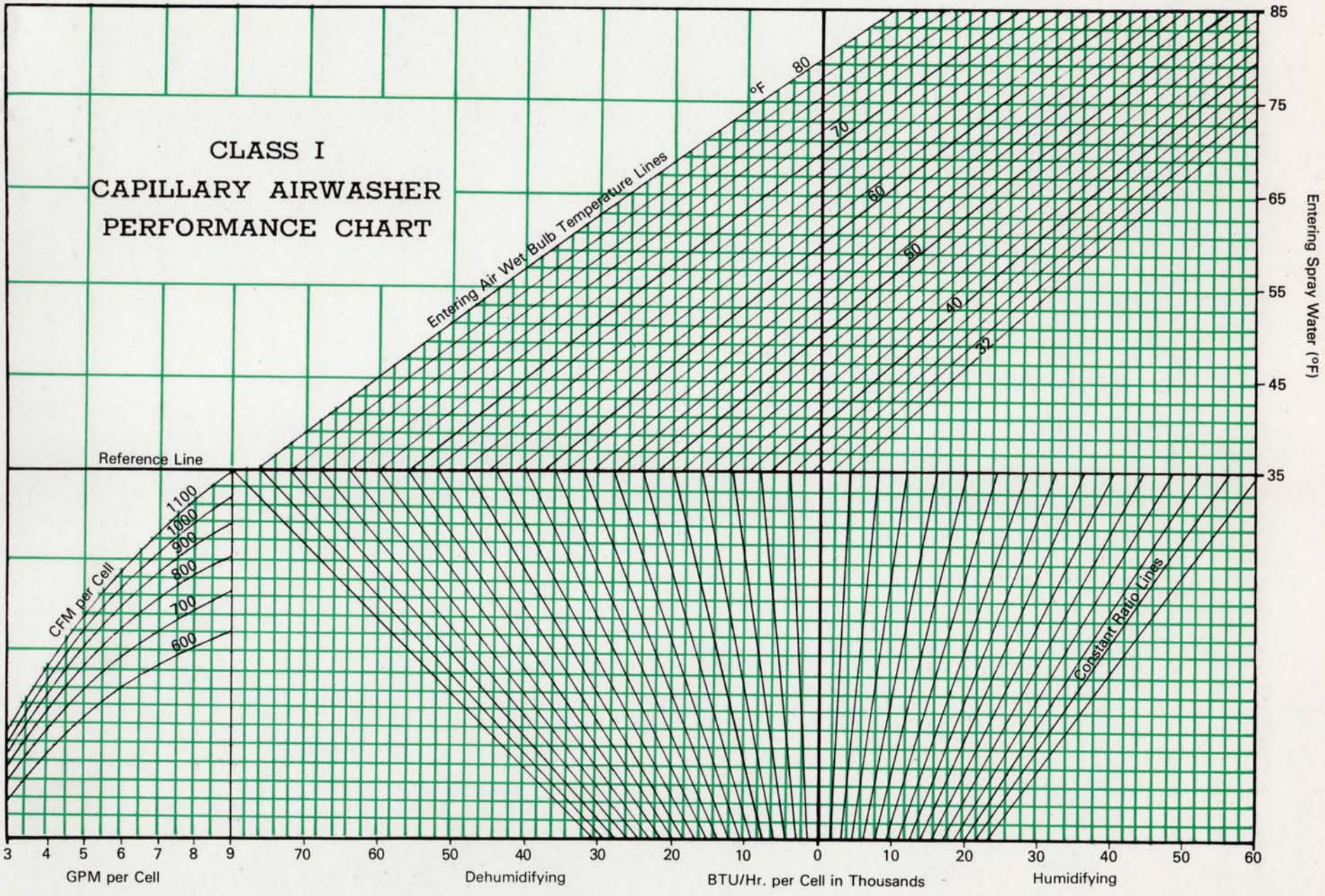
Coils — Cooling coils may also be added between the Capillary Cells and the eliminators, if required.

Drain Tank — Covers entire bottom of Capillary Section; complete with float valve and drain connections.

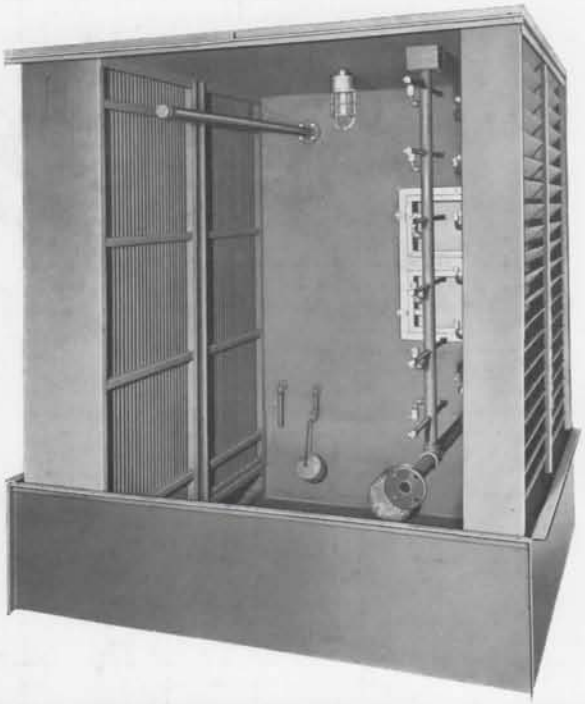
Pump — Close-coupled centrifugal pump mounted on side of casing with water piping to nozzles.

Pressure Gauge — Provided on supply line, complete with shut-off valve.

Sheldons Capillary Air-Conditioning Units are engineered and designed for the dependable service, ease of maintenance and reliability that goes into every Sheldon product.


CLASS I
CAPILLARY AIRWASHER
PERFORMANCE CHART
Entering Air Wet Bulb Temperature Lines
°F
80
70
60
50
40
32
Reference Line
CFM per Cell
1100
1000
900
800
700
600
Constant Ratio Lines
85
75
65
55
45
35
Entering Spray Water (°F)
3 4 5 6 7 8 9
GPM per Cell
70 60 50 40 30 20 10 0 10 20 30 40 50 60
Dehumidifying
BTU/Hr. per Cell in Thousands
Humidifying

Some further examples of Sheldon Air Conditioning equipment are shown below:



SHELDON AIRWASHERS
Types A, B and C

Sheldon Airwashers are an efficient, economical method of removing dust and dirt from air. They also perform such necessary heat transfer functions as humidification, cooling and dehumidification.

The Type A heavy-duty unit provides maximum humidification. Two opposed banks of sprays. Continuously washed eliminators.

Type B for general cleaning and humidifying. One spray bank. One set of flooding nozzles.

Type C, smallest, most economical model. Has wide spray nozzles for maximum wet surface.

SPRAYED COIL DEHUMIDIFIERS

Sheldon Sprayed Coil Dehumidifiers are ideally suited for use in office buildings, hotels, hospitals, and large commercial and industrial installations where accurate control of temperature and humidity over a wide range of conditions is required.

For further information on the application and sizes of these units, apply to any of the Sales Offices listed below.

SHELDONS ENGINEERING LIMITED

GALT, ONTARIO, Montreal, Toronto, London, Ottawa, Hamilton

Representatives in all principal cities across Canada