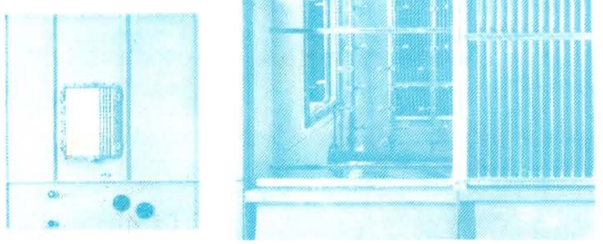
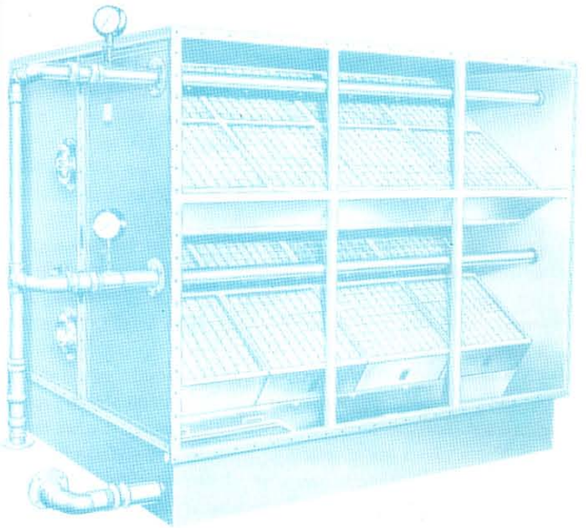
TAHVIEH HAMOON

AIR WASHERS

TAHVIEH HAMOON MANUFACTURING Co. LTD

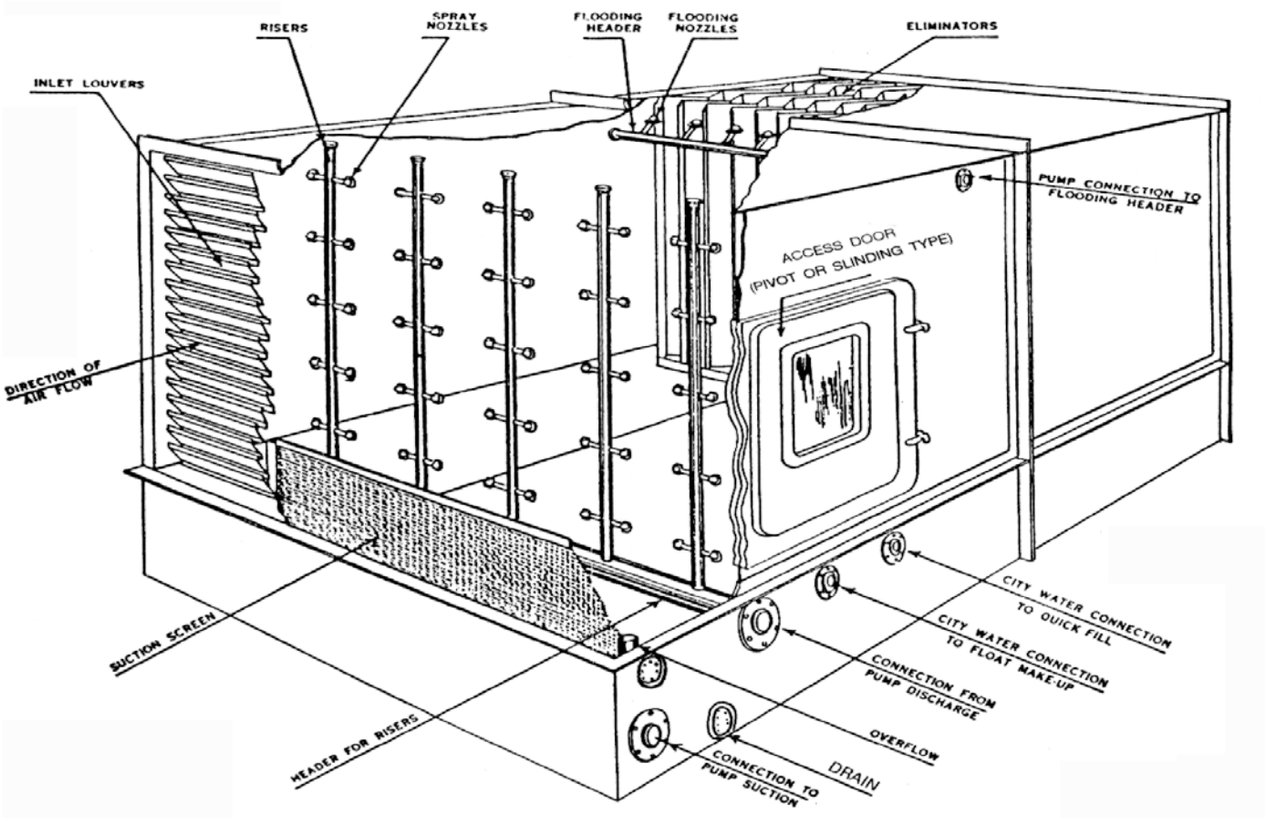




SPRAY TYPE AIRWASHER

CELL TYPE AIRWASHER

AIR WASHERS

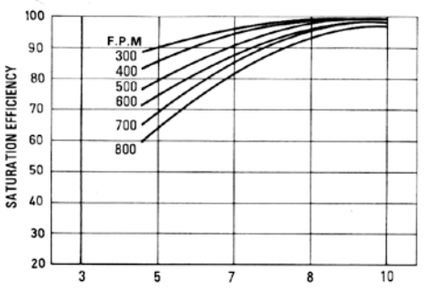


The TAHVIEH HAMOON washer illustrated has one bank of spray nozzles. Sometimes two, and occasionally three banks of sprays, one after another are installed. Nozzles used for air washers have a capacity of approximately 1¼ to 2 GPM per nozzle. The pressure required to force this quantity of water through these nozzles is about 20 psi. In single-bank air washers, about 5 GPM of water per 1000 CFM is usually provided. In a two – bank washer twice as much water can be provided or approximately 10 GPM per 1000 CFM; and 15 GPM per 1000 CFM in a three – bank washer. The quantity of water delivered by each bank can be varied by installing a larger or smaller number of nozzles.

The eliminator plates are installed at the outlet of the washer for purpose of removing dirt from the air and also to prevent entrained moisture from being carried out of the washer by the air. These plates are spaced $1\frac{1}{8}$ inches apart and are kept wet by means of flooding nozzles, which are installed immediately above and ahead of them. The eliminators are designed and installed that the direction of air flow is changed about six times while flowing through them. In this way, the air impinges against the wet surfaces of the plates and deposits the heavier dust particles, which are then washed down into the tank by the continuous stream of water from the flooding nozzles. Practically all eliminators have hooked edges on the outlet side to prevent water from being carried through. The eliminator plates are made of galvanized sheet metal of about 22 gage, although they are occasionally built of copper or other noncorrosive metals. The flooding nozzles are installed on a header on three – inch centers and have a capacity of approximately 1.0 GPM per nozzle with a pressure of about 5 psi. The amount to between 3.5 and 4.5GPM per ft of washer width .

Most odors can be removed from air in an air washer. An odor is usually due to the vapors of some compound mixed with the air. Many of these vapors will dissolve in water. Of course as the water becomes saturated with the soluble vapors, it becomes less and less able to remove odors from the air. Furthermore, the water itself acquires an odor due to the material in solution; therefore, it must be changed frequently under these conditions, and the tank filled with fresh water.

Louvers are often, though not always, installed on the inlet side of the washer. These louvers serve a double purpose: they help to distribute the air uniformly over the entire cross – sectional area of the washer,
and they prevent spray water from wetting the floor and walls ahead of the washer.
The air washer tank, which is about 18 or 20 in. deep is usually built of No. 12 or 14 – gage steel. A removable, fine mesh copper screen in a metal frame is installed across one end of the tank. All of the water flowing to the pump must first pass through this screen. The openings of the screen are made samller than the nozzle openings. Although this minimizes difficulties with nozzle clogging, it does not entirely eliminate clogging. However spray nozzles can be cleaned.
A float valve is provided washers to automatically admit make-up to replace any water lost through entrainment or evaporation. Water is carried in the tank to a depth sufficient to keep the air washer pump primed. In addition a combined over flow and drainpipe is provided in the tank. The overflow consists of a removable length of pipe, the top of each is slightly below the upper edge of the tank. If, for any reason, the water level should rise in the tank to the top of this overflow pipe, the excess water would flow to the sewer. For draining the washer, the overflow pipe which sets into a socket, can be removed from the drain pipe. In order to fill the tank quickly after it has been drained, a quick fill connection is provided.
TAHVIEH HAMOON air washers are designed to be installed on the suction side of the fan. They should never be installed on the discharge side unless they have been specially built for this purpose. There will be no difficulty with water leaking through the joints of a washer installed on the suction side of a fan however, if a washer is installed on the discharge side of a fan. However, if a washer is installed on the discharge side of a fan. Even the slight air pressure developed by the fan is likely to cause water leakage through the joints, in spits of the rubber gaskets usually installed.
TAHVIEH HAMOON air washers are built in lengths of five. Seven, and either eight or nine feet. The five and seven – foot washers have one bank of sprays and the nine – foot washer two, and sometimes three banks. Two banks of sprays can be installed in a seven – foot washer, although they are generally not considered to be quite as effective as in a longer washer. Although the five – foot washer is the least expensive, the seven – foot washer is the size commonly used.

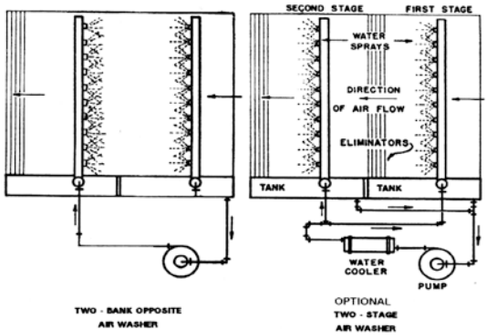


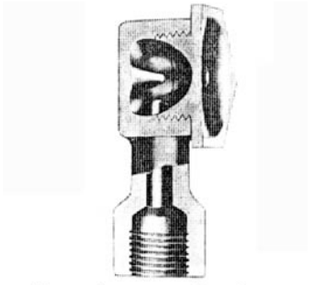
SATURATION EFFICIENCY

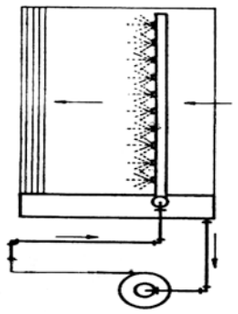
Typical Spray Nozzle Ratings.

Size* (in.)	Capacity of nozzle at pressure indicated (gpm)				
	10 psig	20 psig	25 psig	30 psig	40 psig
1/4 × 3/32	0.33	0.47	0.52	0.57	0.66
3/8 × 1/8	0.59	0.83	0.93	1.02	1.18
3/8 × 3/16	1.27	1.79	2.01	2.20	2.54
3/8 × 1/4	2.01	2.84	3.18	3.48	4.02

* First dimension is shank diameter; second is orifice.




TYPICAL CENTRIFUGAL-TYPE SPRAY NOZZLE WITH REMOVABLE ORIFICE CAP.


SINGLE BANK AIR WASHER

SATURATION EFFICIENCY:

$$S.E = \frac{DB_1 - DB_2}{DB_1 - WB_1}$$

DB_1: ENTRING AIR DRY BULB
WB_1: ENTRING AIR WET BULB
DB_2: LEAVING AIR DRY BULB

The gross cross – sectional area of air washers (the area perpendicular to the direction of air flow) is usually based on an air velocity of 500 FMP. If higher air velocities are used, trouble may be experienced with entrained moisture being carried out of the washer. Therefore, it is considered good practice to limit the velocity of air through washers to a maximum of 600 FPM. The capacity of an air washer can be determined by multiplying its area by 500 FPM, the velocity commonly used in rating air washers.
The fineness of the spray depends upon the nozzle design and the spray pressure. Water pressures commonly used vary between 20 and 40 psig.
Ordinarily, the water in air washers is recirculated. When the air is to be humidified. When the air is to be humidified, either the air or the water, or sometimes both, are heated before entering the washer. If the air is to be cooled and dehumidified in the washer, the water must first be cooled. Heating or cooling of the water can be accomplished.
Occasionally water that is cold enough so that no further cooling is needed can be obtained from a city main or well. In such a case, fresh water is supplied continuously to the sprays and is then wasted to the sewer. When water is used in a washer in this way, it should contain no substances in solution that may import an unpleasant odor to the air. This must be checked very carefully because of the intimate contact of the water and air in the washer. Well water in particular occasionally contains sulphur compounds in solution which impart an obnoxious odor to the air. However, this is no drawback to the use of well water as it can be used inside of coils; thus avoiding direct contact with the air to be cooled. Care must be exercised in disposing of such water in order not to create a nuisance.
Air Washer Computations
In coils using the counter flow principle, only the initial temperature of the water must be lower than the final dew point temperature of the water must be lower than the final dew point temperature to which the air is to be cooled. On the other hand, in single – stage washers not only the initial temperature of the water, but also its final temperature must be kept lower than the final dew point temperature. The reason for this is that in a washer the flow of water and air are parallel to each other.

THE CELL TYPE PRINCIPLE

CONSTRUCTION
The Tahvie Hamoon cell type air washer cell is a standard unit incorporating special element in a 20”*20”*8” deep casing.
The element are held in position by 2” mesh top and bottom, and by patented internal stabilizing screens which eliminate internal lacing and hold the fibres in position.
Rigid specifications define the diameter and length of the elements and their arrangement in the cell casing, and it is this parented construction and specialized design, developed through years of experience with hundreds long, efficient and trouble – free service.

OPERATING PRINCIPLE
The TAHVIEH HAMOON cell type air washer cell is designed to present maximum contact in a minimum volume. The controlled arrangement of the contact surface ensures suitably sizes channels for air and liquid giving maximum efficiency of heat and moisture exchange, with low resistance to air flow.
In operation, liquid is distributed by low pressure nozzles over the upper face of the cell from which point it flows along the thousands of oriented strands by gravity to the lower face where it accumulates until large drops are formed which fall to the collecting tank below. This characteristic prevents entrainment of minute drops in the air stream and permits the use of simple low resistance eliminators. Liquid and air always flow parallel to one another in either a parallel flow or counter flow relationship.

RATED CAPACITY

Providing the cell is full of water, high saturation efficiency is achieved. In practice, the minimum water quantity desirable is 3 GPM to ensure satisfactory flushing. Other quantities up to the maximum are calculated from the requirements of cooling and dehumidifying as determined by the therinal characteristics of liquid gas.

AIR CLEANING AND WASHING

An important function of an air conditioning system is to remove as much of the solid airborne matter as is physically or economically practicable the air entering the plant.

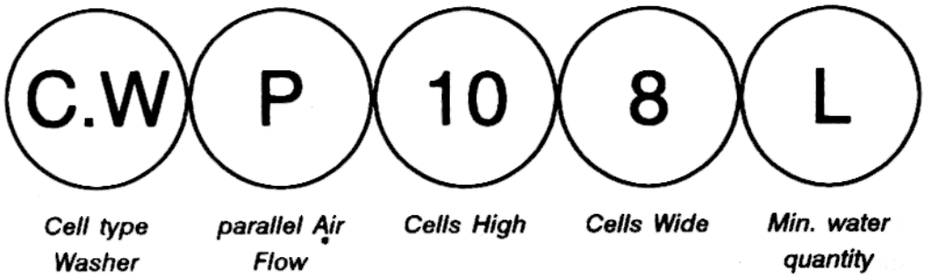
Air filters of some form are often fitted before heating and cooling coils and spray type washers.

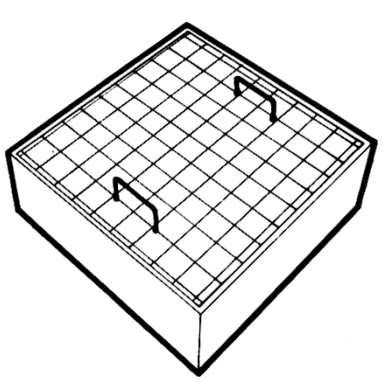
The dust removal performance of the cell type Air washer Cell is a “Bonus” feature of the TAHVIEH HAMOON cell type Air Washer, not available when an ordinary washer is used. In practice, the cells remove in excess of 95% by weight of the airborne solid matter which includes virtually all particles exceeding five microns in size. To take full advantage of this feature the high water quantity should be used to ensure complete flushing of the cells. In extreme conditions in highly industrialized areas where the air is heavily dust – laden a counter flow arrangement should be provided with the high water quantity, if a pre – filter is not fitted.

MODEL REFERENCES

Each part of model reference of TAHVIEH HAMOON cell type air washers has a definite significance. The following table indicates how these operate.

Part of Model Reference	*Code*	*Significance*
First Letter (s)	*CW*	*Cell type Washer*
Second Letter (s)	*P, C, or PC**	*P = Parallel Flow* *C = Counter Flow* *PC = Parallel Flow plus Counter Flow*
First Figure (s)	*1,2,4, ect.*	*Number of cells high*
Second Figure (s)	*1,2,3, etc.*	*Number of cells wide*
Third Letter	*L or R***	*Left or Right hand*
Fourth Letter	*M or H*	*Minimum water quantity or high water quantity*





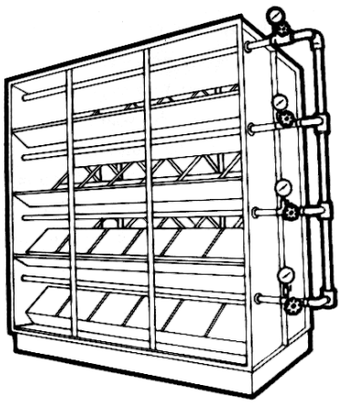


Illustration shows a cell type cell standard unit incorporating special elements in a 20”*20”*8” deep casing . Illustration (right) shows a standard cell type air washer with cell type cells removed from two of the banks.

ENGINEERING SPECIFACATIONS WASHER CASING
Shall be constructed from galvanized sheets adequately strengthened by mild steel angles .

TANK
Shell be constructed from high grade steel plate continuously welded at seams, finished two coats of best quality corrosion resisting paint.

ELIMINATORS
In parallel flow washers mat eliminators shall be provided. Casings to be constructed from galvanized sheet steel, filled with interlaced fibres to eliminate entrained moisture.
In counter flow washers, eliminator plates shall be provided with a minimum of two bends and two water collecting lips spaced at suitable centres and galvanized after manufacture.

CAPACITIES , WEGHTS , DIMENSIONS

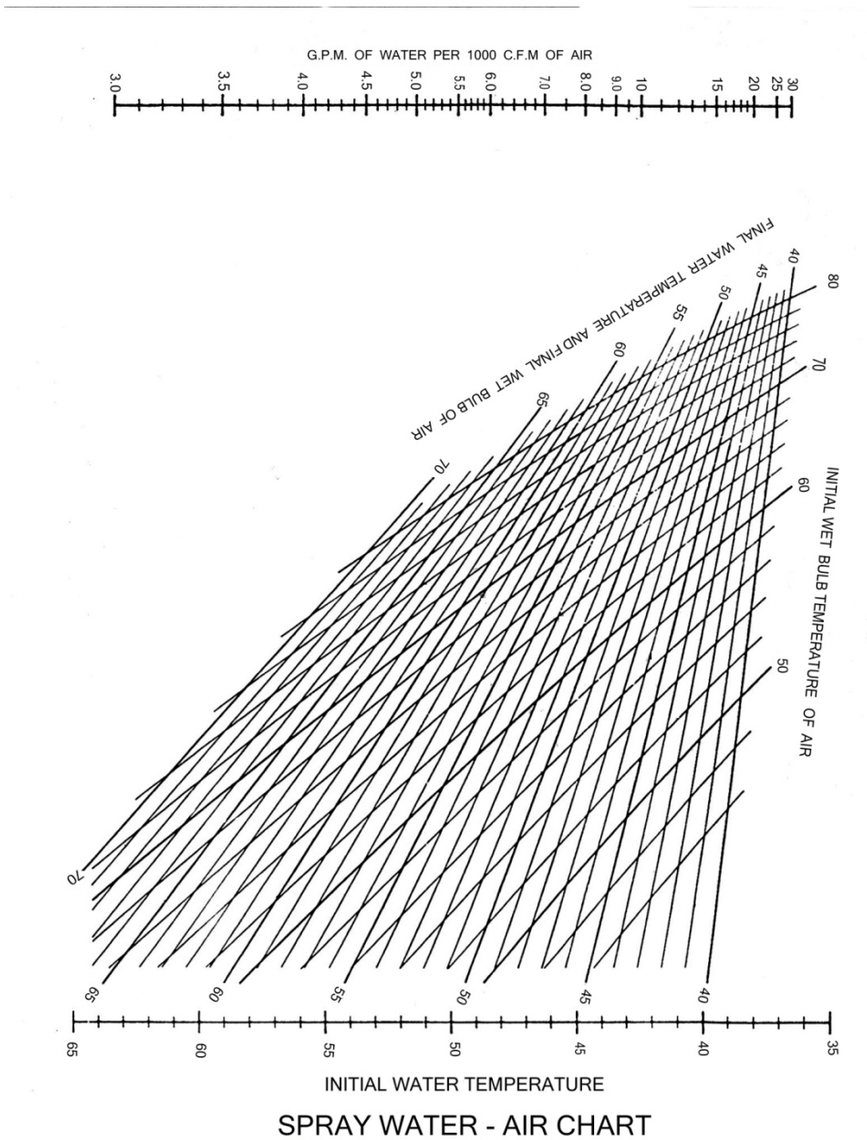
MODEL * REFERANCE	SIZE		No. OF Cells	Dimensions (inches)				maximum Air Volume cfm.	Water flow** Per Cell Bank GPM		WEIGHT TYPE CP		TYPE CC		TYPE CPC	
	Cells High	Cells Wide		H	W	CP L	CC L		Min .High		Net Operating		Net Operating		Net operating	
T-H CW(P) (C) 21	2	1	2	46	24⅛	69½	80	2200	6	15	500	1100	560	1400	690	1900
T-H CW(P) (C) 22		2	4	46	40⅛	69½	80	4400	12	30	690	1600	780	2000	950	2600
T-H CW(P) (C) 23		3	6	46	60⅛	69½	80	6600	18	45	840	2100	1000	2600	1200	3300
T-H CW(P) (C) 24		4	8	46	80½	69½	80	8800	24	60	1100	2800	1200	3500	1500	4600
T-H CW(P) (C) 25		5	10	46	100⅛	69½	80	11000	30	75	1300	3500	1400	4300	1700	5600
T-H CW(P) (C) 26		6	12	46	120⅛	69½	80	13200	36	90	1500	3900	1700	4900	2100	6400
T-H CW(P) (C) 42	4	2	8	74	40½	69½	80	8800	24	60	1000	1900	1100	2300	1300	2900
T-H CW(P) (C) 43		3	12	74	60⅛	69½	80	13200	36	90	1400	2700	1500	3200	1800	4100
T-H CW(P) (C) 44		4	16	74	80⅛	69½	80	17600	48	120	1700	3500	1800	4200	2200	5400
T-H CW(P) (C) 45		5	20	74	100⅛	69½	80	22000	60	150	1900	4100	2200	5100	2700	6600
T-H CW(P) (C) 46		6	24	74	120⅛	69½	80	26400	72	180	2100	4600	2500	5900	3100	7600
T-H CW(P) (C) 47		7	28	74	140⅛	69½	80	30800	84	210	2600	5600	2900	6900	3600	8900
T-H CW(P) (C) 48		8	32	74	160⅛	69½	80	35200	96	240	2900	6400	3200	7900	4000	10300
T-H CW(P) (C) 63	6	3	18	107	60⅛	69½	80	19800	54	135	1900	3200	2000	3700	2500	4800
T-H CW(P) (C) 64		4	24	107	80⅛	69½	80	26400	72	180	2100	3900	2500	4900	3000	6200
T-H CW(P) (C) 65		5	30	107	100⅛	69½	80	33000	90	225	2500	4800	2900	5900	3500	7500
T-H CW(P) (C) 66		6	36	107	120⅛	69½	80	39600	108	270	2900	5400	3400	6900	4100	8800
T-H CW(P) (C) 67		7	42	107	140⅛	69½	80	46200	126	315	3400	6400	3900	7900	4700	10000
T-H CW(P) (C) 68		8	48	107	160⅛	69½	80	52800	144	360	3700	7200	4300	9000	5200	11500
T-H CW(P) (C) 69		9	54	107	180⅛	69½	80	59400	162	405	4100	7900	4800	9900	5800	12600
T-H CW(P) (C) 84	8	4	32	137	80⅛	69½	80	35200	96	240	3000	4700	3400	5700	4100	7200
T-H CW(P) (C) 85		5	40	137	100⅛	69½	80	44000	120	300	3400	5700	4000	7000	4800	8800
T-H CW(P) (C) 86		6	48	137	120⅛	69½	80	52800	144	360	3900	6400	4600	8100	5600	10300
T-H CW(P) (C) 87		7	56	137	140⅛	69½	80	61600	168	420	4600	7600	5400	9400	6500	11800
T-H CW(P) (C) 88		8	64	137	160⅛	69½	80	70400	192	480	5200	8700	6000	10700	7300	13600

T-H CW(P) (C) 89		9	72	137	120⅞	69½	80	79200	216	360	5700	9500	6600	11700	8000	14800
T-H CW(P) (C) 810		10	80	137	200⅞	69½	80	88000	240	600	6300	10600	7300	13000	8900	16500
T-H CW(P) (C) 811		11	88	137	220⅞	69½	80	96800	264	660	6800	11500	8000	14300	9700	18100
T-H CW(P) (C) 812		12	96	137	240⅞	69½	80	105600	288	720	7200	12200	8600	15300	10400	19300
T-H CW(P) (C) 105	10	5	50	167	100⅞	69½	80	55000	150	375	4200	6400	4900	7800	5900	9800
T-H CW(P) (C) 106		6	60	167	120⅞	69½	80	66000	180	450	4800	7400	5700	9200	6900	11600
T-H CW(P) (C) 107		7	70	167	140⅞	69½	80	77000	210	525	5500	8500	6600	10600	8000	13300
T-H CW(P) (C) 108		8	80	167	160⅞	69½	80	88000	240	600	6100	9600	7300	12000	8800	15100
T-H CW(P) (C) 109		9	90	167	180⅞	69½	80	99000	270	675	6700	10600	8100	13300	9800	16700
T-H CW(P) (C) 1010		10	100	167	200⅞	69½	80	110000	300	750	7400	11700	9000	14700	10800	18400
T-H CW(P) (C) 1011		11	110	167	220⅞	69½	80	121000	330	825	8000	12700	9700	16000	11700	20100
T-H CW(P) (C) 1012		12	120	167	240⅞	69½	80	132000	360	900	8600	13600	10400	17100	12500	21400

*Bracketed letters in model refrences are optional, depending on type

** water flow shown applies to types CWP and CWC. Double - bank washers, type T.H,CWP , have double this flow.

*** Operating weight includes water content



SPRAY WATER - AIR CHART