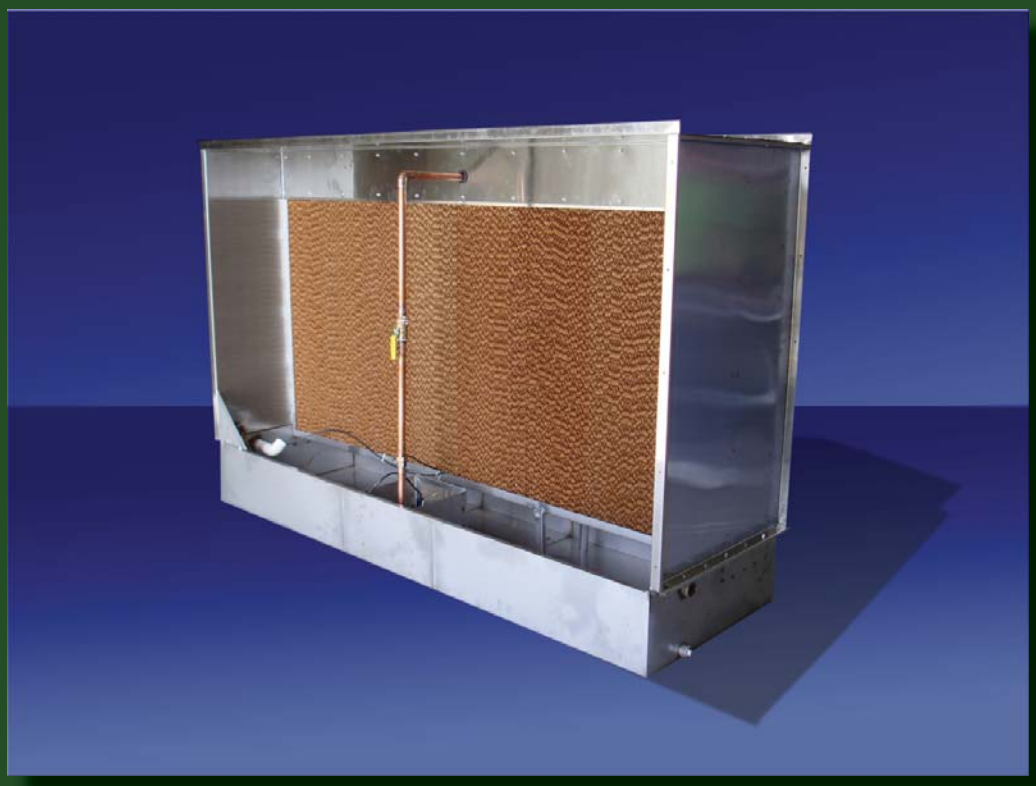
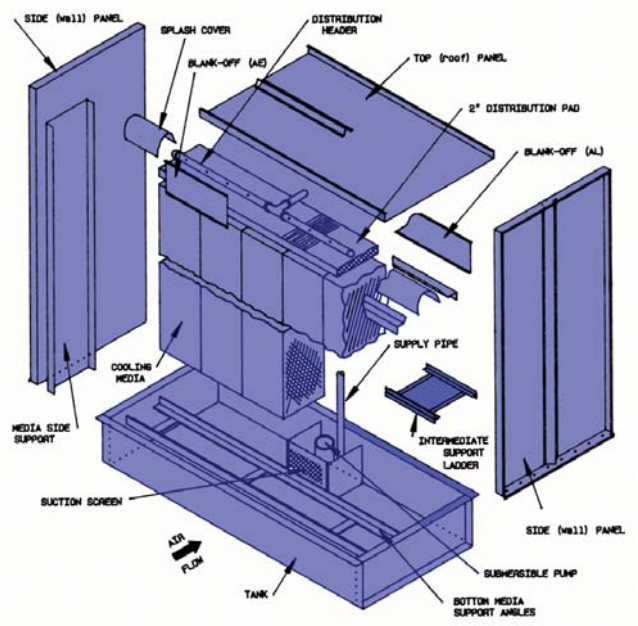
Sun West Air
Washing Units
Class 10/12



Mallory Manufacturing Company

QUALITY • RELIABILITY • SERVICE



CLASS 10/12 AIR WASHER SYSTEMS

The science of air conditioning developed as man devised means of changing conditions within enclosed spaces to improve the level of comfort. A space which is closed is subject to heat gains or losses, depending on the season of the year, and as a result of the way in which the space is used.

There are heat gains and losses by conduction through the walls, ceilings and floors. Radiation and convection also result in gains or losses, as does the introduction of outside air into the space for ventilation. Lights, equipment and people within the space will add heat energy which influences the cooling or heating "load".

In addition to the ability to maintain the temperature within "the space" for comfort, modern air conditioning systems also provide the means to improve the air quality by removing odors, removing and preventing the introduction of dust and dirt, and by maintaining desirable levels of humidity.

Well designed air conditioning systems avoid the introduction of unwanted noise and are capable of maintaining air motion within comfortable limits.

In the past 25 years, most people have been accustomed to think of air conditioning as "refrigerated air conditioning". It is in fact however, that many cooling requirements can be fully or partially satisfied by using techniques associated with cooling by evaporation.

Evaporative cooling is an ancient technique which is once again being increasingly utilized today as an energy effective means of providing comfort cooling and humidification. With the high saturation efficiencies available, modern applications include air washer usage for cooling air, cooling water, humidification and air cleaning and purifying.

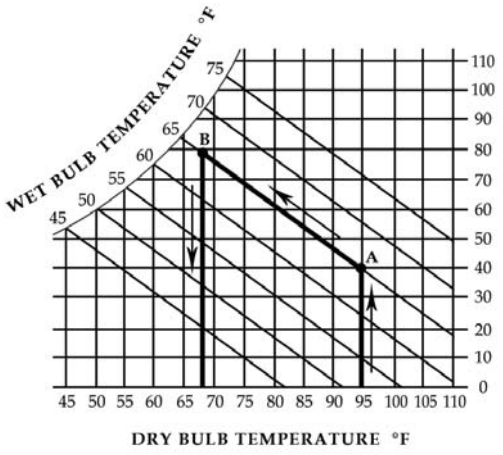
When evaporative cooling is used for all, or for a portion of the cooling required, it is likely that a major part of the energy requirement, and operating cost (when compared with refrigerated cooling) will be saved.

Air washers were developed over 75 years ago primarily as an air cleaning and purifying apparatus. The process of injecting atomized water droplets into a medium velocity air stream tends to capture dust and dirt particles, mold spores, pollen, etc., and collect this material along with the water droplets on the moisture eliminator plates. As the water runs down the eliminators the unwanted air contaminants are flushed into the water circulation reservoir. Airborne odors and some gases may be dissolved by the spray water and captured in solution also.

Besides the atomizing type, "spray filled" Air Washers, other designs evolved which utilize wetted surfaces as a means of bringing air and water into intimate contact.

Evaporation occurs when water and air particles are brought into close contact. Consequently, Air Washers are also evaporative coolers. Much of the development effort put into air washer design has been to improve their effectiveness as evaporative coolers.

Air Washers, when being used as direct evaporative coolers, convert sensible heat to latent heat with no change in the total heat of the air mixture. The sensible or dry-bulb temperature of the air decreases as the evaporating water absorbs energy in changing from a liquid to a gas. This change increases the moisture content of the air resulting in an increased percentage of saturation. A simplified psychrometric chart (next page) illustrates the process change from initial condition at Point "A" to the final condition at point "B". The process occurs along a line which shows a constant wet-bulb and a constant heat.



Mallory/Sun West Washers offer several types of equipment which may function as evaporative coolers. These include: Class 4, Class 6 and Class 8 spray filled air washers; Sprayed Coil Dehumidifiers; and also Class 2, Class 10 and Class 12 wetted surface air washers.

This section describes Sun West Air Washers Class 10 and Class 12 wetted surface Air Washers with primary emphasis on their application as evaporative coolers. Note the Class 12 air washers are designed for service as evaporative water coolers in "open" systems.

Mallory/Sun West Air Washers - Class 10 are high performance evaporative coolers. Because of the scrubbing interaction of the recirculated water with the conditioned air stream over the fluted fill material, there is also an air washing, cleaning, and odor removal benefit.

EVAPORATIVE COOLING

Evaporation is the change in state of a material from a liquid to a gas (or vapor). The laws of physics require that in order for evaporation to occur, heat energy, called "heat of evaporation", must be supplied.

In evaporative cooling processes, where water is evaporated in an air stream, the heat needed to supply the "heat of vaporization" for the water is removed from the air. This results in a sensible cooling effect.

When air passes through a Sun West Air Washer, it is brought into intimate contact with water which is recirculated from a reservoir. When the process reaches equilibrium, the temperature of the water in the reservoir is approximately equal to the wet bulb temperature of the entering air. The transfer of the heat from air to water may be assumed to occur at the wet bulb temperature of the entering air.

In the Class 10 air washer, the removal of sensible heat energy from the air stream results in lowering the dry bulb temperature. The resulting air-water mixture has a lower dry bulb temperature and a higher moisture content than the entering air.

In a perfect 100% efficient system, the air dry bulb temperature could be cooled to the wet bulb temperature of the entering air, and the air would be brought to saturation..

It is not considered practical to design equipment for 100% efficiency. The Sun West Air Washer - Class 10 may be selected in the range of 65% to 97% cooling effectiveness.

EVAPORATIVE COOLING EFFECTIVENESS

In order that evaporative cooling performance may be estimated, specific equipment designs operating at various flow rates are rated by percent. Cooling effectiveness is defined as:

$$e_c = \frac{(t_1 - t_2)}{(t_1 - t^1)} \times 100$$

Where:

e_c = evaporative cooling effectiveness. %

t_1 = dry bulb temperature of entering air

t_2 = dry bulb temperature of leaving air

t^1 = thermodynamic wet bulb temperature of entering air

Note: The terms "humidifying effectiveness", "evaporative cooling efficiency", and "saturation efficiency" are sometimes used instead of "evaporative cooling effectiveness". The symbol "e_h", or "e_s" may be used in some literature instead of "e_c". Some literature may express "e_c" as a decimal.

Curve #1 shows values of evaporative cooling percentage effectiveness for the Sun West Air Washers - Class 10 with various depth of media fill at various velocities. Curve #1 also shows resistance to air flow ratings at the same conditions in inches of water gauge static pressure loss. Values shown are based on SCFM. Values apply for both CELdek® and GLASdek® fill media.

THE PSYCHROMETRIC CHART

Psychrometry is the branch of physics which deals with measurements and determinations related to the atmosphere, particularly to mixtures of air and water vapor.

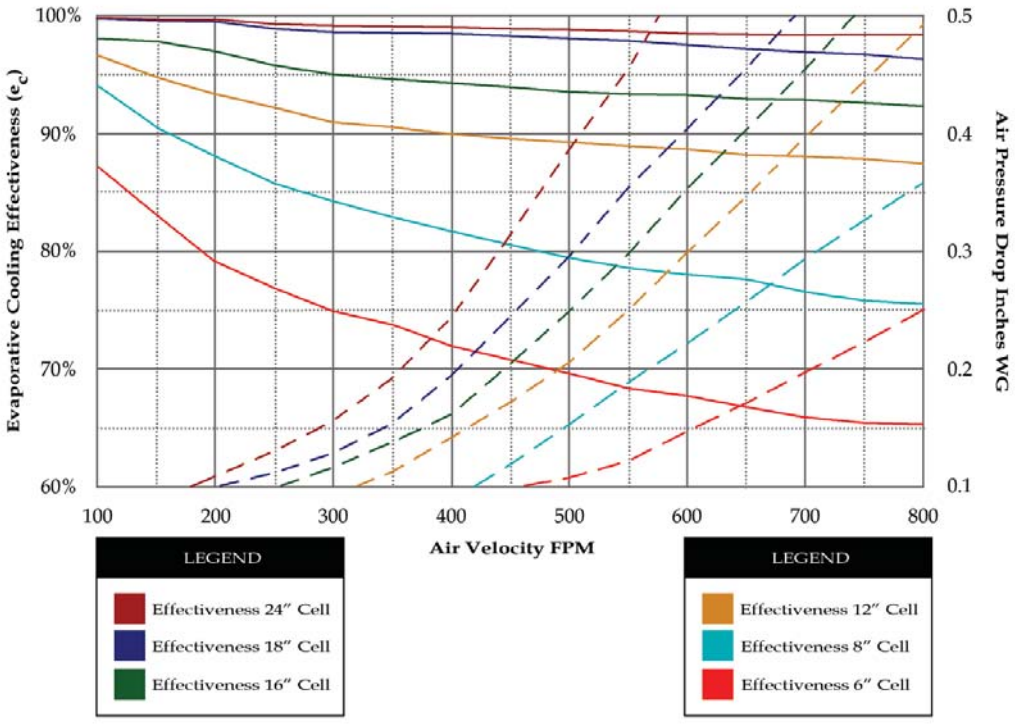
The psychrometric chart is a graphic representation of the various qualities of air and moisture mixtures.

The psychrometric chart is useful in following various heating, cooling, humidifying and dehumidifying processes, including evaporative cooling.

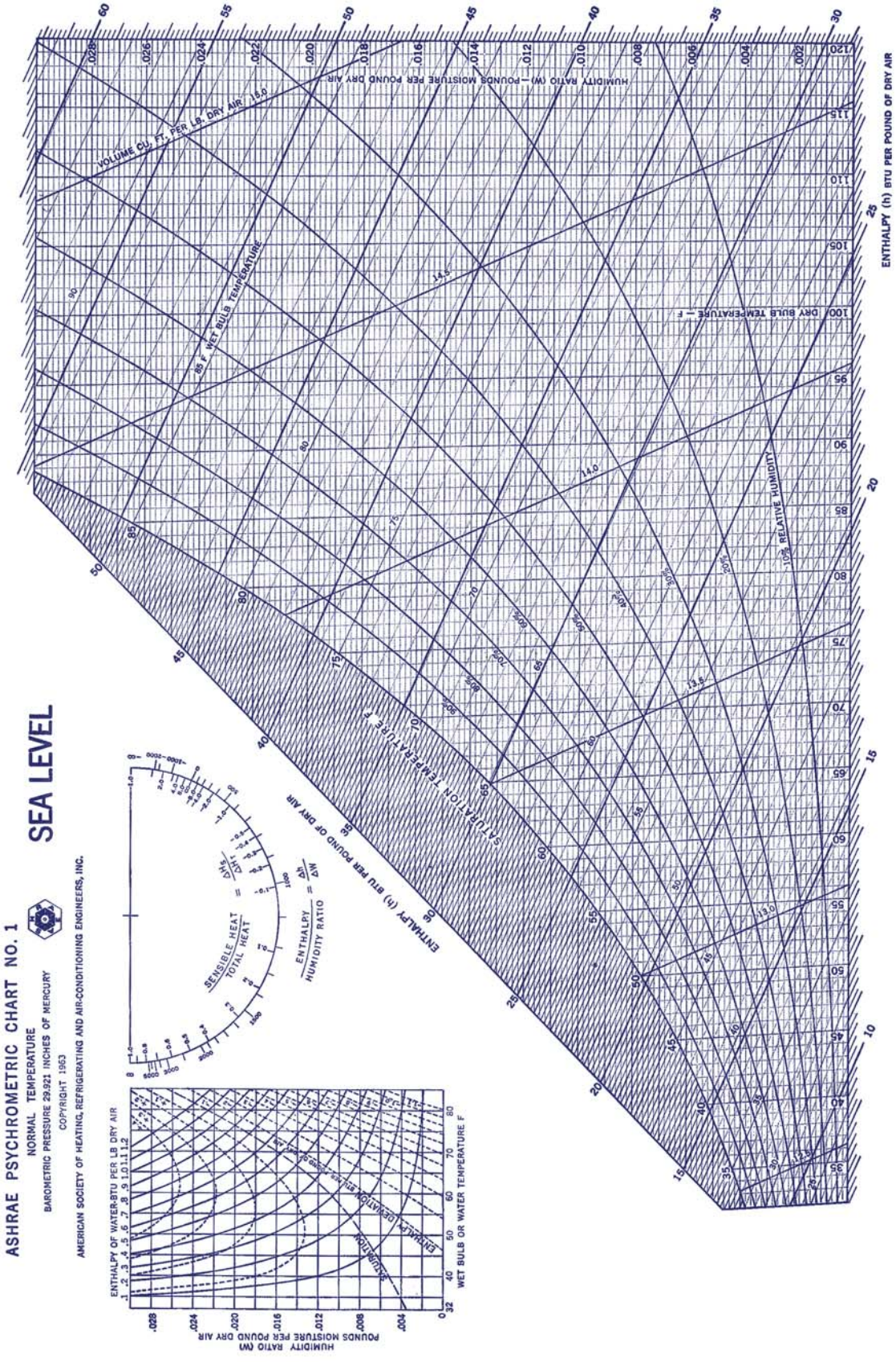
For a detailed discussion of psychrometry and the psychrometric chart, refer to the Fundamentals Volume of the ASHRAE Handbook.

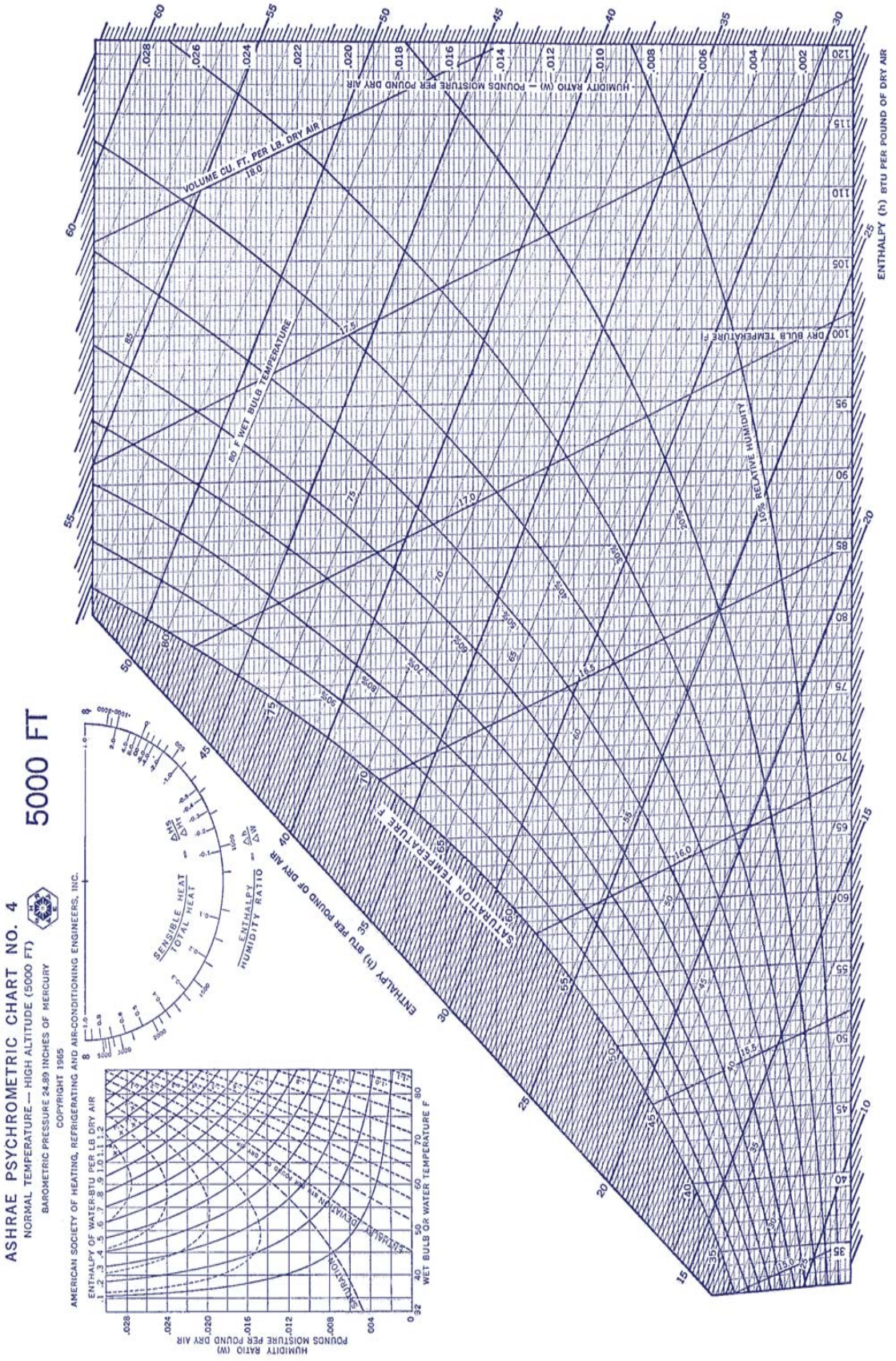
Direct evaporative cooling using recirculating water is an adiabatic process and follows lines of constant wet bulb on the psychrometric chart.

CURVE #1
Class 10 Air Washer Cellulose Fill or Fiberglass Fill Media



AIR WASHING UNITS




ASHRAE PSYCHROMETRIC CHART NO. 4
NORMAL TEMPERATURE — HIGH ALTITUDE (5000 FT)
BAROMETRIC PRESSURE 24.89 INCHES OF MERCURY
COPYRIGHT 1965
AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS, INC.
5000 FT
ENTHALPY (h) BTU PER POUND OF DRY AIR
HUMIDITY RATIO (W) — POUNDS MOISTURE PER POUND DRY AIR
DRY BULB TEMPERATURE F
ENTHALPY (h) BTU PER POUND OF DRY AIR
VOLUME CU. FT. PER LB. DRY AIR
60 F WET BULB TEMPERATURE
RELATIVE HUMIDITY
SATURATION TEMPERATURE F
SENSIBLE HEAT / TOTAL HEAT
ENTHALPY / HUMIDITY RATIO
ENTHALPY OF WATER-BTU PER LB DRY AIR
HUMIDITY RATIO (W)
POUNDS MOISTURE PER POUND DRY AIR
WET BULB OR WATER TEMPERATURE F
SATURATION
CONSTANT WET BULB TEMPERATURE DEVIATION

Indirect evaporative cooling of the primary air stream is a cooling process without the addition or removal of moisture and follows paths of constant moisture level, indicated by horizontal lines on the psychrometric chart. Relationships between dry bulb temperature, moisture content, wet bulb temperature, etc., vary with air density (altitude). Failure to calculate performance calculations to the proper psychrometric chart for the altitude at which the application is located will lead to erroneous results.

The examples and calculations in this information are based on use of a psychrometric chart for 25" of mercury atmosphere pressure unless otherwise identified. This corresponds approximately to an elevation of 5000 ft. above sea level and is chosen because the climate in the Rocky Mountain Region is especially favorable to the use of evaporative cooling.

DESIGN CONDITIONS

The Fundamentals Volume of the ASHRAE Handbook includes in chapter 24, Table 1, climatic conditions for cities in the United States. This table lists recommended dry bulb and wet bulb temperatures, and design dry bulb temperatures with mean coincident wet bulb temperatures.

It is recommended by Mallory that sizing and selection of the Sun West Air Washer sections be made using design wet bulb temperatures.

During hours when actual outside temperatures exceed the temperatures used for equipment selection, it is likely that indoor space temperatures will likewise exceed design.

Mean coincident wet bulb temperatures are useful for calculating performance for energy use studies and comparisons.

DESIGN FEATURES & APPLICATIONS

Design features which are incorporated by Mallory/Sun West Air Washers in the Class 10 and 12 model air washers/evaporative coolers are the result of over 60 years of continuous refinement and upgrading of water-to-air cooling, washing, and conditioning apparatus throughout the industry.

Development of the innovative fill materials used in the Class 10 and 12 Air Washers, as described in this information, make it possible for Mallory to offer equipment especially well suited to the requirements of today's energy conscious engineers and architects.

Because they provide high performance with minimal energy consumption, the cost of operation of air conditioning systems using the Class 10 and 12 Air Washers is extremely low when compared with conventional cooling by refrigeration.

Types of buildings and applications for which the Direct and/or Indirect Evaporative Cooling should be considered include:

- Theaters
- Supermarkets
- Warehouses
- Banks
- Schools
- Gymnasiums
- Department Stores
- Government Buildings
- Libraries
- Laboratories
- Offices
- Manufacturing Plants
- Military Buildings
- Others

Evaporative cooling can be used for spot cooling, area cooling and humidification. Spot cooling is done by ducting cool air or using several small evaporative coolers directed to the immediate vicinity of workers near hot operations. The result is increased worker comfort, increased productivity, and a reduction of heat stress. Spot cooling can be used in foundries, steel mills, vehicle inspection and toll booths, chemical plants and refineries, laundries and kitchens as well as many other applications where personnel must work near hot operations.

Area cooling of large plant or warehouse sections, for example, can be accomplished with evaporative cooling. Area cooling normally involves 100% outside air cooled and distributed through adjustable outlets at ceiling level. Also, one may want to add a mixing/economizer section ahead of the air washer to add ventilation and recirculation capability to the system design without compromising a large APD from the Class 10 air washer fill media; only the water recirculating pump need be turned “off”. Today, evaporative area cooling can provide the benefits of comfort, productivity and performance at much less than half the cost of mechanical cooling.

The Class 10 Air Washer can be applied to many industrial processes where humidification is essential. Mallory/Sun West Air Washers can be used for humidification in paper mills and printing plants, paint booths, greenhouses, and many other applications where humidity control is necessary. Consult the factory for additional detailed information regarding the many methods of accurately controlling humidity levels by means of face and by-pass, staged or striped banks of fill media, and others.

Precooling gas turbine and combustion air intakes with Mallory/Sun West Air Washers - Class 10 serves to increase engine efficiency by the increased density of the evaporatively cooled intake air. In addition, reduced emissions of nitrogen oxides and greater power output can be realized. The increased performance of the engine or gas turbine should translate into savings that will more than pay for the evaporative coolers. Mallory can provide this type of precooling air washer with any kind of filtration system and plenum intake section required as a factory pre-assembled package.

Another precooling application which can be considered is the usage of Class 12 air washers to act as a cooling tower providing evaporatively cooled water for precooling coils. The load requirements on refrigerated cooling machines can often be reduced significantly to allow for the use of smaller refrigeration equipment, thus significantly lowering operating costs.

Also by introducing evaporatively cooled air from the Class 12 air washer to an air cooled condenser coil, a significant savings is gained when used in conjunction with mechanical cooling systems. The resulting increase of cooling capacity because of lower condensing temperatures, (lower head pressure), reduces horsepower requirements and energy costs as well as helping to extend the life of the refrigeration equipment.

Installations in the Rocky Mountain area, Southwest, and West regions of the United States are especially suitable because the climate favors the performance of the air washers as Direct and Indirect evaporative coolers.

Mallory/Sun West Air Washers Class 10 and 12 should not be confused with the residential “swamp cooler” type evaporative coolers.

These residential type units may use hair or wood shavings as the wetted surface and light duty furnace fans. The Sun West Air Washer - Class 10 and 12 are designed for heavy duty industrial and commercial usage. Construction is heavy duty throughout as described in the product description section of this catalog.

AIR WASHER OPERATION

Air washers are designed to bring into intimate contact with a film or drops of recirculating water. Because this process promotes evaporation of a portion of the water. Air washers have a high effectiveness as evaporative coolers.

For evaporation to occur heat must be added. The required latent heat of evaporation is taken from the sensible heat of the air stream. Removal of sensible heat results in lowering the air dry bulb temperature.

Evaporation occurs at water surfaces, where a thin film layer of air may be considered to become saturated with water vapor.

In "spray filled" air washers, such as the Class 4, 6, and 8, water is atomized by being pumped through spray nozzles. Each water droplet is surrounded by a thin air film. High effectiveness in this type of air washer is dependent on nozzle pressure, amount of water circulated, and the length of the spray chamber. Moisture eliminators are required to prevent water drops from being carried through the washer along with the discharged air.

The Sun West Air Washer Class 10 and Class 12 utilize a wetted surface design. This wetted surface, sometimes referred to as "media" or "fill", is made up of laminations, each sheet of which is formed with specifically angled and sized flutes. Two different angles are used and the sheets or laminations are laid up so that these angle flutes are sloped in different directions on alternating layers.

The flow of water is directed against the direction of air flow. This design feature has the effect of keeping the media surfaces covered with water. Maximum scrubbing by the air across the wetted surfaces is achieved with low turbulence and minimal resistance to air flow.

Water is continuously recirculated from the Class 10 air washer reservoir during operation by means of the internal pump. In standard construction Class 10 air washer the pump is a submersible design. The pump suction is taken from the reservoir through removable track mounted brass screens. The pump discharge is internally piped to the upper distribution pan and discharged through a perforated header pipe. Water flow from the upper distribution pan is directed onto the two inch deep fill distribution pad, and across the media fill. The pump discharge riser includes a balance valve and pressure gauge for setting recirculation flow rate, and tappings for connection to an optional bleed regulating device and to an optional water treatment feeder if specified.

As water is evaporated, continuous make-up of fresh water is provided by a ball float controlled make-up valve. This valve also supplies fresh water for dilution. Mallory recommends an initial bleed rate of approximately 10% of the water circulated for average water conditions. Extreme conditions may require the use of a higher bleed rate and water treatment to keep down the build up of minerals on the interior surfaces. See details in the operation and maintenance date.

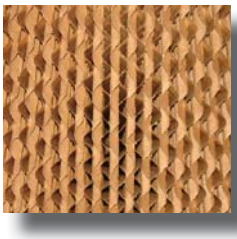
A tee fitting with hose bib is provided for use as a manual quick fill and as a means for periodic manual cleaning and flushing.

WETTED MEDIA CELL DESIGN

The wetted surface fill design used in the Mallory/ Sun West Air Washers - Class 10 and Class 12 air washer design offers the following advantages:

•*High Evaporative Cooling Effectiveness*

Twelve inch deep CELdek® or GLASdek® pads at 400-500 FPM velocity range offer cooling effectiveness up to 90%.



CELdek® Material

•*High Permissible Velocity* Rated conservatively at 700 FPM with out significant water carry over. With proper water flow and distribution.

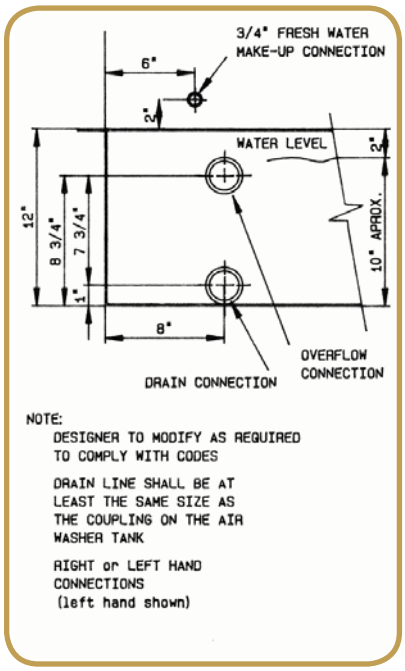
•*Self-Cleaning*
Fill is self-cleaning during operation with water flow flushing off sand and atmosphere dust. Operation of recirculating water without air flow flushes the surface areas and serves as protection form mineral build-up

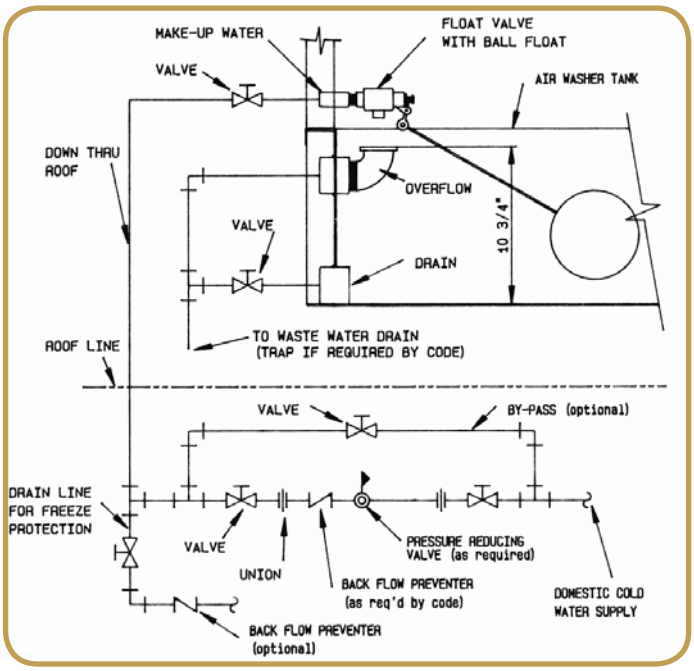
•*Low Air Static Pressure Drop*
Twelve inch deep CELdek® or GLASdek® pads at 500 FPM velocity has S.P. loss of approximately 0.20" w.g.

DIMENSIONS
Casing length "L" in direction of air flow is 24" for units with 6" deep and 8" deep and in some cases 12" deep cells. For units with 12" deep and sometimes 18" deep cells "L" dimension is 32". For 24" deep cells, "L" dimension is 44"

RECIRCULATION PUMP DATA
Submersible pumps are sized to provide recommended flow with available pressure of 1 to 2 psig at the distribution header. Consult factory for larger sized of Class 10 Air Washers and for pump selections for all Class 12 Air Washers. Pumps will be furnished 120 volt, single phase as standard. Pump motors have built in thermal protection. Three phase pumps are available at additional cost.

STANDARD PIPING CONNECTIONS
CLASS 10 & 12 AIR WASHERS





TYPICAL MAKE-UP & DRAIN PIPING
CLASS 10 & 12 AIR WASHER

•*Low Pumping Horsepower*
Low water flow rates and gravity water distribution instead of pressure nozzles reduces pumping horsepower required to a fraction of that required by spray type air washers.

•*Compact Design*
Less than 3 feet of casing depth required for unit with 12 inch deep fill

•*Large Surface Area*
Each cubic foot of CELdek® or GLASdek® me dia provides 123 square feet of evaporative sur face area.

PIPING
Units can be furnished with right hand or left hand connection location (when looking in the direction of air flow). Look to figure below left for suggested fresh water and waste piping.

OPTIONS
Air Washer Units with bypass duct and face and bypass dampers are available as optional.

SIZING BASIS
Tabulated nominal CFM is based on 500 feet per minute velocity. Maximum CFM column is based on velocities less than 650 feet per minute.

Class 10 AW Product Description

The Mallory/Sun West Air Washer Class 10 consists of reservoir or basin, casing top panel, casing side panels, wetted surface fill, upper distribution pan, recirculating pump, water distribution pipe and header, fresh water make-up system, and overflow and drain pipe connections.

The Basin

Is constructed of heavy gauge steel, formed and welded on both sides. The basin includes welded steel supports for the fill material and welded pipe connections for overflow and drain. After fabrication and thorough leak testing, the tank is cleaned and given two coats of coal tar epoxy, inside and out, for corrosion protection.

The Casing Side Panels and top Panel

Are fabricated from 14 and 16 gauge galvanized steel with angle flanges at panel edges and formed intermediate reinforcing ribs for rigidity. Joints between panels and between panels and basin are gasketed and caulked to be water and air tight. Access doors are furnished when specified. Access doors are 1" insulated double wall construction with intermediate reinforcing bars, gasketed back up angles and Ventlok® 260 latches.

The Wetted Surface Fill

Is Celdek® as standard with GLASdek® available as an option at additional cost. CELdek® is made from cellulose which has been impregnated with insoluble anti-rot salts and rigidifying saturants. GLASdek® is made using long glass fibers bound together using inorganic, non-crystal line fillers. This material carries a U.L. 900 class 2 rating in cell depths of 12" or less. Both fill materials are formed and laid up using a unique cross fluted design which produces a highly turbulent mixing of air and water for optimum evaporation and heat transfer. This design provides flushing during water circulation which minimizes fouling due to mineral build up, sand, or atmospheric dust. An additional feature is low resistance to air flow. Air velocities may approach 700 AFPM without appreciable moisture carry over. Fill depths available are 6", 8", 12", 16", 18" and 24" in the direction of air flow. The upper section of the fill consists of 2" thick distribution pad of the same material as the fill.

The Water Recirculation System

Consists of a factory furnished and mounted vertical submersible pump, located in the basin.
The pump discharge is piped to the upper distribution header covered by a PVC distribution cover. The pump is protected against entry of debris by removable brass suction screens in stainless steel frames which are track mounted. Standard construction for the tank discharge piping and distribution header is type L copper pipe. Also, PVC or other materials are available at the designers choosing. A balancing valve and pressure gauge are furnished for adjustment of flow. Ports are furnished in the pump discharge pipe for use with bleed valve and for connection to water treatment feeder if specified.

Make-up Water Flow

Is regulated by a brass make-up float valve with ball. The make-up water connection is located in the casing side panel. A fitting and hose bib are furnished as standard in fresh water for use as a quick fill means and for flushing.

Optional Equipment and Construction

Includes face and bypass dampers; bypass duct (top or sides); inlet louvers; screens; pre-filters; access doors; moisture eliminators for high velocity applications; stainless steel construction; insulated casing; special interior casing; corrosion resistant finish; etc. Matching cooling coils may be factory mounted on Class 10 air washers. Consult factory or local factory representative for application assistance and details. Special two position make-up valves and other flushing and drain valve options are available. Optional corrosion resistant finish for metal surfaces inside of casing is available.

Size Availability

The Sun West Class 10 Air Washer is available as standard in the normal sizes tabulated in the dimension pages of this catalog. Sizes shown are nominal feet of face opening wide by nominal feet of face opening high. For example, a size 6-4 unit is approximately 6 feet wide by 4 feet high above the tank. In addition to the tabulated sizes, Mallory will manufacture intermediate sizes in one-half foot increments of width and height without price penalty. Additional special configurations may be available on application to meet particular project requirements.

CLASS 10 AIR WASHER
TABLE #1
DIMENSIONS and PHYSICAL DATA

SIZE W x H	FACE AREA SQ. FT.	CFM Nominal	CFM Maximum	A	B	C	D	6" and 12" Fill		18" and 24" Fill	
								Ship Wt.	Op. Wt.	Ship Wt.	Op. Wt.
4-4	14.77	7,350	9,500	68	53	54	48	620	1250	730	1500
6-4	22.48	11,200	14,500	68	77	54	72	775	1650	895	2100
8-4	30.19	14,750	18,600	68	101	54	96	910	2100	1055	2600
10-4	37.89	18,500	23,500	68	125	54	120	1045	2500	1200	3100
4-5	18.60	9,400	11,850	80	53	66	48	655	1300	770	1600
6-5	28.31	14,250	18,000	80	77	66	72	805	1700	930	2100
8-5	38.02	18,600	23,500	80	101	66	96	950	2200	1100	2700
10-5	47.73	23,400	29,500	80	125	66	120	1085	2600	1260	3200
4-6	22.44	11,300	14,500	92	53	78	48	690	1300	800	1600
6-6	34.14	17,100	21,500	92	77	78	72	835	1800	1000	2200
8-6	45.85	22,400	28,500	92	101	78	96	995	2250	1150	2800
10-6	57.56	28,300	35,600	92	125	78	120	1125	2700	1300	3300
6-7	39.01	19,400	24,500	104	77	90	72	875	1900	1000	2300
8-7	52.38	25,500	32,500	104	101	90	96	1030	2300	1200	2900
10-7	65.76	32,100	40,500	104	125	90	120	1175	2800	1400	3400
12-7	79.13	38,750	49,000	104	149	90	144	1330	3300	1600	4000
14-7	92.51	44,700	56,500	104	173	90	168	1475	3700	1700	4600
6-8	43.87	22,400	28,500	116	77	102	72	905	1900	1100	2400
8-8	58.91	29,300	37,000	116	101	102	96	1070	2400	1300	3000
10-8	75.59	36,900	46,500	116	125	102	120	1230	2900	1400	3600
12-8	90.96	44,500	56,000	116	149	102	144	1375	3400	1600	4200
14-8	106.3	51,500	65,000	116	173	102	168	1530	3900	1800	4800
16-8	121.7	59,000	74,500	116	197	102	192	1685	4400	2000	5400
18-8	137.1	66,500	84,000	116	221	102	216	1835	4800	2200	6000
6-9	50.67	25,250	32,000	128	77	114	72	945	2000	1100	2400
8-9	68.05	33,400	42,000	128	101	114	96	1105	2500	1300	3000
10-9	85.42	41,750	53,000	128	125	114	120	1245	3000	1500	3600
12-9	102.8	50,500	63,600	128	149	114	144	1415	3500	1700	4300
14-9	120.2	58,500	73,800	128	173	114	168	1580	4000	1800	4900
16-9	137.6	67,000	84,500	128	197	114	192	1750	4500	2050	5500
18-9	154.9	75,500	95,300	128	221	126	216	1900	5000	2200	6100
8-10	75.88	37,000	46,600	140	101	126	96	1255	2600	1350	3100
10-10	95.26	47,000	59,400	140	125	126	120	1305	3100	1500	3800
12-10	114.6	56,500	71,300	140	149	126	144	1480	3600	1700	4400
14-10	134.0	65,500	82,500	140	173	126	168	1645	4200	1900	5000
16-10	153.4	75,000	94,500	140	197	126	192	1800	4700	2100	5700
18-10	172.8	84,000	106,000	140	221	126	216	2000	5200	2300	6300
20-10	192.1	93,500	118,000	140	245	126	240	2200	5700	2500	7000

CLASS 10 AIR WASHER

TABLE #2

PUMP CAPACITY

PUMP[1], PIPING & GPM REQUIREMENTS FOR CELLULOSE & FIBERGLASS FILL																			
SIZE W x H	FACE AREA SQ. FT.	CFM Nominal	CFM Maximum	6" Fill				12" Fill				18" Fill				24" Fill			
				GPM	Head	Pipe Size	Pump HP	GPM	Head	Pipe Size	Pump HP	GPM	Head	Pipe Size	Pump HP	GPM	Head	Pipe Size	Pump HP
4-4	14.77	7,350	9,500	3.5	5	1"	1/6	7	6	1"	1/6	10.5	7	1"	1/6	14	7	1-1/4"	1/4
6-4	22.48	11,200	14,500	5.25	6	1"	1/6	10.5	7	1"	1/6	15.7	7	1-1/4"	1/4	21	8	1-1/4"	1/4
8-4	30.19	14,750	18,600	7	7	1"	1/6	14	8	1"	1/6	21	8	1-1/4"	1/4	28	9	1-1/2"	1/3
10-4	37.89	18,500	23,500	8.75	8	1"	1/6	17.5	9	1-1/4"	1/4	26.2	10	1-1/4"	1/4	35	11	1-1/2"	1/3
4-5	18.60	9,400	11,850	3.5	6	1"	1/6	7	7	1-1/4"	1/6	10.5	7	1"	1/6	14	8	1-1/4"	1/4
6-5	28.31	14,250	18,000	5.25	7	1"	1/6	10.5	8	1-1/4"	1/6	15.7	8	1"	1/6	21	10	1-1/4"	1/4
8-5	38.02	18,600	23,500	7	8	1"	1/6	14	9	1-1/4"	1/4	21	9	1-1/4"	1/4	28	11	1-1/2"	1/3
10-5	47.73	23,400	29,500	8.75	9	1"	1/6	17.5	10	1-1/4"	1/4	26.2	10	1-1/4"	1/4	33	13	1-1/2"	1/3
4-6	22.44	11,300	14,500	3.5	7	1"	1/6	7	8	1-1/4"	1/6	10.5	8	1"	1/6	14	9	1-1/4"	1/4
6-6	34.14	17,100	21,500	5.25	8	1"	1/6	10.5	9	1-1/4"	1/6	15.7	9	1-1/4"	1/4	21	11	1-1/4"	1/4
8-6	45.85	22,400	28,500	7	9	1"	1/6	14	10	1-1/4"	1/4	21	10	1-1/4"	1/4	28	12	1-1/2"	1/3
10-6	57.56	28,300	35,600	8.75	10	1"	1/6	17.5	11	1-1/4"	1/4	26.2	11	1-1/2"	1/3	35	13	1-1/2"	1/3
6-7	39.01	19,400	24,500	5.25	7	1"	1/6	10.5	9	1-1/4"	1/6	15.7	9	1-1/4"	1/4	21	12	1-1/4"	1/4
8-7	52.38	25,500	32,500	7	8	1"	1/6	14	10	1-1/4"	1/4	21	10	1-1/4"	1/4	28	13	1-1/2"	1/3
10-7	65.76	32,100	40,500	8.25	9	1"	1/6	17.5	11	1-1/4"	1/4	26.2	11	1-1/2"	1/3	35	13	2"	1/2
12-7	79.13	38,750	49,000	10.5	10	1"	1/6	21	11	1-1/2"	1/3	31.5	12	1-1/2"	1/3	42	14	2"	1/2
14-7	92.51	44,700	56,500	12.25	9	1-1/4"	1/4	24.5	12	1-1/2"	1/3	36.7	14	2"	1/2	49	15	2"	1/2
6-8	43.87	22,400	28,500	5.25	8	1"	1/6	10.5	10	1-1/4"	1/4	15.7	10	1-1/4"	1/4	21	13	1-1/2"	1/3
8-8	58.91	29,300	37,000	7	9	1"	1/6	14	10	1-1/4"	1/4	21	11	1-1/4"	1/4	28	14	2"	1/2
10-8	75.59	36,900	46,500	8.75	10	1"	1/6	17.5	11	1-1/4"	1/4	26.2	11	1-1/2"	1/3	35	14	2"	1/2
12-8	90.96	44,500	56,000	10.5	11	1"	1/6	21	12	1-1/2"	1/3	31.5	12	1-1/2"	1/3	42	15	2"	1/2
14-8	106.3	51,500	65,000	12.25	10	1-1/4"	1/4	24.5	13	1-1/2"	1/3	36.7	14	2"	1/2	49	17	2"	3/4
16-8	121.7	59,000	74,500	16	12	1-1/4"	1/4	32	13	2"	1/2	48	15	2"	1/2	64	20	2-1/2"	3/4
18-8	137.1	66,500	84,000	18	15	1-1/4"	1/4	36	14	2"	1/2	54	20	2"	3/4	72	22	2-1/2"	3/4
6-9	50.67	25,250	32,000	6	10	1"	1/6	12	11	1-1/4"	1/4	15.7	11	1-1/4"	1/4	24	15	2"	1/2
8-9	68.05	33,400	42,000	8	11	1"	1/6	16	12	1-1/2"	1/3	21	12	1-1/2"	1/3	32	16	2"	1/2
10-9	85.42	41,750	53,000	10	13	1-1/4"	1/4	20	12	1-1/2"	1/3	26.2	13	2"	1/2	40	17	2"	1/2
12-9	102.8	50,500	63,600	12	14	1-1/4"	1/4	24	14	1-1/2"	1/3	31.5	13	2"	1/2	48	19	2"	3/4
14-9	120.2	58,500	73,800	14	15	1-1/2"	1/3	28	15	2"	1/2	36.7	15	2"	1/2	56	20	2-1/2"	3/4
16-9	137.6	67,000	84,500	16	16	1-1/2"	1/3	32	17	2"	1/2	48	15	2"	1/2	64	22	2-1/2"	3/4
18-9	154.9	75,500	95,300	18	17	1-1/2"	1/3	36	17	2"	1/2	54	21	2"	3/4	72	24	2-1/2"	3/4
8-10	75.88	37,000	46,600	8	12	1-1/4"	1/4	16	13	1-1/2"	1/3	21	13	1-1/2"	1/3	32	17	2"	1/2
10-10	95.26	47,000	59,400	10	13	1-1/4"	1/4	20	13	1-1/2"	1/3	26.2	13	2"	1/2	40	18	2"	1/2
12-10	114.6	56,500	71,300	12	14	1-1/4"	1/4	24	14	1-1/2"	1/3	31.5	14	2"	1/2	48	20	2-1/2"	3/4
14-10	134.0	65,500	82,500	14	15	1-1/2"	1/3	28	15	2"	1/2	36.5	15	2"	1/2	56	22	2-1/2"	3/4
16-10	153.4	75,000	94,500	16	17	1-1/2"	1/3	32	17	2"	1/2	48	16	2"	3/4	64	24	2-1/2"	3/4
18-10	172.8	84,000	106,000	18	18	1-1/2"	1/3	36	19	2"	1/2	54	22	2"	3/4	72	25	2-1/2"	3/4
20-10	192.1	93,500	118,000	20	20	1-1/2"	1/3	40	22	2"	1/2	60	25	2-1/2"	3/4	80	27	2-1/2"	3/4

Direct Evaporative Cooling

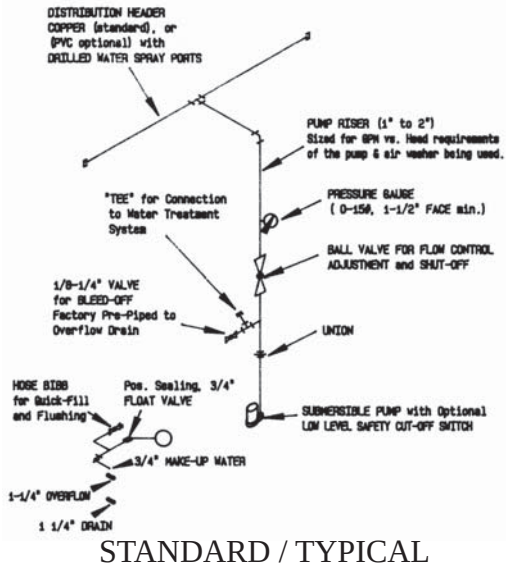
Performance of Sun West Class 10 Air Washers used as single stage evaporative coolers may be predicted using data from curve #1. Curve #1 shows evaporative cooling effectiveness "e_c" plotted against velocity of air flow through the air washer face area in terms of equivalent standard air $(\frac{SCFM}{Sq.\ Ft.})$. Curves are shown on Curve #1 as solid lines for cell thickness of 6", 8", 12", 16", 18", and 24" deep.

The leaving air dry bulb temperature may be calculated when the entering dry bulb and wet bulb temperatures are known using the equation:

$$t_2 = t_1 - \frac{e_c}{100}(t_1 - t^1)$$

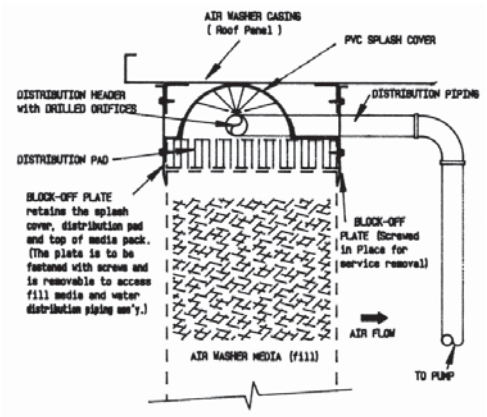
Where:

t_2=leaving dry bulb temperature
t_1=entering dry bulb temperature
e_c=evaporative cooling effectiveness (%) from Figure 1 for face velocity and depth of cell
t^1=entering wet bulb temperature



STANDARD / TYPICAL
SCHEMATIC AIR WASHER PIPING DETAIL

Example:
Based on 5000 feet elevation, with entering air temperatures of 93° db and 63° wet bulb comparative performance would be:



WATER DISTRIBUTION DETAIL

•For actual velocity 510 feet per minute and 6" cell. Equivalent standard air velocity equals 510 / 1 = 425 from Curve #1, e_c=70%.

Leaving dry bulb $(t_2) = 93 - \frac{70}{100}(93-63) = 72°F$

•For actual velocity 516 feet per minute and 12" cell. Equivalent standard air velocity equals 430 feet per minute from Curve #1, e_c = 90%

Leaving dry bulb $(t_2) = 93 - \frac{90}{100}(93-63) = 66°F$

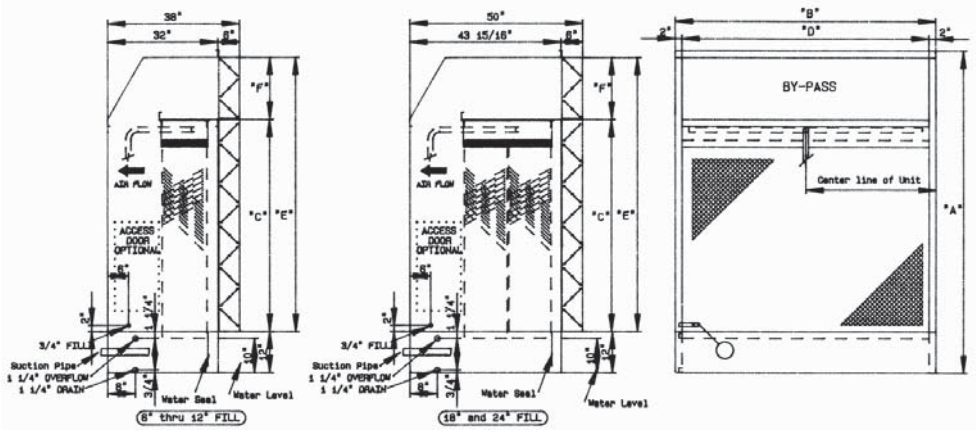
•For actual velocity 712 feet per minute and 18" cell. Equivalent standard air velocity equals 600 feet per minute. from Curve#1, e_c = 95%

Leaving dry bulb $(t_2) = 93 - \frac{95}{100}(93-63) = 64.5°F$

Resistance to air flow of Class 10 Air Washer is expressed in inches of water gauge static pressure drop. Values at various air velocities are shown for SIX different depths of cell (fill) for 6", 8",12", 16",18", and 24" by dashed lines on Curve #1.

If the curve is entered at velocity based on actual air flow, at 5000 feet, the resulting S.P. drop values are "actual static pressure drop".

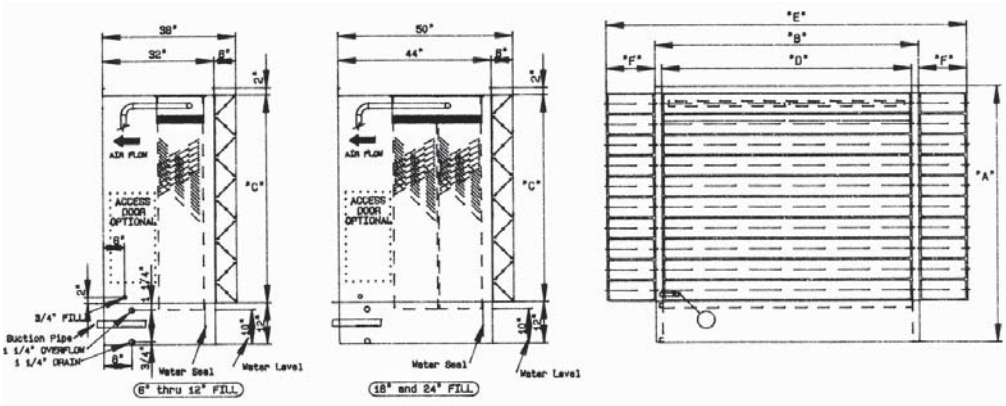
•For "a" above: to find equivalent standard air S.P. enter curve with 510 ft. per min. and read 0.1".
•For "b" above: enter curve with 516 ft. per min. and read 0.21".
•For "c" above: enter curve with 720 ft. per min. and read 0.37".



Dimensions and Physical Data, TOP BY-PASS DAMPER

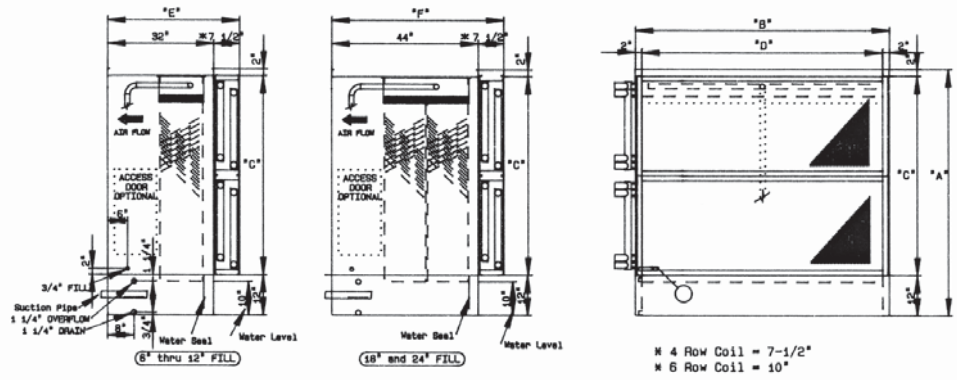
SIZE W x H	FACE AREA SQ. FT.	CFM Nominal	CFM Maximum	A	B	C	D	E	F	6" and 12" Fill		18" and 24" Fill	
										Ship Wt.	Op. Wt.	Ship Wt.	Op. Wt.
4-4	14.77	7,350	9,500	82	53	54	48	68	14	890	1500	1000	1750
6-4	22.48	11,200	14,500	82	77	54	72	68	14	1125	1975	1275	2400
8-4	30.19	14,750	18,600	82	101	54	96	68	14	1400	2550	1550	3050
10-4	37.89	18,500	23,500	82	125	54	120	68	14	1600	3050	1850	3700
4-5	18.60	9,400	11,850	98	53	66	48	84	18	1000	1575	1100	1900
6-5	28.31	14,250	18,000	98	77	66	72	84	18	1250	2150	1390	2550
8-5	38.02	18,600	23,500	98	101	66	96	84	18	1500	2675	1675	3250
10-5	47.73	23,400	29,500	98	125	66	120	84	18	1800	3250	1950	3900
4-6	22.44	11,300	14,500	116	53	78	48	102	24	1100	1650	1200	2000
6-6	34.14	17,100	21,500	116	77	78	72	102	24	1350	2250	1500	2700
8-6	45.85	22,400	28,500	116	101	78	96	102	24	1600	2850	1800	3400
10-6	57.56	28,300	35,600	116	125	78	120	102	24	1900	3450	2100	4100
6-7	39.01	19,400	24,500	128	77	90	72	114	24	1400	2350	1600	2800
8-7	52.38	25,500	32,500	128	101	90	96	114	24	1700	3000	1900	3550
10-7	65.76	32,100	40,500	128	125	90	120	114	24	2000	3600	2250	4300
12-7	79.13	38,750	49,000	128	149	90	144	114	24	2300	4250	2550	5050
14-7	92.51	44,700	56,500	128	173	90	168	114	24	2600	4850	2900	5800
6-8	43.87	22,400	28,500	146	77	102	72	132	30	1500	2500	1690	3000
8-8	58.91	29,300	37,000	146	101	102	96	132	30	1900	3150	2050	3800
10-8	75.59	36,900	46,500	146	125	102	120	132	30	2200	3800	2400	4500
12-8	90.96	44,500	56,000	146	149	102	144	132	30	2600	4550	2800	5350
14-8	106.3	51,500	65,000	146	173	102	168	132	30	2800	5150	3100	6050
16-8	121.7	59,000	74,500	146	197	102	192	132	30	3150	5750	3450	6850
18-8	137.1	66,500	84,000	146	221	102	216	132	30	3500	6400	3800	7600
6-9	50.67	25,250	32,000	158	77	114	72	144	30	1600	2600	1800	3100
8-9	68.05	33,400	42,000	158	101	114	96	144	30	2000	3300	2150	3900
10-9	85.42	41,750	53,000	158	125	114	120	144	30	2300	3950	2500	4650
12-9	102.8	50,500	63,600	158	149	114	144	144	30	2600	4650	2700	5500
14-9	120.2	58,500	73,800	158	173	114	168	144	30	3000	5350	3250	6300
16-9	137.6	67,000	84,500	158	197	114	192	144	30	3300	6050	3650	7000
18-9	154.9	75,500	95,300	158	221	114	216	144	30	3700	6700	4000	7900
8-10	75.88	37,000	46,600	176	101	126	96	162	36	2100	3450	2300	4050
10-10	95.26	47,000	59,400	176	125	126	120	162	36	2400	4150	2650	4900
12-10	114.6	56,500	71,300	176	149	126	144	162	36	2800	4900	3050	5800
14-10	134.0	65,500	82,500	176	173	126	168	162	36	3150	5600	3500	6600
16-10	153.4	75,000	94,500	176	197	126	192	162	36	3500	6350	3900	7400
18-10	172.8	84,000	106,000	176	221	126	216	162	36	3900	7050	4300	8300
20-10	192.1	93,500	118,000	176	245	126	240	162	36	4300	7800	4700	9100

CLASS 10 AIR WASHER



Dimensions and Physical Data, SIDE BY-PASS DAMPER													
SIZE W x H	FACE AREA SQ. FT.	CFM Nominal	CFM Maximum	A	B	C	D	E	F	6" and 12" Fill		18" and 24" Fill	
										Ship Wt.	Op. Wt.	Ship Wt.	Op. Wt.
4-4	14.77	7,350	9,500	68	53	54	48	81	14	990	1600	1100	1850
6-4	22.48	11,200	14,500	68	77	54	72	105	14	1225	2075	1375	2500
8-4	30.19	14,750	18,600	68	101	54	96	129	14	1500	2650	1650	3150
10-4	37.89	18,500	23,500	68	125	54	120	153	14	1700	3150	1950	3800
4-5	18.60	9,400	11,850	80	53	66	48	89	18	1100	1675	1200	2000
6-5	28.31	14,250	18,000	80	77	66	72	113	18	1350	2250	1490	2650
8-5	38.02	18,600	23,500	80	101	66	96	137	18	1600	2775	1775	3350
10-5	47.73	23,400	29,500	80	125	66	120	161	18	1900	3350	2050	4000
4-6	22.44	11,300	14,500	92	53	78	48	101	24	1200	1750	1300	2100
6-6	34.14	17,100	21,500	92	77	78	72	125	24	1450	2350	1600	2800
8-6	45.85	22,400	28,500	92	101	78	96	149	24	1700	2950	1900	3500
10-6	57.56	28,300	35,600	92	125	78	120	173	24	2000	3550	2200	4200
6-7	39.01	19,400	24,500	104	77	90	72	125	24	1500	2450	1700	2900
8-7	52.38	25,500	32,500	104	101	90	96	149	24	1800	3100	2000	3650
10-7	65.76	32,100	40,500	104	125	90	120	173	24	2100	3700	2350	4400
12-7	79.13	38,750	49,000	104	149	90	144	197	24	2400	4350	2650	5150
14-7	92.51	44,700	56,500	104	173	90	168	221	24	2700	4950	3000	5900
6-8	43.87	22,400	28,500	116	77	102	72	137	30	1600	2600	1790	3100
8-8	58.91	29,300	37,000	116	101	102	96	161	30	2000	3250	2150	3900
10-8	75.59	36,900	46,500	116	125	102	120	185	30	2300	3900	2500	4600
12-8	90.96	44,500	56,000	116	149	102	144	209	30	2700	4650	2900	5450
14-8	106.3	51,500	65,000	116	173	102	168	233	30	2900	5250	3200	6150
16-8	121.7	59,000	74,500	116	197	102	192	257	30	3250	5850	3550	6950
18-8	137.1	66,500	84,000	116	221	102	216	281	30	3600	6500	3900	7700
6-9	50.67	25,250	32,000	128	77	114	72	137	30	1700	2700	1900	3100
8-9	68.05	33,400	42,000	128	101	114	96	161	30	2100	3300	2250	4000
10-9	85.42	41,750	53,000	128	125	114	120	185	30	2400	4050	2600	4750
12-9	102.8	50,500	63,600	128	149	114	144	209	30	2700	4750	2800	5600
14-9	120.2	58,500	73,800	128	173	114	168	233	30	3100	5450	3350	6400
16-9	137.6	67,000	84,500	128	197	114	192	257	30	3400	6150	3750	7100
18-9	154.9	75,500	95,300	128	221	114	216	281	30	3800	6800	4100	8000
8-10	75.88	37,000	46,600	140	101	126	96	173	36	2200	3550	2400	4150
10-10	95.26	47,000	59,400	140	125	126	120	197	36	2500	4250	2750	5000
12-10	114.6	56,500	71,300	140	149	126	144	221	36	2900	5000	3150	5900
14-10	134.0	65,500	82,500	140	173	126	168	245	36	3250	5700	3600	6700
16-10	153.4	75,000	94,500	140	197	126	192	269	36	3600	6450	4000	7500
18-10	172.8	84,000	106,000	140	221	126	216	293	36	4000	7150	4400	8400
20-10	192.1	93,500	118,000	140	245	126	240	317	36	4400	7900	4800	9200

CLASS 10 AIR WASHER with C/W COIL or with PRE-COOLING COIL for CLASS 12 AIR WASHER



Dimensions and Physical Data, WITH COIL													
SIZE W x H	FACE AREA SQ. FT.	CFM Nominal	CFM Maximum	A	B	C	D	E-6 Row	F-6 Row	6" and 12" Fill		18" and 24" Fill	
										Ship Wt.	Op. Wt.	Ship Wt.	Op. Wt.
4-4	14.77	7,350	9,500	68	53	54	48	42	54	980	1500	1000	1750
6-4	22.48	11,200	14,500	68	77	54	72	42	54	1125	1975	1275	2400
8-4	30.19	14,750	18,600	68	101	54	96	42	54	1400	2550	1550	3050
10-4	37.89	18,500	23,500	68	125	54	120	42	54	1600	3050	1850	3700
4-5	18.60	9,400	11,850	80	53	66	48	42	54	1000	1575	1100	1900
6-5	28.31	14,250	18,000	80	77	66	72	42	54	1250	2150	1390	2550
8-5	38.02	18,600	23,500	80	101	66	96	42	54	1500	2675	1675	3250
10-5	47.73	23,400	29,500	80	125	66	120	42	54	1800	3250	1950	3900
4-6	22.44	11,300	14,500	92	53	78	48	42	54	1100	1650	1200	2000
6-6	34.14	17,100	21,500	92	77	78	72	42	54	1350	2250	1500	2700
8-6	45.85	22,400	28,500	92	101	78	96	42	54	1600	2850	1800	3400
10-6	57.56	28,300	35,600	92	125	78	120	42	54	1900	3450	2100	4100
6-7	39.01	19,400	24,500	104	77	90	72	42	54	1400	2350	1600	2800
8-7	52.38	25,500	32,500	104	101	90	96	42	54	1700	3000	1900	3550
10-7	65.76	32,100	40,500	104	125	90	120	42	54	2000	3600	2250	4300
12-7	79.13	38,750	49,000	104	149	90	144	42	54	2300	4250	2550	5050
14-7	92.51	44,700	56,500	104	173	90	168	42	54	2600	4850	2900	5800
6-8	43.87	22,400	28,500	116	77	102	72	42	54	1500	2500	1690	3000
8-8	58.91	29,300	37,000	116	101	102	96	42	54	1900	3150	2050	3800
10-8	75.59	36,900	46,500	116	125	102	120	42	54	2200	3800	2400	4500
12-8	90.96	44,500	56,000	116	149	102	144	42	54	2600	4550	2800	5350
14-8	106.3	51,500	65,000	116	173	102	168	42	54	2800	5150	3100	6050
16-8	121.7	59,000	74,500	116	197	102	192	42	54	3150	5750	3450	6850
18-8	137.1	66,500	84,000	116	221	102	216	42	54	3500	6400	3800	7600
6-9	50.67	25,250	32,000	128	77	114	72	42	54	1600	2600	1800	3100
8-9	68.05	33,400	42,000	128	101	114	96	42	54	2000	3300	2150	3900
10-9	85.42	41,750	53,000	128	125	114	120	42	54	2300	3950	2500	4650
12-9	102.8	50,500	63,600	128	149	114	144	42	54	2600	4650	2700	5500
14-9	120.2	58,500	73,800	128	173	114	168	42	54	3000	5350	3250	6300
16-9	137.6	67,000	84,500	128	197	114	192	42	54	3300	6050	3650	7000
18-9	154.9	75,500	95,300	128	221	114	216	42	54	3700	6700	4000	7900
8-10	75.88	37,000	46,600	140	101	126	96	42	54	2100	3450	2300	4050
10-10	95.26	47,000	59,400	140	125	126	120	42	54	2400	4150	2650	4900
12-10	114.6	56,500	71,300	140	149	126	144	42	54	2800	4900	3050	5800
14-10	134.0	65,500	82,500	140	173	126	168	42	54	3150	5600	3500	6600
16-10	153.4	75,000	94,500	140	197	126	192	42	54	3500	6350	3900	7400
18-10	172.8	84,000	106,000	140	221	126	216	42	54	3900	7050	4300	8300
20-10	192.1	93,500	118,000	140	245	126	240	42	54	4300	7800	4700	9100

Indirect Evaporative Cooling

"Indirect Evaporative Cooling" is the name given to a process which combines evaporative cooling with a heat exchanging system. A primary air stream my be cooled with the addition of moisture. The heat removed is rejected to a secondary air stream which has been cooled by evaporation.

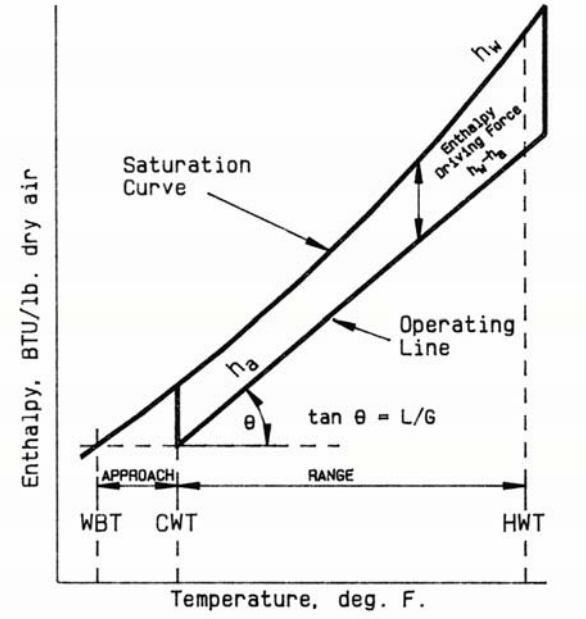
The Mallory/Sun West Air Washer Class 12 Indirect Evaporative Cooling System consists of computer-match selected water cooling coils with Class 12 Air Washer Indirect Evaporative cooler with fans, circulating pump, and interconnecting piping.

The water coil is located in the primary air stream. The Class 12 Air Washer is located in a secondary air stream. The Class 12 Air washer acts as a cooling tower with the basic function of cooling water by intimately mixing it with air. This cooling is accomplished by a combination of sensible heat transfer between the air and water and the evaporation of a small portion of the water. This type of transfer is represented by the equation:

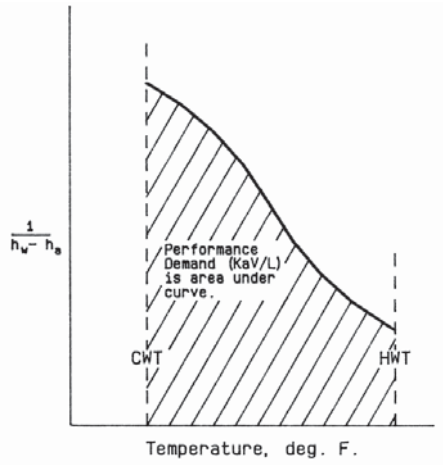
$$\frac{KaV}{L} = \int_{T_2}^{T_1} \frac{dT}{h_w - h_a}$$

This equation is commonly referred to as the Merkel equation. This equation can also be represented graphically by the following diagrams:

(a) SATURATION CURVE & OPERATING LINE



(b) EVALUATION OF $\frac{1}{h_w - h_a}$



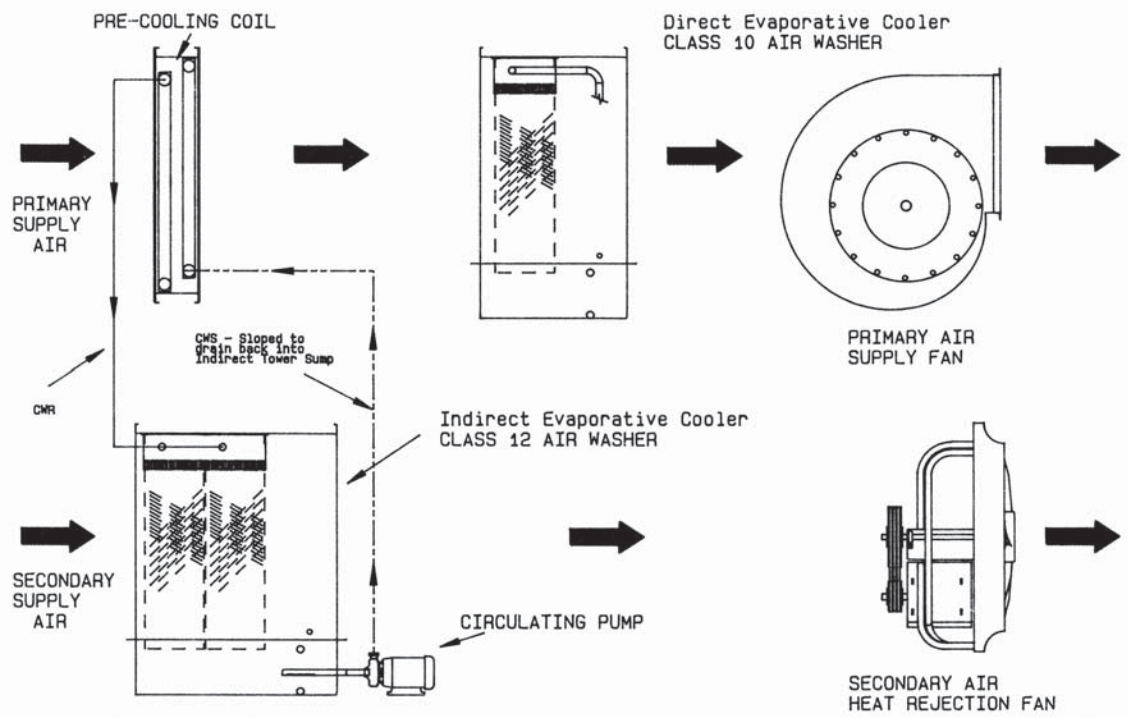
A secondary, heat-rejection or "wet-side" fan is used to pass air across the wetted cells of the Class 12 Air Washer. Water is pumped, through connecting piping, from the reservoir to the water coil, and back to the upper distribution header of the Class 12 Air Washer. The water flows over the cell surfaces and back to the reservoir.

The primary air stream is cooled by transfer of heat from water flowing through the coil. The heat is carried through the water back to the Class 12 Air Washer, where it is rejected to the secondary air stream by evaporation and water-to-air heat transfer.

The system is an "open" system since the water is open to the secondary air stream.

When the indirect evaporative cooling system is used as the first stage of a two-stage cooling process with refrigerated cooling or with direct evaporative cooling, the indirect evaporative cooling coil should be located in the primary air stream of the second cooling stage in the position of a pre-cooling coil.

As the circulating water of the indirect evaporative cooling system passes through the Class 12 Air Washer, a portion is evaporated. This has the effect of cooling the secondary entering air dry bulb temperature to approach the wet bulb temperature. The heated water returning from the coil in the primary air stream gives up its heat to the nearly saturated secondary air stream raising its temperature.



INDIRECT-DIRECT EVAPORATIVE COOLING with CLASS 12 AIR WASHER

In a continuous process at equilibrium, the water temperature as it is pumped from the sump will approach within a few degrees F of the wet bulb temperature of the entering secondary air. The water returning from the coil in the primary air stream will be warmer. The heat given up will increase the temperature of the secondary air, leaving the Class 12 Air Washer to approach the temperature of the water returning from the coil. Selection of Air Washer, coil sizes, and water and air flow rates is optimized by the Mallory computer selections.

PRODUCT DESCRIPTION

Class 12 Air Washers are specifically designed for use as evaporative water coolers in open systems.

In indirect evaporative cooling systems, Class 12 Air Washers supply cooled water to matched cooling coils in the primary air stream and reject heat by heat exchange and evaporation of water into a secondary air stream. Optimum sizing by computer for each specific capacity requirement.

The Sun West Air Washers Class 12 are similar design and construction to Class 10 Air Washer with the following exceptions:

Pumps are sized for higher water flow rates for Class 12 Air Washers, yielding approximately a 0.5 water/air ratio. Pumps may be vertical submersible type, mounted in the reservoir, with the discharge piped to the casing side panel, or horizontal end suction type for external mounting. Usually the external pump is selected and an additional tank connection is required.

b. Although 12”, 16”, or 18” deep CELdek® fill could be furnished, 24” deep fill is normally furnished to provide optimum cross-sectional area to accommodate higher water flow rates.

c. Sizing and dimensions, except for additional casing and tank connections, are the same as for Class 10 Air Washers as shown in the dimension drawings as shown on pg. 10, table 1. Typical supply and return connections for piping to remote coils are illustrated above.

INDIRECT EVAPORATIVE COOLING PERFORMANCE

In this catalog, indirect evaporative cooling is expressed in terms of "Performance Factor" (P.F.) which is defined as follows:

$$P.F. = \frac{(t_1 - t_2)}{(t_1 - t_{SWB})} \quad \text{where}$$

t_1 = dry bulb temperature of primary air up-stream of pre-cooling coil.

t_2 = dry bulb temperature of primary air down-stream of pre-cooling coil.

t_{SWB} = wet bulb temperature of air stream entering Class 12 Air Washer (sec ondary air stream)

The Mallory Indirect Evaporative Cooling System selected for an application to perform a specific cooling process would be computer match selected for the requested duty by the factory engineering department.

Selections may be possible over a range of P.F. between 0.60 to 0.75 or higher with pre-cooling coil sizing for 400 to 600 ACFM per square foot of coil face area.

See curve #2, page 20, for preliminary performance estimating data.

INDIRECT EVAPORATIVE COOLING - FIRST STAGE

The performance of Mallory Indirect evaporative cooling equipment may be estimated to provide a Performance Factor, P.F., within a range of 0.60 to 0.85. These P.F. ratings would cover a range of coil sizing between 650 ACFM / sq. ft. and 400 ACFM / sq. ft. respectively. Curve #2 may be for preliminary selections but *all selections should be referred to the factory for confirmation.*

In this example, the selection shall be based on an initial, primary air at 93°F dry bulb and 63°F wet bulb (at 5000 feet altitude), with the secondary air at the same conditions. Now, one can determine the primary air leaving dry bulb and wet bulb temperatures from the indirect system pre-cooling coil assuming a desired P.F. = 0.80. See calculation as follows:

$$P.F. = \frac{(t_1 - t_2)}{(t_1 - t_{SWB})} : \text{Thus, } t_2 = t_1 - P.F.\ (t_1 - t_{SWB})$$

$$t_2 = 93 - 70\ (93 - 63) = 72°F$$

The leaving wet bulb of the primary air may be determined graphically from the 5000 ft. psychrometric chart by projecting a horizontal line to the left, originating at 93° db and 63° wb and terminating at 72° db. The leaving wb is 56.3°.

If calculation was performed for P.F.=.65 and P.F.=.75, the results would be:

at P.F.=.65 t_2 = 73.5 wb = 56.8
P.F.=.75 t_2 = 70.5 wb = 55.7

Preliminary selections using data from Curve #2 assume the following:

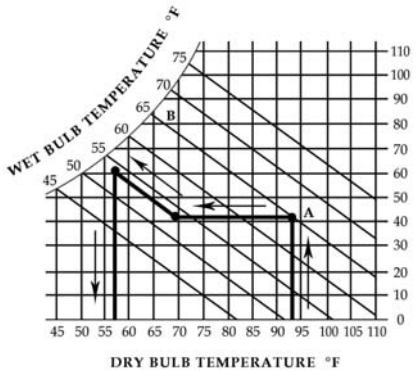
a. Pre-cooling coils 6 row, 10 fpi (fins per inch) and at 500 FPM face velocity.

b. Class 12 Air Washer with F.A. equal to the coil face area and with 24" fill depth.

c. Secondary air quantity is 500 ACFM / sq. ft. media face area.

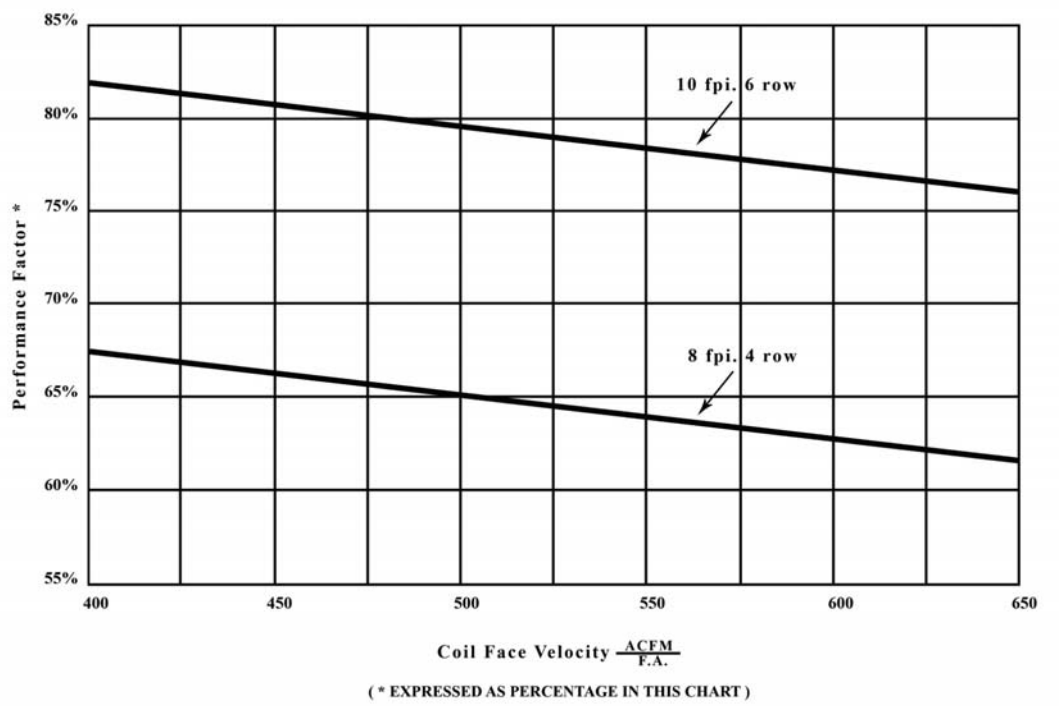
d. Water flow rate is selected for approximately a Water/Air ratio = 0.5, derived from the equation below:

$$W/A = L/G = \frac{500 \times GPM}{SCFM \times 4.5}$$



Note: Water coils may freeze if subjected to freezing temperatures. Freeze protection should be provided. Seasonal drain and antifreeze flush recommended.

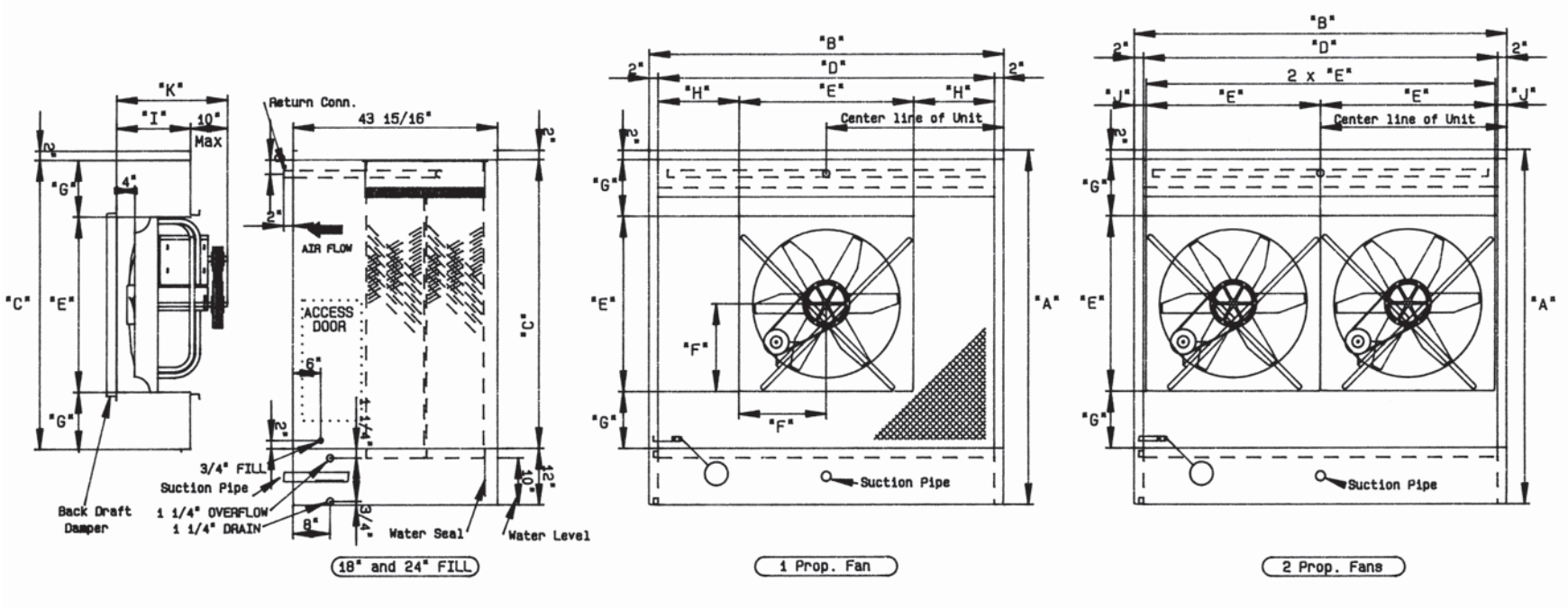
CURVE #2



Calculated performance "P.F." at various pre-cooling coil velocities based on Water / Air ratio of approximately 0.5 ($\frac{L}{G}$)

Factory computer match selections are possible over a range of "P.F." between 0.50 and 0.85 or possibly higher using pre-cooling coil sizing from 550 to 450 FPM and various row and fin circuiting as well as various W/A selection by varying GPM and CFM slightly on Class 12 air washer cooling tower.

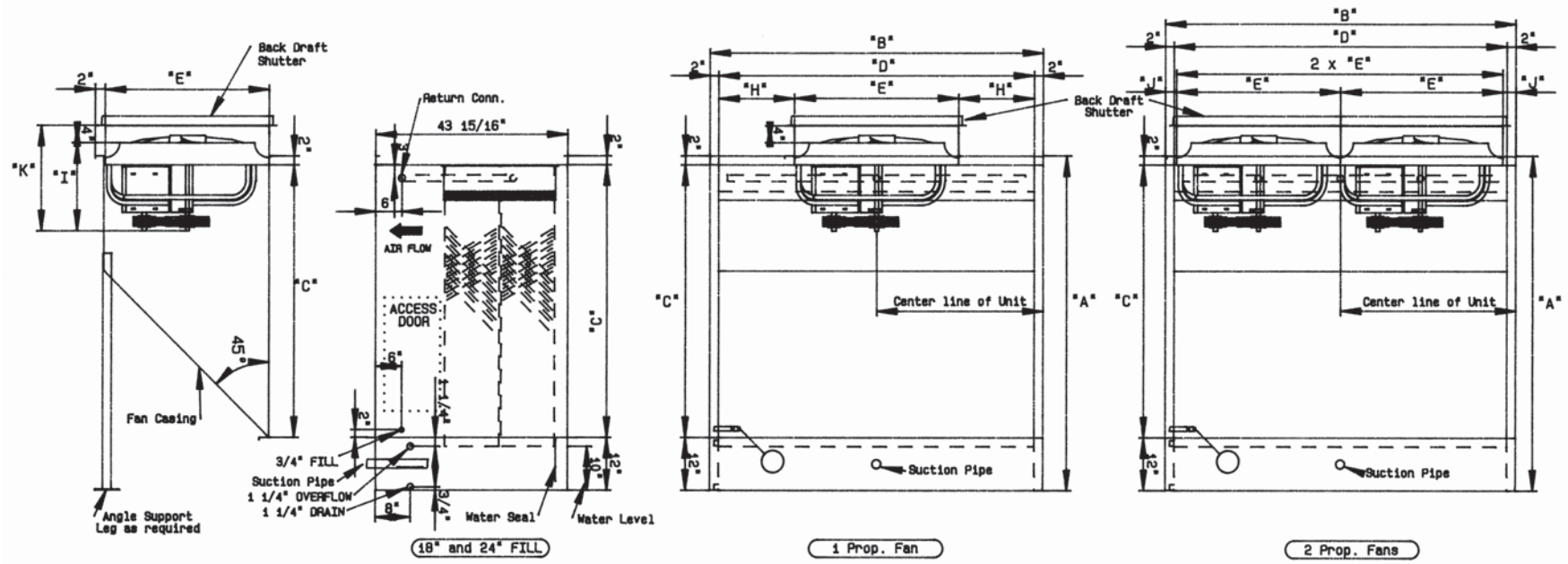
CLASS 12 AIR WASHER with HORIZONTAL DISCHARGE



Dimensions and Physical Data, Class 12 Air Washer, with Propeller Fans																						
CFM (Nominal)	CFM (Maximum)	Air Washer Size	Fan Size	Max Motor Base	Fan Max HP	Approx. Fan Wt.	A	B	C	D	E	F	G=C-E 2	H=D-E 2	I	J=D-2E 2	K	Pump Type	Pump GPM	Pump Head (feet)	Pump HP	Voltage
3,500	6,500		24”	142	1	177					30	15			19		29					
5,000	9,000		30”	182	2	235	See Pg. 10, Table 1 AW size selected				36	18			19		29					
7,500	16,000		36”	213	5	339					42	21			25		35					
13,500	22,000		42”	215	5	500					48	24			25		35	Consult Factory for Pump Selection Data				
19,000	29,000		48”	254	7-1/2	622					54	27			25		35					
26,000	38,000		54”	284	10	792					60	30			27		37					
34,000	50,000		60”	284	15	995					66	33			28		38					
39,000	56,000		66”	284	15	1112					72	36			28		39					
44,000	60,000		72”	284	15	1229					84-1/2	42-1/4			28		39					

PUMP TYPE: X = Submersible Y = Close-coupled, End-suction Z = Other:_____

CLASS 12 AIR WASHER with VERTICAL DISCHARGE



Dimensions and Physical Data, Class 12 Air Washer, with Propeller Fans																						
CFM (Nominal)	CFM (Maximum)	Air Washer Size	Fan Size	Max Motor Base	Fan Max HP	Approx. Fan Wt.	A	B	C	D	E	F	G=C-E 2	H=D-E 2	I	J=D-2E 2	K	Pump Type	Pump GPM	Pump Head (feet)	Pump HP	Voltage
3,500	6,500		24”	142	1	177					30	15			19		29					
5,000	9,000		30”	182	2	235	See Pg. 10, Table 1 AW size selected				36	18			19		29					
7,500	16,000		36”	213	5	339					42	21			25		35					
13,500	22,000		42”	215	5	500					48	24			25		35	Consult Factory for Pump Selection Data				
19,000	29,000		48”	254	7-1/2	622					54	27			25		35					
26,000	38,000		54”	284	10	792					60	30			27		37					
34,000	50,000		60”	284	15	995					66	33			28		38					
39,000	56,000		66”	284	15	1112					72	36			28		39					
44,000	60,000		72”	284	15	1229					84-1/2	42-1/4			28		39					

PUMP TYPE: X = Submersible Y = Close-coupled, End-suction Z = Other:_____

MECHANICAL SPECIFICATIONS

INDIRECT EVAPORATIVE COOLERS
CLASS 12 AIR WASHERS

Indirect evaporative cooler(s) shall be Sun West brand Class 12 Air Washer(s) manufactured by Mallory.

Each Class 12 Air Washer shall consist of: water recirculation reservoir or basin; casing side and top panels; wetted surface cell fill; upper return water connection and distribution system; water make-up system; with optional accessories, all as described below.

a. ***Basin*** to be constructed of 10 gauge steel with internal supports for fill cells, and pump suction. All joints to be double welded. Basin shall include anti-cavitation pump suction header with brass suction screen which is removable for service.

b. ***Casing side panels and top panel*** to be constructed of 14 and 16 gauge galvanized steel with angle flanges and formed reinforcing. Joints between side panels, top panels, and basin shall be gasketed and caulked to be water and air tight.

c. ***Wetted surface cell fill*** to be 18" or 24" deep (CELdek® or GLASdek®) assembled in unit without voids. Block off sheets to be provided along edges and bottom of fill to prevent bypass. Fill shall include 2″ distribution pad of same material.

d. ***Return water distribution*** piping shall be PVC, galvanized, or copper and shall connect from return piping to upper distribution headers. Interior of distribution section shall provide access to headers for cleaning and service.

e. ***Optional circulation pump*** shall be submersible horizontal, end suction, close-coupled type of type and performance scheduled. If factory supplied submersible pump option is selected, pump shall be factory mounted with piping form discharge to casing connection to include union fitting, pressure gauge, balancing valve, and fittings for optional bleed device and connection to optional water treatment feeder, with factory mounted optional track type suction screens. If external pump option is selected, contractor shall furnish piping, fittings, and accessories as detailed.

f. ***Interior and exterior of basin*** shall be finished with two coats of coal tar epoxy protective coating.

g. ***Optional access door(s)*** shall be provided where shown and shall be 14" by 30" minimum size. Doors shall be 1" thick, insulated double wall with Ventlok 310 hardware and removable gaskets.

h. ***Optional casing construction*** to include 2" insulated double wall panels.

i. ***Optional interior casing finish*** shall be provided consisting of two coats coal tar epoxy.

DIRECT EVAPORATIVE COOLERS
CLASS 10 AIR WASHERS

Direct evaporative cooler(s) shall be Sun West brand Class 10 Air Washer(s) manufactured by Mallory.

Each Class 10 Air Washer shall consist of water recirculation reservoir basin; casing side and top panels; wetted surface cell fill; recirculation piping and water distribution system; water make-up system; with optional accessories, all as described below.

a. ***Basin*** to be constructed of 10 gauge steel with internal supports for fill cells, and with pipe connections for overflow and drain. All joints to be double welded. Basin shall include track mounted, brass pump suction screens framed in stainless steel.

b. ***Casing side panels and top panel*** to be constructed of 14 and 16 gauge galvanized steel with angle flanges and formed reinforcing. Joints between side panels, top panels, and basin shall be gasketed and caulked to be water and air tight.

c. ***Wetted surface cell fill*** to be 18" or 24" deep (CELdek® or GLASdek®) assembled in unit without voids. Block off sheets to be provid

ed along edges and bottom of fill to prevent bypass. Fill shall include 2″ distribution pad of same material.

d. ***Recirculation pump*** shall be submersible type located in basin. Pump shall be selected to provide sufficient flow to maintain continuous saturation of the wetted cell surfaces.

e. ***Recirculation piping*** shall be PVC, galvanized, or copper and shall connect the pump discharge to the upper distribution header. Furnish pressure gauge, balancing valve, union, and taps for connection to optional bleed regulating device and to optional treatment feeder. Upper distribution chamber to provide access to header for cleaning and service.

f. ***Make-up water*** to be regulated by brass ball float and valve. Manual hose bib to be provided for use in flushing and quick-fill.

g. ***Interior and exterior of basin*** shall be finished with two coats of coal tar epoxy protective coating.

h. ***Optional face and bypass dampers*** shall be supplied in heavy galvanized frames and shall be opposed blade design. Bearings shall be bronze. Plated pivot rods shall be slotted to permit removal of blades. Provide vinyl edge seals and side seals. Leakage shall not exceed 16 cfm per square foot at 1" pressure.

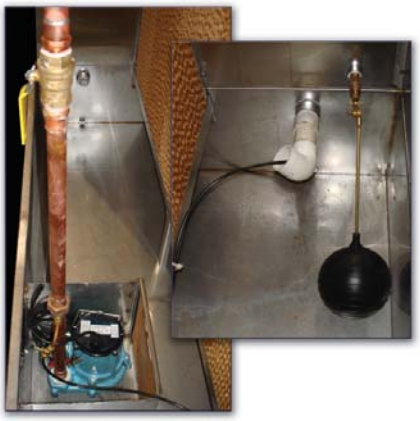
i. ***Optional coils*** shall have face area, rows, air static pressure drop. Construction shall be with galvanized steel casings, copper tubes, aluminum fins and copper headers with brazed steel connections. Coils shall be factory assembled on upstream face of Class 10 Air Washer.

j. ***Optional access door(s)*** shall be provided where shown and shall be 14" by 30" minimum size. Doors shall be 1" thick, insulated double wall with Ventlok 310 hardware and removable gaskets.

k. ***Optional bypass duct*** shall match casing construction and shall be un-insulated or insulated in side with 1" thick matt face fiberglass duct board.

l. ***Optional interior casing finish*** shall be provided consisting of two coats coal tar epoxy.

m. ***Optional casing construction*** to include 2" insulated double wall panels.



CLASS 10 AIR WASHER - MAINTENANCE SUGGESTIONS

The unique design of the Class 10 Air Washer represents a great improvement over previously used equipment such as spray type air washer in that the Class 10 air washer requires less maintenance. However all humidifiers and evaporative coolers that are supplied with water which has a high mineral content require regular maintenance. Problems and maintenance cost can be minimized by proper adjustment and operation.

If the equipment is to be supplied with ground water or well water, Mallory recommends that the Class 10 air washer user consult with any water treatment company and learn what may be required to control mineral deposits. In certain localities, even city water has enough minerals to warrant consideration of water treatment. Strict compliance to the media manufacturer's recommended water treatment must be followed.

In a recirculating system, it is necessary that the make-up water float valve be properly adjusted so that the water losses due to evaporation are replaced plus an additional quantity so there is a continuous "blow down" out the overflow con-

nection. In areas of hard water, it is wise to bleed off at least 10 percent of the recirculated water. The Class 10 air washer can be supplied with a standard dilution bleed line and valve from the discharge of the recirculating pump. As the climatic conditions change, the water evaporation rate may increase, causing the mineral content in the tank water to also increase, so the amount of blow down should also be increased. This is a manual adjustment and probably won't be made. Therefore, the make-up water level should be set for the condition of maximum water evaporation. Non-peak operation will waste a small amount of water. As an option, sophisticated monitoring systems are available which will adjust the bleed or blow down rate as required.

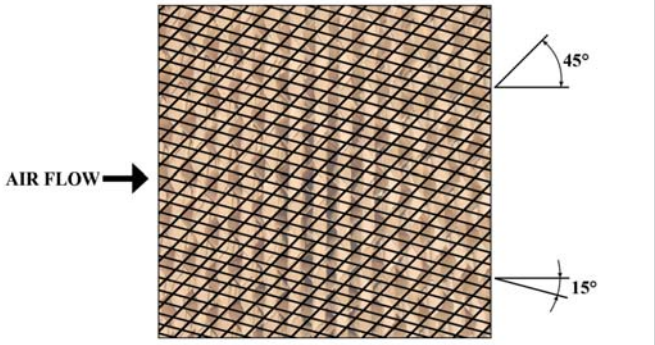
Repeated drying of the fill will cause the rapid build-up of insoluble mineral deposits in the fill. The surface adhesion and wicking action of the fill is reduced by the deposits, ultimately causing small droplets of water to be carried off the leaving side of the fill. There are three frequent operating situations that cause repeated drying of the Class 10 fill: improper adjustment of the control valve in the water distribution header piping, frequent shutdown of the pump to control humidification/evaporative cooling, and localized high air velocities across the face of the fill. The area of the dry spots will ultimately exhibit high mineral deposits. The control valve must be set so that no dry spots appear. When the water quantity is set correctly enough water will flow through the fill to flush out most air born dirt and other solids.

Pump cycling also causes the fill to dry out repeatedly, causing insoluble mineral deposits to develop. Several desirable control alternatives are available for the Class 10, which keep the pump running constantly, while controlling the performance of the cooler. An additional optional feature is the automatic fill flushing upon pump shutdown. City water is introduced into the distribution header until the fill is completely flushed.

A timer turns off the solenoid valve. The extra fresh water also dilutes the tank water. Consult factory or representative for other available methods to maintain the fill media and water.

In many air handling systems, localized high velocities can be measured at various points on the face of system components. Like most other products, the performance of the Class 10 air washer was measured under laboratory conditions and our catalog data assumes uniform conditions across the face area of the fill. Dry spots and carry-over of water droplets from the leaving side of the fill may result if the local face velocities exceed 650 FPM, which is the maximum catalog face velocity. A perforated diffuser plate on the inlet will effectively solve this problem.

The Class 10 fill has a definite polarity and must be installed properly to get trouble free results. Factory assembled units are checked carefully for this point before shipment. Units that must be shipped knocked-down because of job conditions require caution in stacking the fill. The Sun Manufacturing erection instructions include details of the correct orientation of the fill, but pay close attention to the angle of flutes.



In the event that the Class 10 fill becomes so fouled that it must be replaced, the front (air entering side) cover plates at the top of fill can be removed, exposing the water distribution piping, distributor pad and the top of the fill. See Class 10 Air Washer standard construction drawing for an exploded view. The fill is supplied in 12" wide by 12". The perforated PVC distribution header has all threaded joints and can be unscrewed and removed for cleaning. The top and the leaving side of the water distribution section are one piece construction to eliminate a joint which might leak.

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Mallory Manufacturing Company is the choice to make when superior quality and precision count. We pride ourselves in assuring our customers the best quality product, with the least amount of lead time.

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