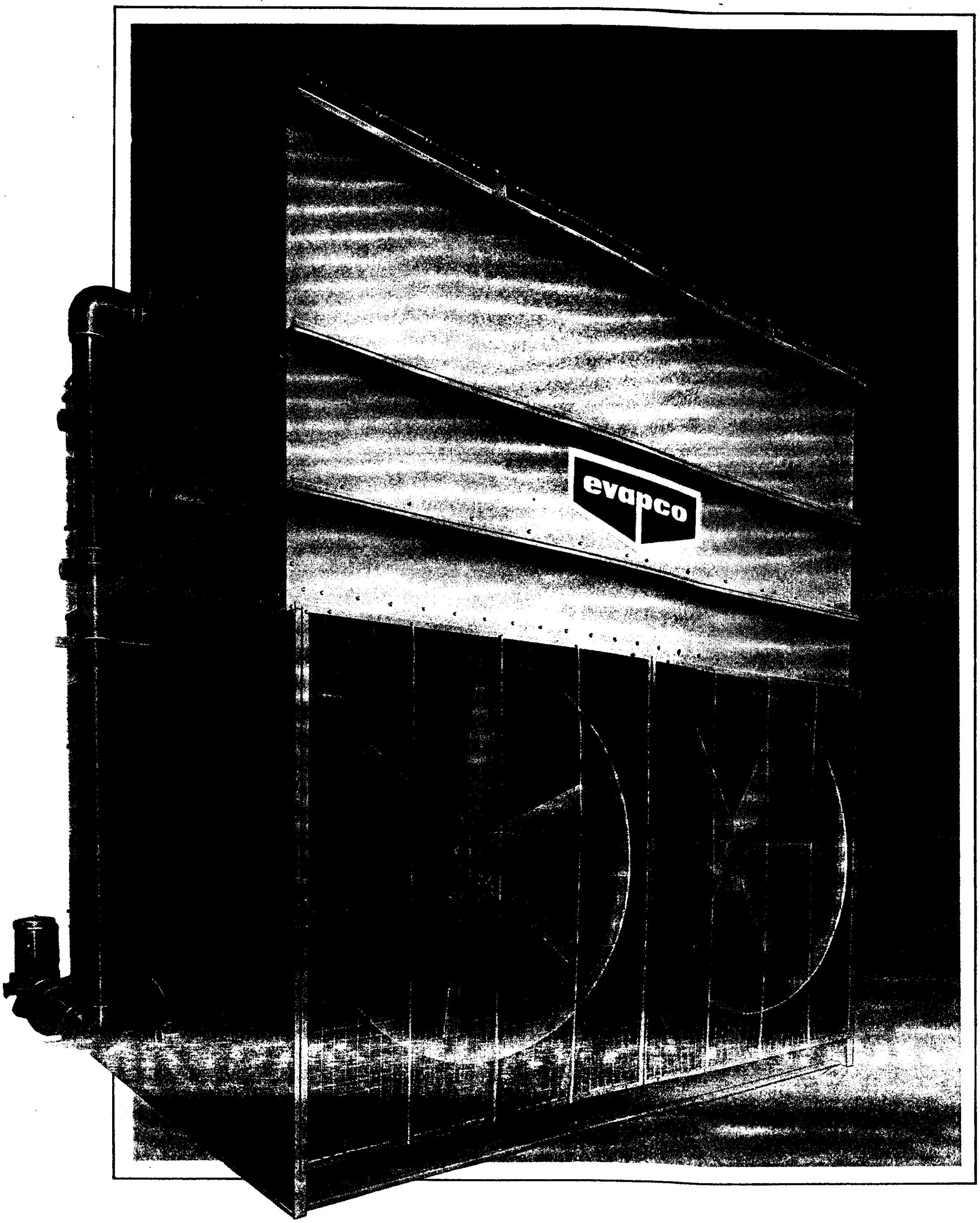
evapco

Mr. GoodTower

Evaporative Condensers

Featuring the Exclusive Thermal-Pak Coil

MEMBER iiar International Institute of Ammonia Refrigeration



Evaporative Condensers from EVAPCO

EVAPCO manufactures both forced draft and induced draft evaporative condensers. (See Bulletin 150B for induced draft models).

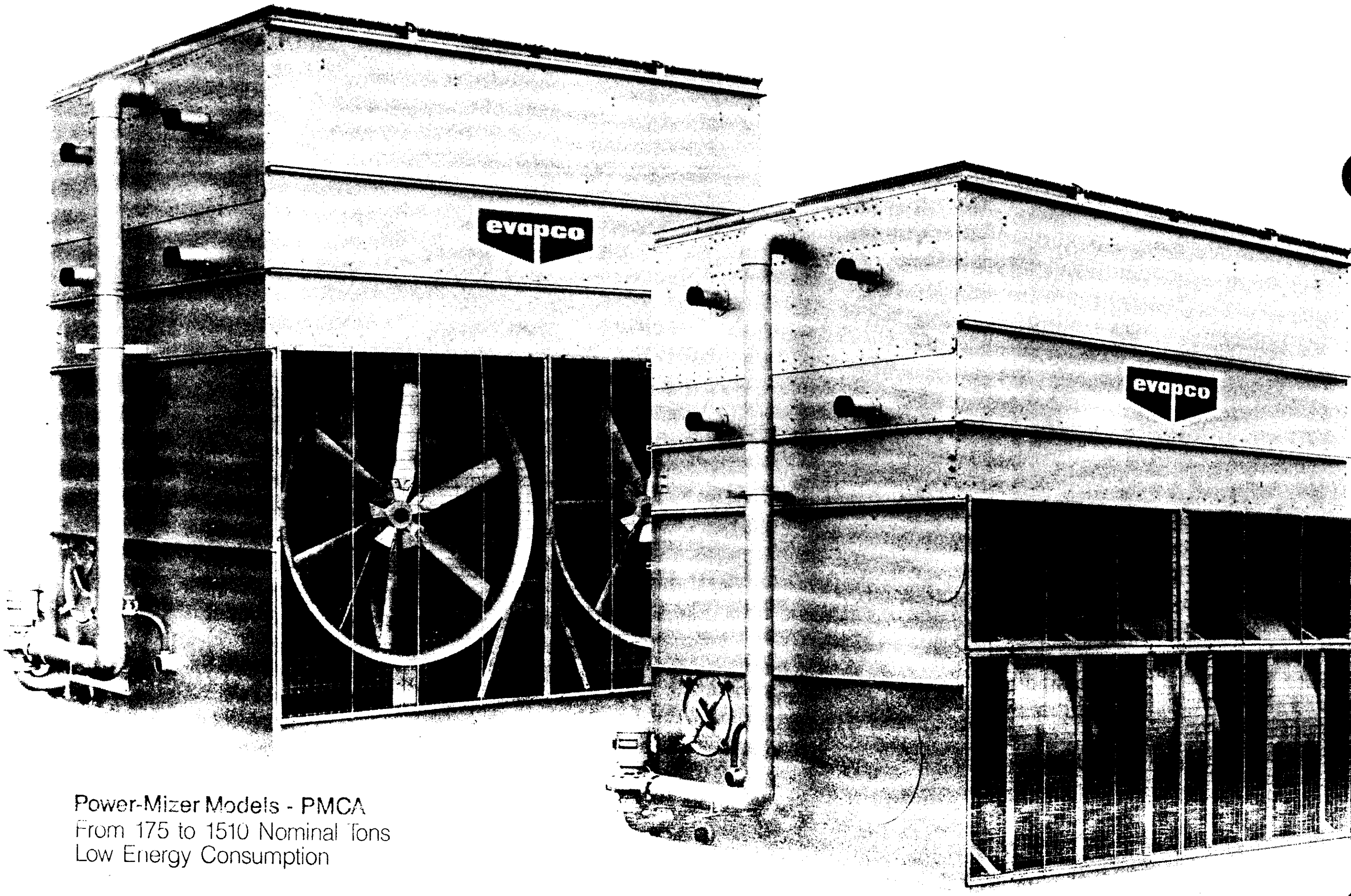
The forced draft, or blow-through models may be of either the vane-axial or centrifugal fan designs. Each has its own advantages as described in the following pages.

Lowest in First Cost

An advantage of the Evaporative Condenser is that the initial cost is less than other methods of condensing, such as air cooled or combination cooling tower with separate shell and tube condenser. In addition, their compact design requires less operating space and less supporting steel. Condensers from EVAPCO utilize a modular design with factory assembled construction to insure lower field installation costs. The total installed costs are therefore, considerably less than those of other condensing methods.

Lowest in Operating Costs

Evaporative Condensers also provide significantly lower operating costs than other conventional air cooled or water cooled condenser systems. The inherent efficiency of evaporative cooling provides lower condensing temperatures and reduced system horsepower resulting in substantial energy savings. In addition, maintenance costs are minimized through the latest technological advancements in evaporative cooled equipment. These include a simplified water distribution system, PVC drift eliminators, the EVAPCOAT corrosion protection system, two stage vane axial fans and many other equipment features pioneered by EVAPCO.



Power-Mizer Models - PMCA
From 175 to 1510 Nominal Tons
Low Energy Consumption

Centrifugal Fan Models - LSCA
From 33 to 1610 Nominal Tons
Very Quiet Operation

Leader in Design Innovation

Thermal-Pak Coil Design

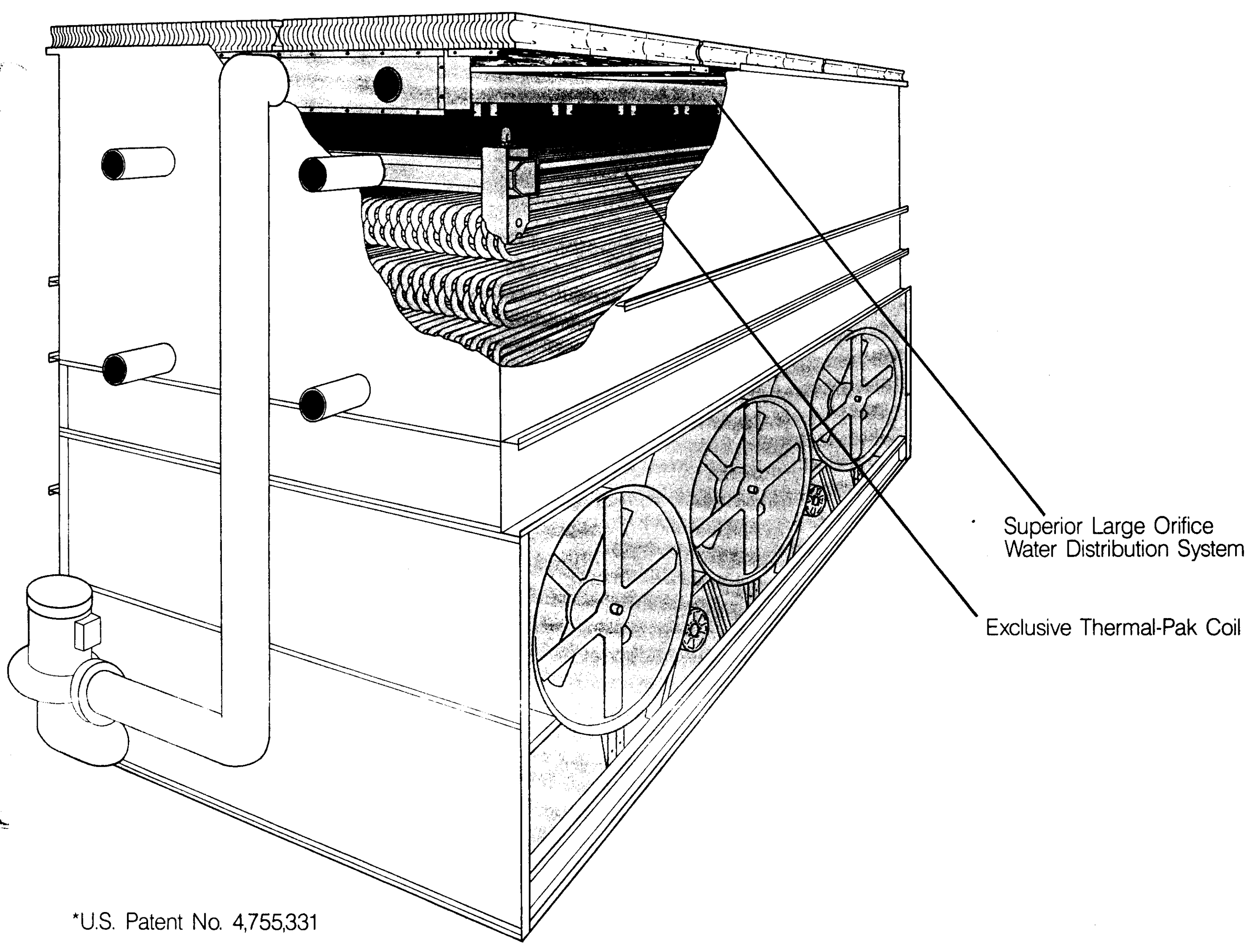
Evaporative Condensers by EVAPCO feature the patented Thermal-Pak* coil design which assures greater operating efficiency. Its advanced tube design provides lower air pressure drop through the coil while maximizing the available coil surface in each unit cross section. The improved water to air contact within the coil bundle allows significantly improved heat transfer efficiency. The Thermal-Pak coil with its unique heat transfer surface provides more condensing capacity per plan area of unit than other commercially available alternatives.

Effective Water Coverage

EVAPCO has led the industry in the design of water distribution systems for evaporative condensers. Innovations include a simplified design with large orifice nozzles and corrosion-free PVC construction as standard equipment. This system is superior because of its greater water flow rate over the coil. The Thermal-Pak coil design allows for flow rates of up to six GPM over each square foot of coil surface area.

Greater water loading provides improved heat transfer as well as ensuring that the coil is thoroughly and completely drenched at all times. The increased water scrubbing action further reduces the possibility of harmful scale formation on the coil. Maintenance is also simplified by using a nozzle with a very large orifice (1" x ½") that virtually eliminates clogging. The orifice is 2.1 times larger than nozzles used in competitive units.

Greater Operating Efficiency

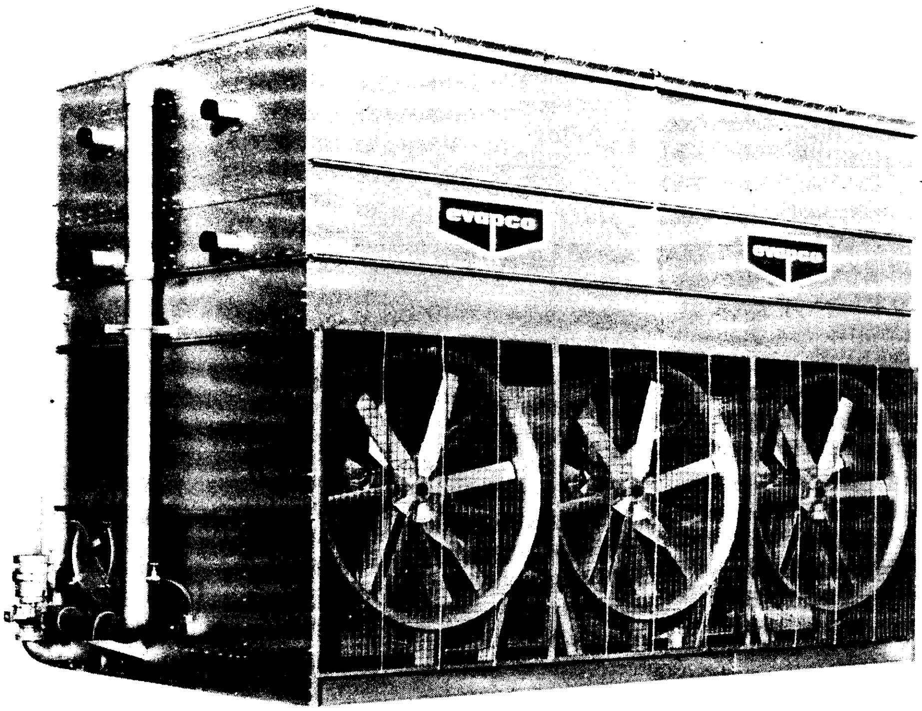


*U.S. Patent No. 4,755,331

Power-Mizer Models

Energy Efficient
For Lowest Operating Cost

PMCA Series

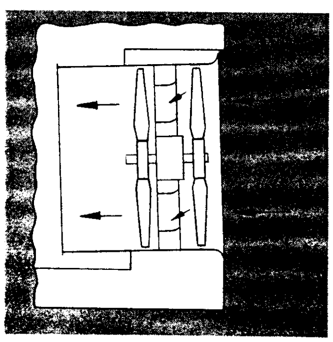


Cuts Operating Horsepower up to 50%

The Power-Mizer models use effective axial flow fans which can reduce power requirements by up to 50%. This results in significant energy savings.

Vane-Axial Fans

In order to obtain high efficiency, a two stage vane-axial fan system is employed. The cast aluminum alloy fans are installed in a closely fitted cowl with a venturi inlet and intermediate guide vanes. The fan design gives the best combination of maximum unit capacity at lowest operating cost.



VANE-AXIAL FAN

Sound Level Consideration

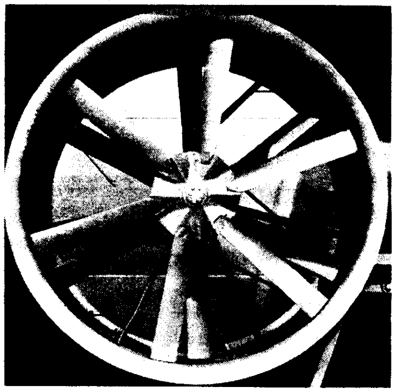
The Power-Mizer condenser models use an efficient airfoil fan that operates at sound levels 8 to 10 decibels above centrifugal fan units. They are normally recommended for commercial and industrial installations.

In noise sensitive situations, the Power-Mizer condenser may be offered with a special wider blade airfoil fan system. The wide blade fan design operates at slower tip speeds with significant sound level reduction. This fan design permits the user to take advantage of substantial energy savings without excessive noise. Consult the factory for wide blade condenser specifications and sound information.

Accessibility

The fan section is completely open and accessible at waist level where each part may be carefully checked by simply removing the safety screens. Bearing grease fittings are extended to the outside of the unit for ease of lubrication.

The pan is also open and easy to access for inspection or cleaning. There is a depressed sump area to catch the dirt accumulated and it may be easily flushed out with a hose through the access door on either end.



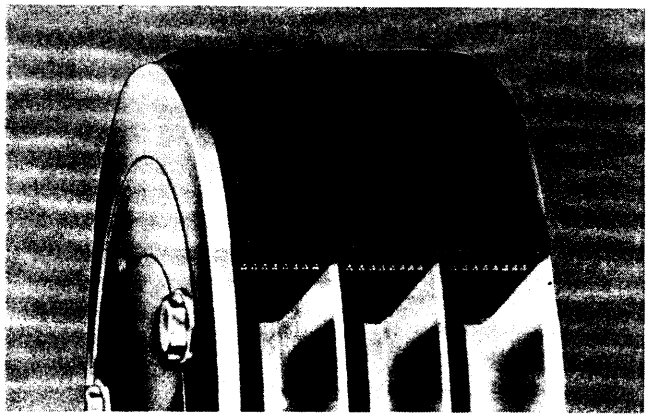
VANE-AXIAL FAN

Cast Aluminum Alloy Fans

The fans are made of heavy-duty cast aluminum alloy and are virtually corrosion free.

Power-Band Drive

The Power-Band drive is a solid backed belt system that has high lateral rigidity. This eliminates the mismatched belt problem and prevents belts from jumping sheaves, a common problem with other designs.



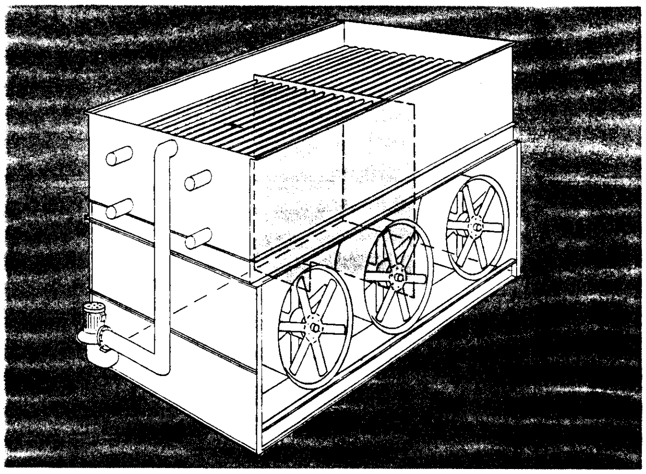
POWER-BAND

Capacity Control

FAN CYCLING VERSATILITY

Industrial refrigeration applications often utilize fan cycling to more closely match the condenser capacity to the system off-peak load. All condenser models from EVAPCO allow each fan motor to be cycled on and off independently.

Units with multiple motors, feature an internal baffle system which extends from the pan bottom vertically through the coil bundle. This system prevents the harmful effects of air by-pass within the unit when the motor is cycled off.



INTERNAL BAFFLE SYSTEM

TWO SPEED MOTORS

For those installations requiring close control, two speed 1800/900 RPM motors are an excellent method of capacity control. Two speed motors are available for the Power-Mizer as well as the Centrifugal Fan units. This arrangement gives capacity steps of 10% (fans off), 60% (fans half speed) and 100%. These control steps will in most cases allow the performance level of the condenser to closely match the system off-peak load.

A two stage pressure controller can be supplied to set control steps with a five pound pressure differential. Head pressure may then be closely maintained without excessive cycling of the fan motors.

Two-speed motors also save on operating costs. At half-speed, the motor draws less than 15% of full load power. Since maximum wet bulb and maximum load very seldom coincide, the condenser will actually operate at half-speed as much as 80% of the year. Thus, power costs will be reduced by approximately 85% during the major portion of the operating season.

A third advantage of two-speed motors is that noise levels are reduced by 6 to 8 dB when operating at half-speed. Since both the load and the wet bulb are normally lower at night, the unit will operate at half-speed and the noise level will be substantially reduced during this noise sensitive period.

On multiple cell units, the fan motors may be cycled on and off at different pressure for capacity control. Or, fan cycling may be combined with two-speed motors for more steps of control and greater power savings. This arrangement is simple, trouble-free and an inexpensive method of capacity control.

Centrifugal Fan Models

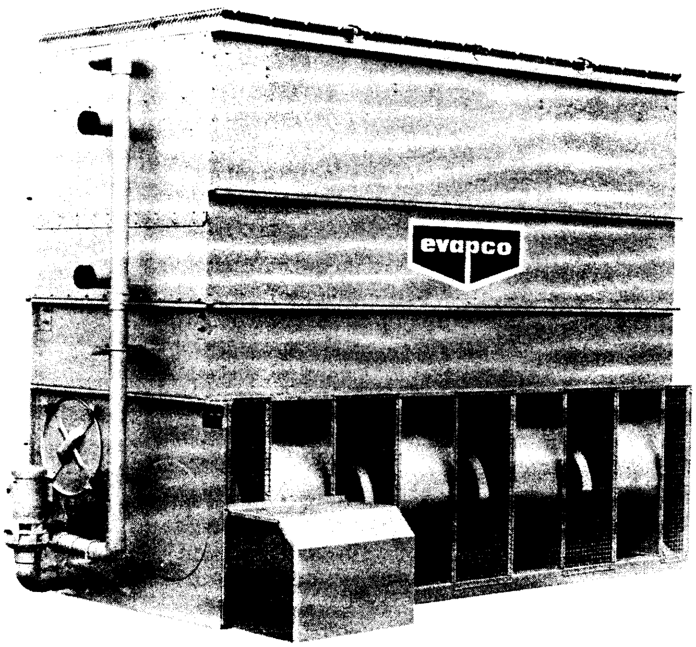
LSCA Series

For Very Quiet Operation
For Indoor Location

Application Versatility

Centrifugal units are recommended for a wide range of installations. They are quiet, can be easily hidden, and the increase in fan motor H.P. over propeller fan units is generally not significant in the small size range. They are also excellent for larger installations where very quiet operation is a must, such as residential neighborhoods.

In addition, centrifugal fan units can operate against the static pressure loss of ductwork and are therefore ideal for indoor installations.



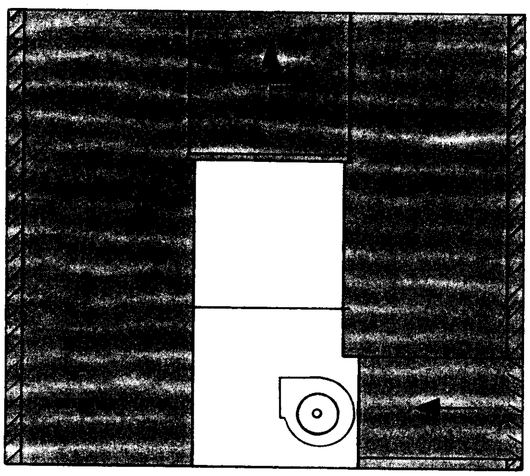
Very Quiet Operation

Centrifugal fan units operate at lower sound levels which make this design preferred for installations where noise is a concern. The sound they produce is primarily at high frequencies which is easily attenuated by building walls, windows, and natural barriers. Additionally, since the sound from the fans is directional, single sided air entry models can be turned away from critical areas avoiding a sound problem. When even quieter operation is necessary, centrifugal fan models can be equipped with optional sound attenuation packages. Consult the factory for details.

Indoor Installation

Centrifugal units may be installed indoors where it is desirable to hide the unit or where this is the only space available. In addition to being quiet, they can handle the external static pressure of ductwork.

The units are designed to be easily connected to ductwork. Drawings are available from the factory which show how to make these ductwork connections.

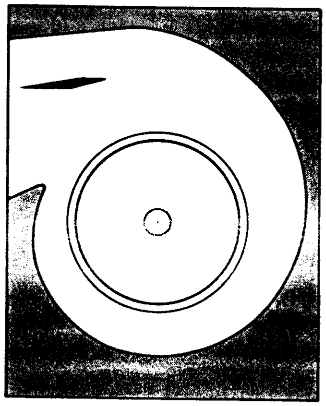


DUCTWORK

Capacity Control Fan Dampers

In addition to the capacity control methods outlined on the previous page an additional feature of the centrifugal fan unit is the availability of capacity control dampers. These dampers are located directly in the fan housings. They control head pressure by modulating air flow through the unit to match the capacity of the evaporative condenser to the load. When the dampers approach their closed position an end switch shuts off the fan motor. Dampers are recommended when close control of head pressure is necessary and there is a rapidly fluctuating load.

The disadvantage with capacity control dampers is the linkages, motor operators and controllers that are required to operate them. As with all mechanical devices, they need regular maintenance. Damper maintenance is often overlooked, and operational problems may result. In most industrial refrigeration applications two speed motors are the preferred means of capacity control.

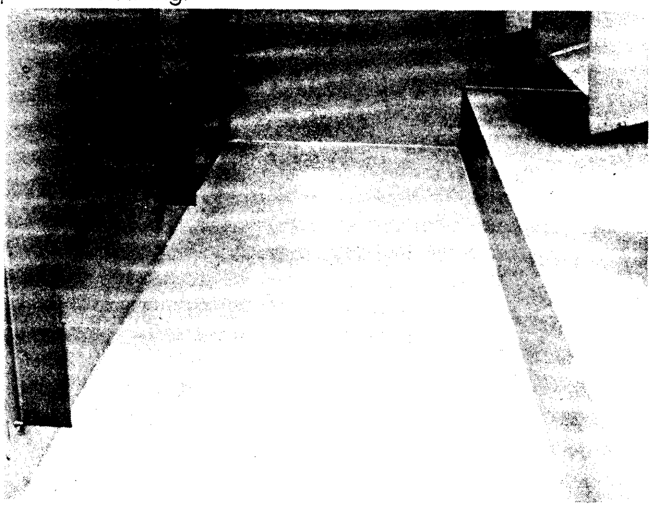


DAMPER

Accessibility

The pan/fan section of a centrifugal fan unit is designed for accessibility and ease of maintenance. Fan and drive components are positioned to allow easy adjustment and cleaning. All grease fittings are in convenient locations for periodic lubrication.

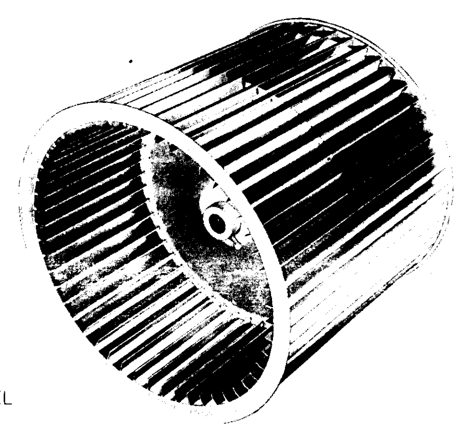
Large circular access doors are provided on each section to allow entry into the pan. All float valve and strainer assemblies are located near the door for easy adjustment and cleaning. The pan sump is designed to catch the dirt accumulated and can be flushed out simply with a hose. The stainless steel strainers may be easily removed for periodic cleaning.



PAN SECTION ACCESSIBILITY

Centrifugal Fan Assembly

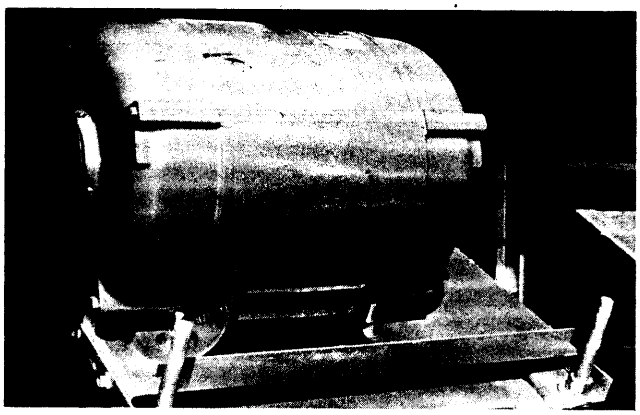
Fans on the LSCA models are of the forward curved centrifugal type with hot-dip galvanized steel construction. All fans are statically and dynamically balanced and are mounted in a hot-dip galvanized steel housing designed and manufactured by EVAPCO.



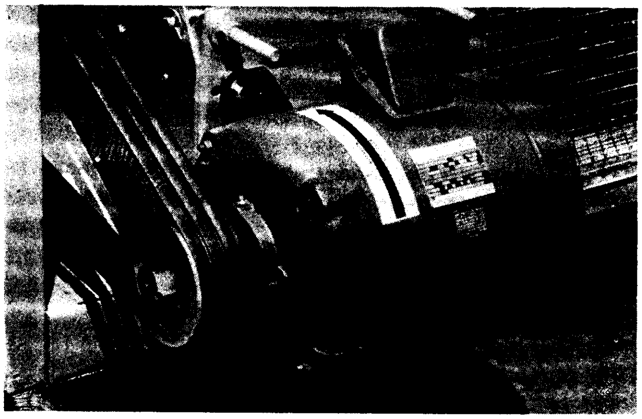
CENTRIFUGAL WHEEL

Fan Motor Mount

Fan motors are mounted in a convenient open area to make it easy to adjust belt tension, lubricate the motor, electrically connect it, or change the motor if necessary. The fan motor and drive are under a protective cover for safety and to protect them from the elements.



LARGE SERIES MOTOR MOUNT



SMALL SERIES MOTOR MOUNT

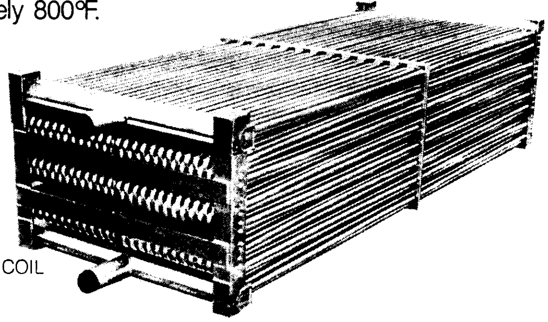
Quality Construction

Condensing Coil

EVAPCO's patented Thermal-Pak condensing coils feature a design which assures maximum condensing capacity. The airflow thru the coil is counterflow to the refrigerant flow providing the most efficient heat transfer process. A special coil design is utilized to reduce the air pressure drop through the unit while maximizing tube surface area and increasing its heat transfer capabilities. The uniquely shaped tubes of the coil are staggered in the direction of air flow to obtain a high film coefficient. In addition, all tubes are pitched in the direction of refrigerant flow to give good drainage of liquid refrigerant.

The coils are manufactured from high quality steel tubing following the most stringent quality control procedures. Each circuit is inspected to assure the material quality and then tested before being assembled into a coil. Finally, the assembled coil is tested at 350 P.S.I.G. air pressure under water to make sure it is leak free.

To protect the coil against corrosion, it is placed in a heavy-duty steel frame and the entire assembly is dipped in molten zinc (hot dip galvanized) at a temperature of approximately 800°F.



THERMAL-PAK COIL

Water Distribution Section

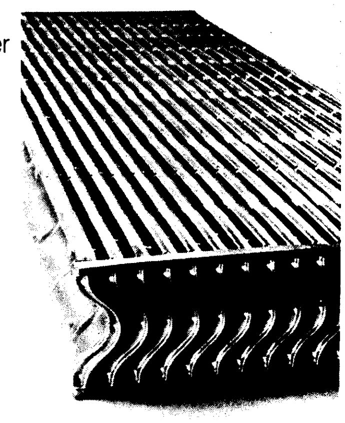
Another important part of an evaporative condenser is the water distribution section. In order to give the maximum heat transfer and minimize scaling, the coil must be completely drenched with water at all times. The EVAPCO system does this by circulating 6 gallons of water per minute over every square foot of coil face area.

The water distribution system is greatly simplified in EVAPCO units, with the largest non-clog water diffusers available for evaporative condensers. The diffusers are threaded into the water distribution header to ensure correct positioning. Also, a collar on the diffuser extends into the header and acts as an anti-sludge ring to reduce the need for maintenance. Excellent flooding of the coil is maintained at all times without numerous small orifice nozzles or complicated troughs.

For corrosion protection the diffusers are made of ABS plastic and distributor pipes are non-corrosive Polyvinyl Chloride (PVC).

WATER DIFFUSER

PVC Eliminators



ELIMINATOR

The final elements in the upper part of the condenser are moisture eliminators which strip the entrained water droplets from the leaving air stream. EVAPCO's patented* eliminators are approximately 5"-deep, spaced on 1" centers. They incorporate a hooked leaving edge designed to direct the discharge air stream away from the fans to help eliminate recirculation of hot, saturated air back into the fan intake.

EVAPCO eliminators are constructed entirely of inert, corrosion-free PVC. This PVC material has been specially treated to resist damaging ultra-violet light. The eliminators are assembled in easily handled sections to facilitate removal thereby exposing the upper portion of the unit and water distribution system for periodic inspection.

*U.S. Patent No. 4,500,330

Pan Section

EVAPCO pans are large and open, making them easy to clean and service. There is a depressed sump area to catch all foreign matter. The pans are equipped with standard accessories including a close coupled centrifugal pump with mechanical seal, waste water bleed line, makeup valve with float, and access doors. A Type 304 Stainless Steel strainer is provided as standard equipment and is easily removed for periodic cleaning.

EVAPCOAT: Galvanized Steel Construction

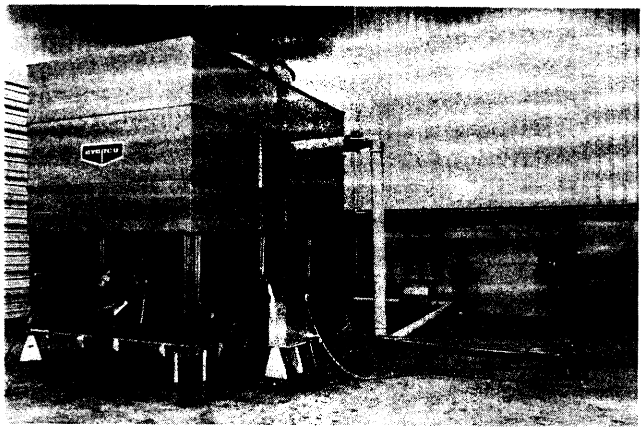
The steel casings and pan are constructed of heavy gauge G-210 mill hot-dip galvanized steel. The material is coated with 2.1 ounces of zinc per suare foot, the heaviest zinc coating available for extended corrosion resistance.

During fabrication, all panel edges are coated with a 95% pure zinc-rich compound. After fabrication the completed unit is coated externally with zinc chromatized aluminum paint thus assuring a long service life for the equipment.

Owner Advantages

Technology Leader

EVAPCO is committed to providing the highest quality products at the lowest possible cost. In order to achieve this goal, a major program of research and development is on-going. This program has resulted in a number of advancements in evaporative cooling equipment design which provide EVAPCO's many customers with the highest quality equipment, affordably priced. These include accurate thermal ratings, a new more efficient Thermal-Pak coil design, the EVAPCOAT corrosion protection system, PVC drift eliminators, type 304 stainless steel strainers and simplified water distribution system as standard equipment. EVAPCO is committed to continual product improvements through its extensive research and development program.

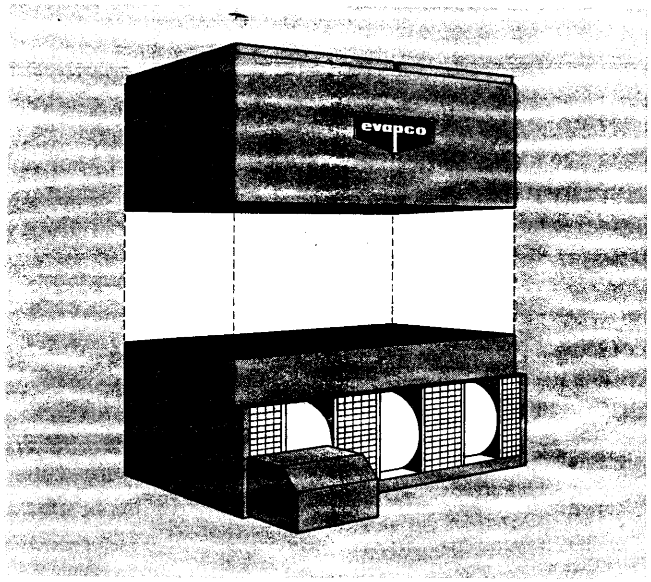


EVAPCO is pleased to announce the introduction of our new 20,000 square foot state-of-the-art Research Center at its Maryland World Headquarters. This new facility is one of the largest of its type in the evaporative cooling industry, and the most advanced.

Once again, EVAPCO's commitment to quality and excellence is clearly demonstrated, and the customer can be assured of obtaining the best product available.

Low Installed Costs

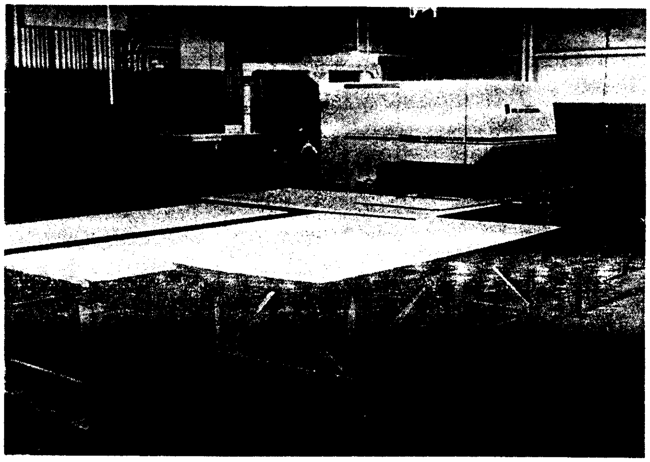
The model LSCA and PMCA evaporative condensers are designed using a modular concept to minimize rigging, piping and support costs. All major components are factory assembled into complete sections. Fans, motors and drives are installed and aligned at the factory as an integral part of the pan section to eliminate the necessity of field rigging these key parts.



MODULAR INSTALLATION

Quality Assured

Rigid manufacturing standards are implemented throughout the fabrication process. Unit components are fabricated in-house using the latest computer controlled machinery. This ensures that all parts are built to precise standards at the lowest possible cost. The entire manufacturing and assembly process is committed to maintaining a standard of excellence in product quality.



Selection Procedure

Two methods of selection are presented, the first and simplest is based on evaporator tons as described immediately below. This is applicable to systems with open type reciprocating compressors.

The second method of selection is by heat of rejection which is described on pages 12 and 13. It is applicable to all but centrifugal compressor applications and is normally used for selecting evaporative condensers for use with hermetic compressors and screw compressors. It can also be used for standard open type reciprocating compressor systems as an alternate to the evaporator ton method below.

Refer to the factory for selection on centrifugal compressors.

Evaporator Ton Method

The condenser unit number in Table I is equal to the unit capacity in evaporator tons for standard CFC-12 or HCFC-22 conditions of 105° condensing, 40° suction and 78° Wet Bulb.

For other conditions or for ammonia refrigerant, obtain the capacity factors from either Table II or III and multiply times the evaporator load in tons to determine the unit size needed. Select a unit number from Table I equal to or larger than the resultant figure.

EXAMPLE

Given: **140 ton evaporator load, ammonia refrigerant 95° condensing temperature, 10° suction temperature, and 75° W.B. temperature.**

Selection: **The capacity factor from Table III for 95° condensing and 75° W.B = 1.36. The capacity factor for 10° suction = 1.03**

140 tons x 1.36 x 1.03 = 196 corrected tons. Therefore select either PMCA 200 or LSCA 200.

TABLE I - Unit Sizes

Power-Mizer Models		
PMCA-175	PMCA-425	PMCA-900
190	450	950
200	475	990
210	495	1060
220	530	1170
230	585	1250
275	625	1290
300	645	1370
325	685	1430
335	715	1510
350	755	
385	850	
Centrifugal Fan Models		
LSCA- 33	LSCA-210	LSCA- 625
36	225	650
43	240	690
48	250	720
54	280	755
58	300	800
65	315	805
70	335	860
75	355	900
80	370	960
90	385	1000
100	400	1030
110	430	1180
120	450	1250
135	480	1380
155	500	1440
170	515	1510
185	550	1610
200	590	
Alternate Plan Area Models		
LSCA-P280	LSCA-P475	LSCA-P820
P295	P505	P860
P330	P530	P920
P345	P555	P950
P360	P590	P1010
P380	P660	P1060
P410	P690	P1110
P430	P720	
P460	P760	

TABLE II - CFC-12 and HCFC-22 Capacity Factors

Condensing Pres. PSIG		Cond. Temp. °F	WET BULB TEMPERATURE °F																	
CFC-12	HCFC-22		50	55	60	62	64	66	68	70	72	74	75	76	77	78	80	82	84	86
92	156	85	1.05	1.16	1.32	1.43	1.53	1.68	1.85	2.03	2.33	2.65	2.80	3.13	3.47	3.81	—	—	—	—
100	168	90	.90	.98	1.10	1.18	1.24	1.32	1.42	1.53	1.67	1.85	1.93	2.04	2.17	2.29	2.68	—	—	—
108	182	95	.78	.85	.93	.98	1.02	1.07	1.12	1.19	1.27	1.37	1.41	1.46	1.51	1.57	1.75	2.01	2.32	2.70
117	196	100	.70	.75	.81	.84	.87	.90	.93	.97	1.02	1.08	1.11	1.14	1.18	1.21	1.31	1.45	1.61	1.80
127	211	105	.63	.66	.70	.72	.75	.77	.80	.83	.87	.91	.93	.95	.97	1.00	1.05	1.12	1.22	1.35
136	226	110	.57	.59	.63	.65	.66	.68	.70	.72	.75	.78	.80	.81	.83	.85	.89	.94	.99	1.06

Suction Temp. F.	−20°	−10°	0°	+10°	+20°	+30°	+40°	+50°
Capacity Factor	1.22	1.17	1.13	1.09	1.06	1.03	1.00	.97

TABLE III - Ammonia (R-717) Capacity Factors

Condensing Pres. PSIG	Cond. Temp. °F.	WET BULB TEMPERATURE °F.																	
		50	55	60	62	64	66	68	70	72	74	75	76	77	78	80	82	84	86
152	85	1.00	1.11	1.26	1.36	1.47	1.61	1.78	1.95	2.24	2.54	2.69	3.00	3.33	3.66	—	—	—	—
166	90	.86	.95	1.06	1.12	1.18	1.26	1.36	1.48	1.60	1.78	1.85	1.96	2.08	2.21	2.57	—	—	—
181	95	.75	.82	.89	.94	.99	1.03	1.08	1.14	1.22	1.31	1.36	1.40	1.45	1.51	1.68	1.93	2.24	2.58
185	96.3	.73	.79	.85	.90	.94	.98	1.02	1.08	1.15	1.24	1.27	1.31	1.36	1.41	1.56	1.79	2.06	2.37
197	100	.67	.72	.78	.80	.83	.86	.90	.93	.98	1.03	1.06	1.09	1.13	1.17	1.26	1.38	1.55	1.74
214	105	.60	.64	.68	.70	.72	.74	.77	.80	.84	.87	.90	.91	.93	.96	1.01	1.08	1.16	1.26
232	110	.54	.57	.60	.62	.63	.65	.67	.69	.72	.75	.77	.78	.80	.81	.85	.89	.95	1.02

Suction Temp. F.		−20°	−10°	0°	+10°	+20°	+30°	+40°
Capacity Factor		1.14	1.10	1.07	1.03	1.00	.97	.95

Selection Procedure

Heat of Rejection Method

The heat of rejection selection method is similar to the evaporator ton method in that once the heat of rejection is known, the factor for the specified operating conditions (condensing temperature and wet bulb temperature) is obtained from Table V or VI and multiplied times the heat rejection. The resultant figure is used to select a unit from Table IV. Unit Capacities are given in Table IV in thousands of BTU/Hr or MBH.

If the heat of rejection is not known it can be determined by one of the following formulas:

Open Compressors
Heat of Rejection = Evaporator Load (BTU/Hr) + Compressor BHP x 2545

Hermetic Compressors
Heat of Rejection = Evaporator Load (BTU/Hr) + K.W. Compressor Input x 3415

EXAMPLE

Given: **260 ton load, ammonia refrigerant 96.3° condensing temperature, 78° W.B. temperature and 300 compressor BHP**

Selection: Heat of Rejection
260 tons x 12000 = 3,120,000 BTU/Hr
300 BHP x 2545 = 763,500 BTU/Hr
Total 3,883,500 BTU/Hr

From Table VI the capacity factor for 96.3° condensing and 78° W.B. = 1.37 3,883,500 x 1.37 = 5,320,395 BTU/Hr or 5320 MBH.

Therefore, select PMCA-385 or LSCA-370, or LSCA-P380 depending upon layout, horsepower, and any other design considerations.

Note:

For screw compressor selections employing water cooled oil cooling, select a condenser for the total BTU/Hr as in the example. The condenser can then function in one of two ways:

(1) Recirculating water from the water sump can be used directly in the oil cooler. A separate pump should be employed and the return water should be directed into the water sump at the opposite end from the pump suction.

(2) The condenser coil can be circuited so that water or a glycol-water mixture for the oil cooler can be cooled in a separate section of the coil. Specify load and water flow required.

For refrigerant injection cooled screw compressors select the condenser in the same manner as shown in the example.

If the oil cooler is supplied by water from a separate source, then the oil cooling load should be deducted from the heat of rejection before making the selection.

TABLE IV - Unit Heat Rejection Capacity

Power-Mizer Models

PMCA-175	2573	PMCA- 585	8600
190	2793	625	9188
200	2940	645	9482
210	3087	685	10070
220	3234	715	10511
230	3381	755	11099
275	4043	850	12495
300	4410	900	13230
325	4778	950	13965
335	4925	990	14553
350	5145	1060	15582
385	5660	1170	17199
425	6248	1250	18375
450	6615	1290	18963
475	6983	1370	20139
495	7277	1430	21021
530	7791	1510	22197

Centrifugal Fan Models

LSCA- 33	485	LSCA-370	5439
36	529	385	5660
43	632	400	5880
48	706	430	6321
54	794	450	6615
58	853	480	7056
65	956	500	7350
70	1029	515	7571
75	1103	550	8085
80	1176	590	8673
90	1323	625	9188
100	1470	650	9555
110	1617	690	10143
120	1764	720	10584
135	1985	755	11099
155	2279	800	11760
170	2499	805	11834
185	2720	860	12642
200	2940	900	13230
210	3087	960	14112
225	3308	1000	14700
240	3528	1030	15141
250	3675	1180	17346
280	4116	1250	18375
300	4410	1380	20286
315	4631	1440	21168
335	4925	1510	22197
355	5219	1610	23667

Alternate Plan Area Models

LSCA-P280	4116
P295	4337
P330	4851
P345	5072
P360	5292
P380	5586
P410	6027
P430	6321
P460	6762
P475	6983
P505	7424
P530	7791
P555	8159
P590	8673
P660	9702
P690	10143
P720	10584
P760	11172
P820	12054
P860	12642
P920	13524
P950	13965
P1010	14847
P1060	15582
P1110	16317

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TABLE V - CFC-12 and HCFC-22 Heat Rejection Factors

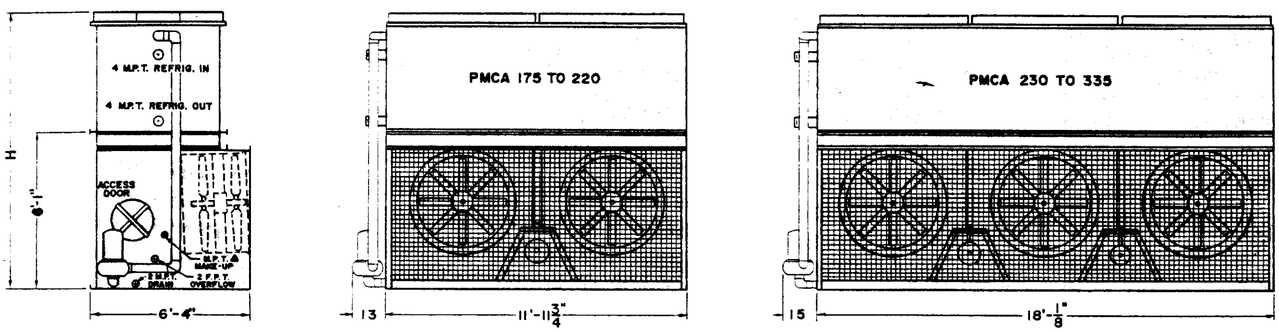
Condensing Pres. PSIG		Cond. Temp. °F	WET BULB TEMPERATURE °F																	
CFC-12	HCFC-22		50	55	60	62	64	66	68	70	72	74	75	76	77	78	80	82	84	86
92	156	85	1.10	1.22	1.39	1.50	1.61	1.76	1.94	2.13	2.45	2.78	2.94	3.29	3.64	4.00	—	—	—	—
100	168	90	.93	1.02	1.14	1.22	1.29	1.37	1.47	1.59	1.73	1.92	2.00	2.12	2.25	2.38	2.78	—	—	—
108	182	95	.80	.87	.95	1.00	1.05	1.10	1.15	1.22	1.31	1.40	1.45	1.50	1.55	1.61	1.79	2.05	2.37	2.77
117	196	100	.71	.76	.82	.85	.88	.91	.94	.98	1.03	1.09	1.12	1.15	1.19	1.23	1.33	1.46	1.63	1.82
127	211	105	.63	.66	.70	.72	.75	.77	.80	.83	.87	.91	.93	.95	.97	1.00	1.05	1.12	1.22	1.33
136	226	110	.56	.58	.62	.64	.65	.67	.69	.71	.74	.77	.79	.80	.82	.84	.88	.93	.98	1.04

TABLE VI - Ammonia (R-717) Heat Rejection Factors

Condensing Pres. PSIG	Cond. Temp. °F	WET BULB TEMPERATURE °F																	
		50	55	60	62	64	66	68	70	72	74	75	76	77	78	80	82	84	86
152	85	1.00	1.11	1.26	1.36	1.47	1.60	1.77	1.94	2.23	2.53	2.68	2.99	3.31	3.64	—	—	—	—
166	90	.85	.93	1.04	1.11	1.17	1.25	1.34	1.45	1.57	1.75	1.82	1.93	2.05	2.17	2.53	—	—	—
181	95	.73	.79	.86	.91	.96	1.00	1.05	1.11	1.18	1.27	1.32	1.36	1.41	1.47	1.63	1.86	2.16	2.52
185	96.3	.71	.76	.82	.87	.91	.95	.99	1.04	1.11	1.20	1.23	1.27	1.32	1.37	1.51	1.71	1.98	2.29
197	100	.64	.69	.75	.77	.80	.83	.86	.89	.94	.99	1.02	1.05	1.08	1.12	1.21	1.33	1.48	1.67
214	105	.57	.60	.64	.66	.68	.70	.73	.76	.79	.83	.85	.86	.88	.91	.96	1.03	1.11	1.20
232	110	.51	.53	.56	.58	.59	.61	.63	.65	.67	.70	.72	.73	.75	.76	.80	.84	.89	.95

Engineering Dimensions & Data

Power Mizer Models PMCA 175 to 335



▲NOTE: MAKE-UP 1" M.P.T. ON PMCA 175 to PMCA 220
MAKE-UP 1½ M.P.T. ON PMCA 230 TO PMCA 335

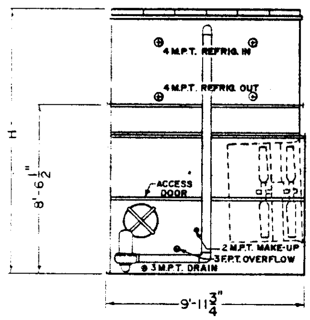
TABLE VII - Engineering Data

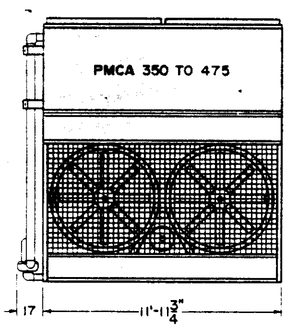
UNIT NO. CFC-12 & HCFC-22 Capacity*	NH_3 Capacity*	WEIGHTS			FANS		SPRAY PUMP		REMOTE SUMP		DIMENSIONS	
		Shipping	Operating	Heaviest Section	HP	CFM	HP	GPM	Gallons Req'd**	Conn. Size	Height	Length
PMCA-175	124	7,850	10,120	5,470	7½	30,000	2	345	240	8	10' 9¼"	11' 11¾"
190	135	7,980	10,250	5,470	10	33,000	2	345	240	8	10' 9¼"	11' 11¾"
200	142	8,960	11,290	6,580	7½	29,100	2	345	240	8	11' 5¾"	11' 11¾"
210	149	9,090	11,420	6,580	10	32,000	2	345	240	8	11' 5¾"	11' 11¾"
220	156	10,110	12,490	7,700	10	31,000	2	345	240	8	12' 2¼"	11' 11¾"
PMCA-230	163	10,390	13,240	6,690	7½&5	46,400	3	515	350	10	10' ¾"	18' ⅛"
275	195	12,030	14,970	8,330	7½&5	45,100	3	515	350	10	10' 9¼"	18' ⅛"
300	213	13,700	16,730	9,990	7½&5	43,700	3	515	350	10	11' 5¾"	18' ⅛"
325	231	13,830	16,860	9,990	10 & 5	48,100	3	515	350	10	11' 5¾"	18' ⅛"
335	238	15,390	18,520	11,660	10 & 5	46,600	3	515	350	10	12' 2¼"	18' ⅛"

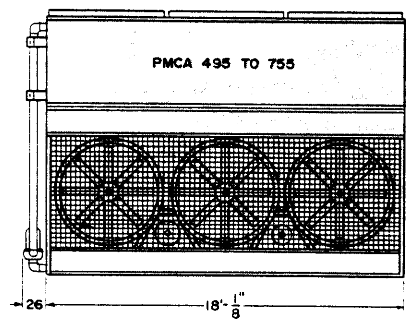
* Tons at standard conditions: CFC-12 and HCFC-22. 105° condensing, 40° suction and 78° W.B.; ammonia 96.3° condensing, 20° suction and 78° W.B.

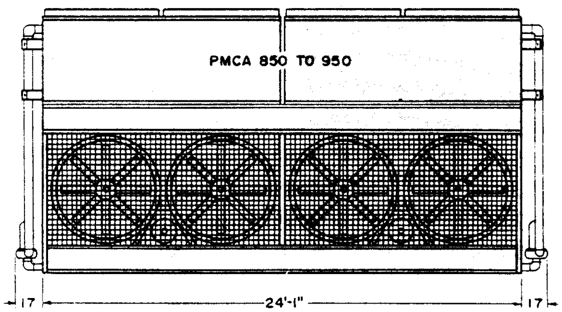
** Gallons shown is water in suspension in unit and piping. Allow for additional water in bottom of remote sump to cover pump suction and strainer during operation. (12" would normally be sufficient.)

Power Mizer Models
PMCA 350 to 1510









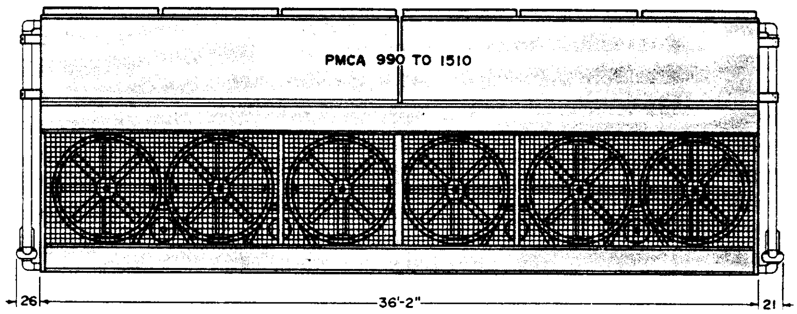


TABLE VIII - Engineering Data

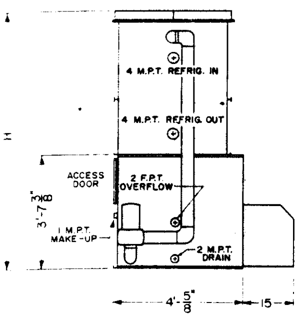
UNIT NO. CFC-12 & HCFC-22 Capacity*	NH_3 Capacity*	WEIGHTS			FANS		SPRAY PUMP		REMOTE SUMP		DIMENSIONS	
		Shipping	Operating	Heaviest Section	HP	CFM	HP	GPM	Gallons Req'd**	Conn Size	Height	Length
PMCA- 350	248	14,920	20,770	10,740	10	57,900	5	685	420	10	13' 2¾"	11' 11¾"
385	273	15,070	20,920	10,740	15	66,200	5	685	420	10	13' 2¾"	11' 11¾"
425	301	17,180	23,260	12,940	15	64,200	5	685	420	10	13' 11¼"	11' 11¾"
450	319	17,300	23,380	12,940	20	70,700	5	685	420	10	13' 11¼"	11' 11¾"
475	337	19,410	25,730	15,150	20	68,500	5	685	420	10	14' 7¾"	11' 11¾"
PMCA- 495	351	19,130	27,280	12,380	15 & 7½	102,500	7½	1030	620	12	12' 6¼"	18' ⅛"
530	376	22,270	30,770	15,500	10 & 5	87,000	7½	1030	620	12	13' 2¾"	18' ⅛"
585	415	22,460	30,960	15,500	15 & 7½	99,600	7½	1030	620	12	13' 2¾"	18' ⅛"
625	443	22,620	31,120	15,500	20 & 10	109,600	7½	1030	620	12	13' 2¾"	18' ⅛"
645	457	25,670	34,520	18,680	15 & 7½	96,600	7½	1030	620	12	13' 11¼"	18' ⅛"
685	486	25,820	34,670	18,680	20 & 10	106,300	7½	1030	620	12	13' 11¼"	18' ⅛"
715	507	29,030	38,230	21,870	20 & 10	103,000	7½	1030	620	12	14' 7¾"	18' ⅛"
755	535	29,300	38,500	21,870	25 & 15	111,000	7½	1030	620	12	14' 7¾"	18' ⅛"
PMCA- 850	603	33,990	46,150	12,940	(2)15	128,500	(2)5	1370	850	12	13' 11¼"	24' 1"
900	638	34,140	46,300	12,940	(2)20	141,400	(2)5	1370	850	12	13' 11¼"	24' 1"
950	674	38,460	51,080	15,150	(2)20	137,000	(2)5	1370	850	12	14' 7¾"	24' 1"
PMCA- 990	702	37,800	54,220	12,380	(2)15 & (2)7½	205,100	(2)7½	2060	1620	14	12' 6¼"	36' 2"
1060	752	44,070	61,190	15,500	(2)10 & (2)5	173,900	(2)7½	2060	1620	14	13' 2¾"	36' 2"
1170	830	44,470	61,590	15,500	(2)15 & (2)7½	199,100	(2)7½	2060	1620	14	13' 2¾"	36' 2"
1250	887	44,780	61,900	15,500	(2)20 & (2)10	219,200	(2)7½	2060	1620	14	13' 2¾"	36' 2"
1290	915	50,880	68,700	18,860	(2)15 & (2)7½	193,100	(2)7½	2060	1620	14	13' 11¼"	36' 2"
1370	972	50,990	68,810	18,860	(2)20 & (2)10	212,600	(2)7½	2060	1620	14	13' 11¼"	36' 2"
1430	1014	57,600	76,130	21,870	(2)20 & (2)10	205,000	(2)7½	2060	1620	14	14' 7¾"	36' 2"
1510	1070	58,140	76,640	21,870	(2)25 & (2)15	221,900	(2)7½	2060	1620	14	14' 7¾"	36' 2"

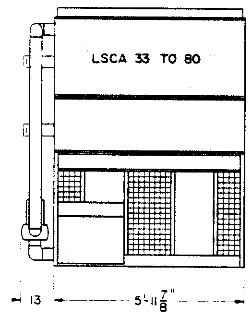
* Tons at standard conditions: CFC-12 and HCFC-22, 105° condensing, 40° suction and 78° W.B.; ammonia 96.3° condensing, 20° suction and 78° W.B.

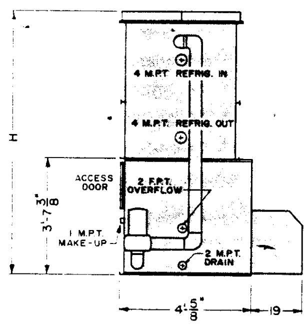
** Gallons shown is water in suspension in unit and piping. Allow for additional water in bottom of remote sump to cover pump suction and strainer during operation. (12" would normally be sufficient.)

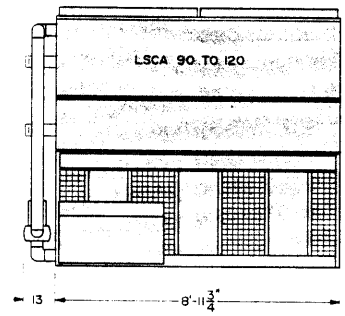
Engineering Dimensions & Data

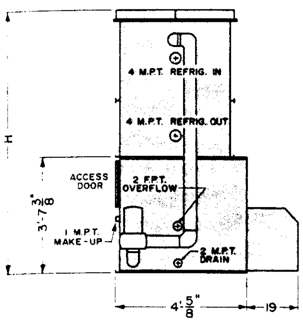
Centrifugal Fan Models LSCA 33 to 170











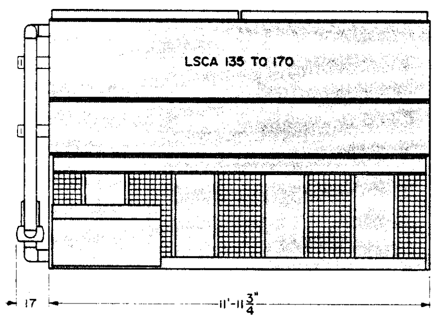


TABLE IX - Engineering Data

UNIT NO. CFC-12 & HCFC-22 Capacity*	NH₃ Capacity*	WEIGHTS			FANS		SPRAY PUMP		REMOTE SUMP		DIMENSIONS	
		Shipping	Operating	Heaviest Section	HP**	CFM	HP	GPM	Gallons Req'd***	Conn. Size	Height	Length
LSCA-33	23	2,100	3,050	2,100†	2	8,900	¾	120	80	4	6' 8½"	5' 11⅞"
36	26	2,220	3,170	2,220†	3	10,200	¾	120	80	4	6' 8½"	5' 11⅞"
43	31	2,640	3,480	1,680	2	8,800	¾	120	80	4	7' 4"	5' 11⅞"
48	34	2,710	3,550	1,680	3	10,000	¾	120	80	4	7' 4"	5' 11⅞"
54	38	2,790	3,630	1,680	5	11,900	¾	120	80	4	7' 4"	5' 11⅞"
58	41	3,020	3,880	2,040	3	9,800	¾	120	80	4	7' 11½"	5' 11⅞"
65	46	3,100	3,960	2,040	5	11,700	¾	120	80	4	7' 11½"	5' 11⅞"
70	50	3,190	4,050	2,040	7½	13,300	¾	120	80	4	7' 11½"	5' 11⅞"
75	53	3,420	4,300	2,430	5	11,400	¾	120	80	4	8' 7"	5' 11⅞"
80	57	3,570	4,450	2,430	7½	13,100	¾	120	80	4	8' 7"	5' 11⅞"
LSCA-90	64	4,380	5,700	3,000	5	15,200	1	180	120	6	7' 11½"	8' 11¼"
100	71	4,520	5,840	3,000	7½	17,400	1	180	120	6	7' 11½"	8' 11¼"
110	78	4,650	5,970	3,000	10	19,200	1	180	120	6	7' 11½"	8' 11¼"
120	85	5,050	6,390	3,590	10	18,800	1	180	120	6	8' 7"	8' 11¼"
LSCA-135	96	5,720	7,580	3,960	10	23,300	1½	245	170	6	7' 11½"	11' 11¾"
155	110	6,500	8,410	4,750	10	22,800	1½	245	170	6	8' 7"	11' 11¾"
170	121	6,650	8,560	4,750	15	26,100	1½	245	170	6	8' 7"	11' 11¾"

† Model normally ships in one piece.

* Tons at standard conditions: CFC-12 and HCFC-22. 105° condensing, 40° suction and 78° W.B.; ammonia 96.3° condensing, 20° suction and 78° W.B.

** For external static pressure up to ½" use next larger size fan motor.

*** Gallons shown is water in suspension in unit and piping. Allow for additional water in bottom of remote sump to cover pump suction and strainer during operation. (12" would normally be sufficient.)

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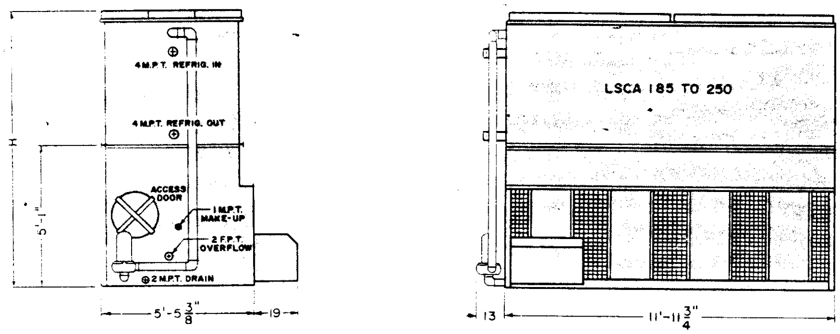
Centrifugal Fan Models
LSCA 185 to 385



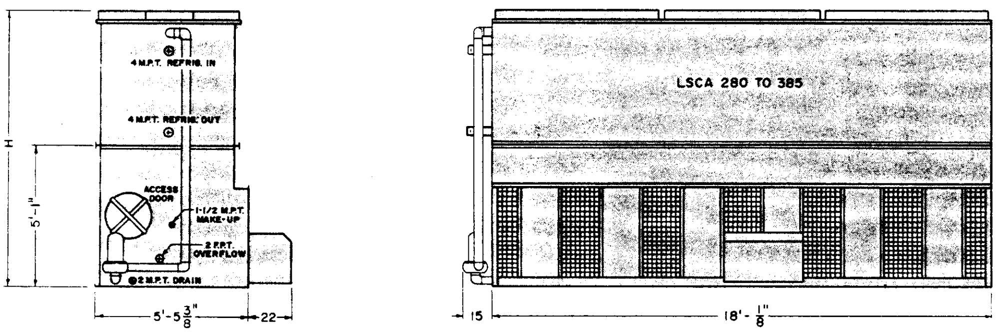


TABLE X - Engineering Data

UNIT NO. CFC-12 & HCFC-22 Capacity*	NH_3 Capacity*	WEIGHTS			FANS		SPRAY PUMP		REMOTE SUMP		DIMENSIONS	
		Shipping	Operating	Heaviest Section	HP**	CFM	HP	GPM	Gallons Req'd***	Conn. Size	Height	Length
LSCA-185	131	7,910	10,240	5,470	10	31,300	2	345	230	8	9' 9¼"	11' 11¾"
200	142	8,060	10,390	5,470	15	35,700	2	345	230	8	9' 9¼"	11' 11¾"
210	149	8,190	10,520	5,470	20	39,300	2	345	230	8	9' 9¼"	11' 11¾"
225	160	9,070	11,470	6,580	15	34,700	2	345	230	8	10' 5¾"	11' 11¾"
240	170	9,200	11,600	6,580	20	38,200	2	345	230	8	10' 5¾"	11' 11¾"
250	177	10,210	12,670	7,700	20	37,500	2	345	230	8	11' 2¼"	11' 11¾"
LSCA-280	199	12,070	15,130	8,330	15	46,800	3	515	340	8	9' 9¼"	18' ⅛"
300	213	12,200	15,260	8,330	20	51,500	3	515	340	8	9' 9¼"	18' ⅛"
315	223	12,400	15,460	8,330	25	55,500	3	515	340	8	9' 9¼"	18' ⅛"
335	238	13,770	16,900	9,990	20	50,400	3	515	340	8	10' 5¾"	18' ⅛"
355	252	13,970	17,100	9,990	25	54,300	3	515	340	8	10' 5¾"	18' ⅛"
370	262	14,120	17,250	9,990	30	57,700	3	515	340	8	10' 5¾"	18' ⅛"
385	273	15,590	18,810	11,660	30	56,500	3	515	340	8	11' 2¼"	18' ⅛"

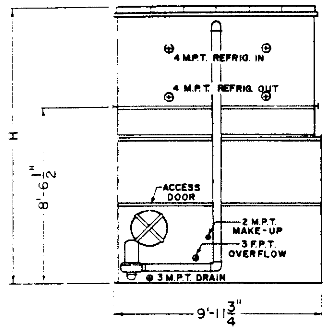
* Tons at standard conditions: CFC-12 and HCFC-22. 105° condensing, 40° suction and 78° W.B.; ammonia 96.3° condensing, 20° suction and 78° W.B.

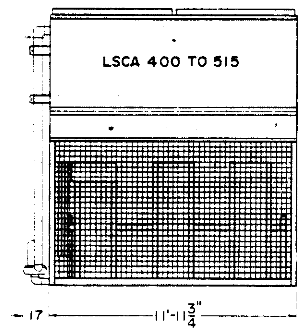
** For external static pressure up to ½" use next larger size fan motor.

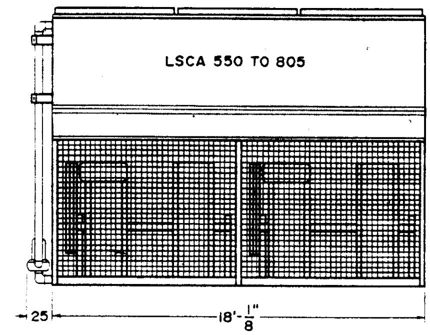
*** Gallons shown is water in suspension in unit and piping. Allow for additional water in bottom of remote sump to cover pump suction and strainer during operation. (12" would normally be sufficient.)

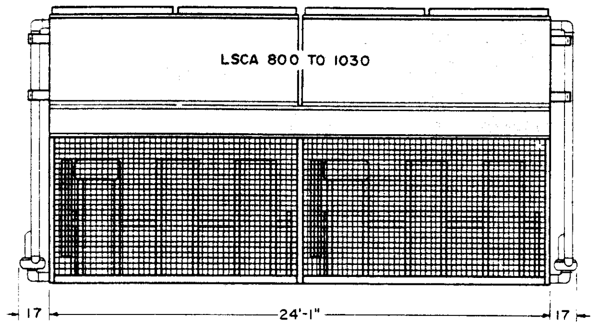
Engineering Dimensions & Data

Centrifugal Fan Models LSCA 400 to 1610









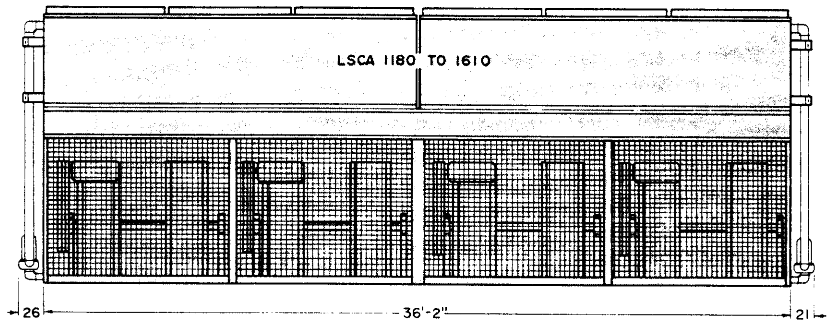


TABLE XI - Engineering Data

UNIT NO. CFC-12 & HCFC-22 Capacity*	NH3 Capacity*	WEIGHTS			FANS		SPRAY PUMP		REMOTE SUMP		DIMENSIONS	
		Shipping	Operating	Heaviest Section	HP**	CFM	HP	GPM	Gallons Req'd***	Conn. Size	Height	Length
LSCA- 400	284	15,870	21,970	10,740	30	72,400	5	685	410	10	13' 2¾"	11'11¾"
430	305	18,020	24,360	12,940	25	66,800	5	685	410	10	13'11¼"	11'11¾"
450	319	18,170	24,510	12,940	30	71,000	5	685	410	10	13'11¼"	11'11¾"
480	340	18,410	24,750	12,940	40	78,100	5	685	410	10	13'11¼"	11'11¾"
500	355	20,420	26,990	15,150	40	75,800	5	685	410	10	14' 7¾"	11'11¾"
515	365	20,480	27,050	15,150	50	79,600	5	685	410	10	14' 7¾"	11'11¾"
LSCA-550	390	22,990	31,860	15,500	(2)15	95,400	7½	1030	600	12	13' 2¾"	18'⅛"
590	418	23,370	32,240	15,500	(2)20	105,000	7½	1030	600	12	13' 2¾"	18'⅛"
625	443	23,610	32,480	15,500	(2)25	113,100	7½	1030	600	12	13' 2¾"	18'⅛"
650	461	26,670	35,900	18,680	(2)20	102,900	7½	1030	600	12	13'11¼"	18'⅛"
690	489	26,910	36,140	18,680	(2)25	110,800	7½	1030	600	12	13'11¼"	18'⅛"
720	511	27,140	36,370	18,680	(2)30	117,700	7½	1030	600	12	13'11¼"	18'⅛"
755	536	30,350	39,930	21,870	(2)30	114,000	7½	1030	600	12	14' 7¾"	18'⅛"
805	571	31,180	40,760	22,490	(2)40	121,500	7½	1030	600	12	15' ⅞"	18'⅛"
LSCA- 800	567	31,400	43,600	10,740	(2)30	144,800	(2) 5	1370	820	12	13' 2¾"	24'1"
860	610	35,710	48,370	12,940	(2)25	133,600	(2) 5	1370	820	12	13'11¼"	24'1"
900	638	35,910	48,570	12,940	(2)30	142,000	(2) 5	1370	820	12	13'11¼"	24'1"
960	681	36,390	49,070	12,940	(2)40	156,200	(2) 5	1370	820	12	13'11¼"	24'1"
1000	709	39,770	52,670	15,150	(2)40	151,600	(2) 5	1370	820	12	14' 7¾"	24'1"
1030	731	39,980	52,890	15,150	(2)50	159,200	(2) 5	1370	820	12	14' 7¾"	24'1"
LSCA-1180	837	46,140	64,170	15,500	(4)20	210,000	(2) 7½	2060	1500	14	13' 2¾"	36'2"
1250	887	46,620	64,650	15,500	(4)25	226,200	(2) 7½	2060	1500	14	13' 2¾"	36'2"
1380	979	53,230	71,960	18,680	(4)25	221,600	(2) 7½	2060	1500	14	13'11¼"	36'2"
1440	1021	53,490	72,230	18,680	(4)30	235,400	(2) 7½	2060	1500	14	13'11¼"	36'2"
1510	1071	60,100	79,380	21,870	(4)30	228,000	(2) 7½	2060	1500	14	14' 7¾"	36'2"
1610	1142	61,750	81,030	22,490	(4)40	243,000	(2) 7½	2060	1500	14	15' ⅞"	36'2"

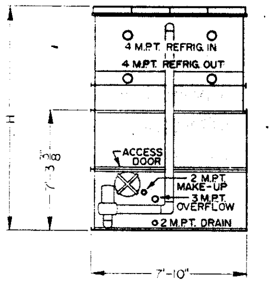
* Tons at standard conditions: CFC-12 and HCFC-22, 105° condensing, 40° suction and 78° W.B.; ammonia 96.3° condensing, 20° suction and 78° W.B.

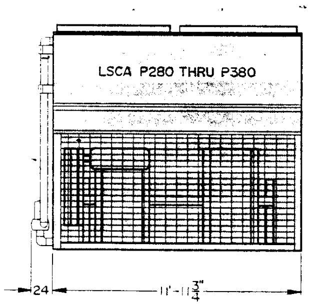
** For external static pressure up to ½" use next larger size fan motor.

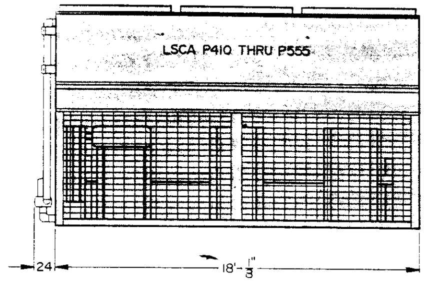
*** Gallons shown is water in suspension in unit and piping. Allow for additional water in bottom of remote sump to cover pump suction and strainer during operation. (12" would normally be sufficient.)

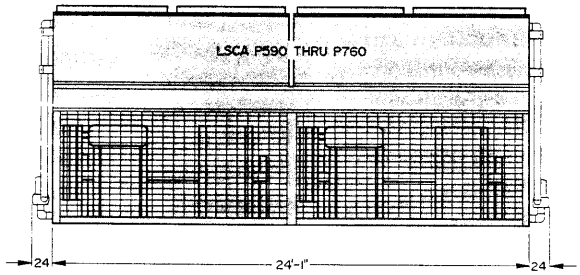
Alternate Plan Area

Centrifugal Fan Models
LSCA P280 to LSCA P1110









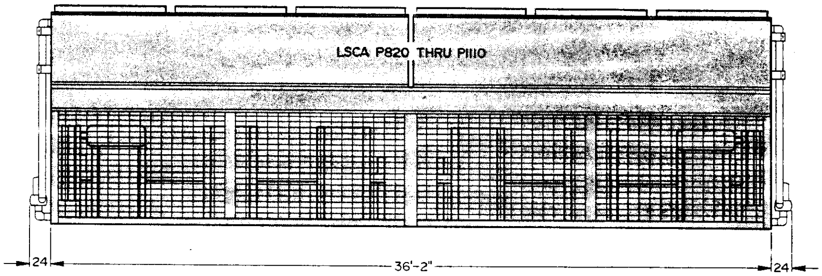


TABLE XII - Engineering Data

UNIT NO. CFC-12 & HCFC-22 Capacity*	NH³ Capacity*	WEIGHTS			FANS		SPRAY PUMP		REMOTE SUMP		DIMENSIONS	
		Shipping	Operating	Heaviest Section	HP**	CFM	HP	GPM	Gallons Req'd***	Conn. Size	Height	Length
LSCA-P280	199	12,300	16,800	8,800	20	47,600	5	570	362	10"	11' 7½"	11'11¾"
P295	209	12,400	17,000	8,800	25	51,300	5	570	362	10"	11' 7½"	11'11¾"
P330	234	14,100	18,800	9,800	25	50,300	5	570	362	10"	12' 3 "	11'11¾"
P345	245	14,200	18,900	9,800	30	53,400	5	570	362	10"	12' 3 "	11'11¾"
P360	255	15,900	20,800	12,200	30	52,400	5	570	362	10"	12'10½"	11'11¾"
P380	270	16,000	20,900	12,200	40	57,600	5	570	362	10"	12'10½"	11'11¾"
LSCA-P410	291	18,000	24,700	13,000	25	67,100	7½	840	530	12"	11' 7½"	18' ⅛"
P430	305	18,000	24,800	13,000	30	71,300	7½	840	530	12"	11' 7½"	18' ⅛"
P460	326	18,100	24,900	13,000	40	78,400	7½	840	530	12"	11' 7½"	18' ⅛"
P475	337	18,400	27,600	15,500	30	69,900	7½	840	530	12"	12' 3 "	18' ⅛"
P505	358	20,700	27,700	15,500	40	76,900	7½	840	530	12"	12' 3 "	18' ⅛"
P530	376	23,200	30,600	18,100	40	75,300	7½	840	530	12"	12'10½"	18' ⅛"
P555	394	23,300	30,600	18,100	50	81,100	7½	840	530	12"	12'10½"	18' ⅛"
LSCA-P590	418	24,600	33,800	8,800	(2)25	102,600	(2)5	1140	724	(2)10"	11' 7½"	24' 1 "
P660	468	28,000	37,500	9,800	(2)25	100,500	(2)5	1140	724	(2)10"	12' 3 "	24' 1 "
P690	489	28,100	37,600	9,800	(2)30	106,800	(2)5	1140	724	(2)10"	12' 3 "	24' 1 "
P720	511	31,600	41,500	12,200	(2)30	104,700	(2)5	1140	724	(2)10"	12'10½"	24' 1 "
P760	539	31,800	41,700	12,200	(2)40	115,200	(2)5	1140	724	(2)10"	12'10½"	24' 1 "
LSCA-P820	582	35,700	49,300	13,000	(2)25	134,100	(2)7½	1680	1060	(2)12"	11' 7½"	36' 2 "
P860	610	35,800	49,400	13,000	(2)30	142,700	(2)7½	1680	1060	(2)12"	11' 7½"	36' 2 "
P920	652	36,000	49,600	13,000	(2)40	156,900	(2)7½	1680	1060	(2)12"	11' 7½"	36' 2 "
P950	674	40,800	55,000	15,500	(2)30	139,800	(2)7½	1680	1060	(2)12"	12' 3 "	36' 2 "
P1010	716	41,100	55,200	15,500	(2)40	153,800	(2)7½	1680	1060	(2)12"	12' 3 "	36' 2 "
P1060	752	46,200	61,000	18,100	(2)40	150,600	(2)7½	1680	1060	(2)12"	12'10½"	36' 2 "
P1110	787	46,300	61,100	18,100	(2)50	162,300	(2)7½	1680	1060	(2)12"	12'10½"	36' 2 "

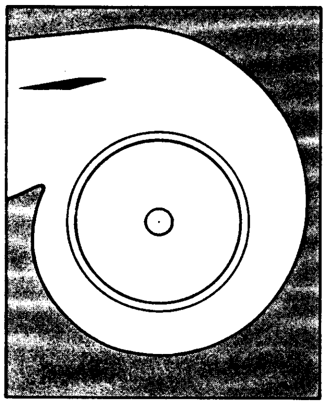
* Tons at standard conditions: CFC-12 and HCFC-22, 105° condensing, 40° suction and 78° W.B.; ammonia 96.3° condensing, 20° suction and 78° W.B.
** For external static pressure up to ½" use next larger size fan motor.
*** Gallons shown is water in suspension in unit and piping. Allow for additional water in bottom of remote sump to cover pump suction and strainer during operation. (12" would normally be sufficient.)

Optional Equipment

Capacity Control Dampers

Capacity control dampers are available for all centrifugal fan condensers. These dampers are installed in the fan housings to modulate the quantity of air flowing through the unit. A 24 volt electric actuator is mounted on the fan section and connected to the dampers through mechanical linkage. The actuator is positioned by a signal from a porportional action pressure controller. The pressure control is provided for field installation in the discharge line from the compressor or in the receiver. A 24 volt step down transformer is also included.

Condensers supplied with multiple circuits may require head pressure control for two or more of the individual circuits. For these applications, a temperature control, mounted in the condenser pan, is substituted for the standard pressure control. The head pressure is maintained indirectly for each circuit by monitoring the spray water temperature. When the dampers close to their minimum airflow position, an auxiliary switch built into the electric actuator opens to turn the fan motor off. See page 6 for additional information.)



DAMPER

Two Speed Fan Motors

In most applications two-speed fan motors will provide adequate control of the condenser capacity while reducing energy consumption and allowing lower sound levels.

When optional multi-speed fan motors are ordered, they are normally supplied in the more economical two speed-one winding design, although two speed-two winding types are available at additional cost. Both designs are 1800/900 RPM and can be wound for any single voltage between 200 and 575 volts in either 50 or 60 hertz. (See page 5 for more details.)

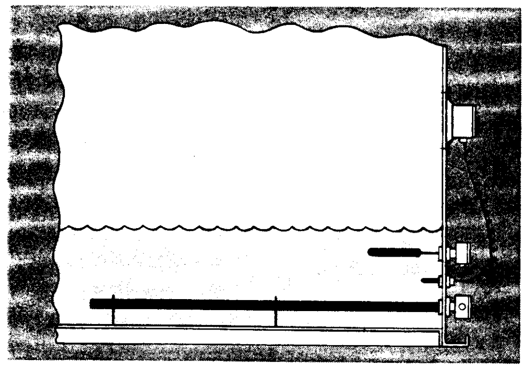
Pan Freeze Protection

REMOTE SUMP

Whenever a condenser is idled during sub-freezing weather, the water in the sump most be protected from freezing and damaging the pan. The simplest and most reliable method of accomplishing this is with a remote sump tank located in a heated space in the building under the condenser. The recirculating water pump is mounted at the remote sump and whenever it is shut-off, all of the water drains into the indoor tank. When a condenser is ordered for remote sump operation, the standard float valve and strainer are omitted, and the unit is provided with an oversized bottom water outlet connection. Where a remote sump is not possible, a supplementary means of heating the pan water must be provided.

ELECTRIC HEATERS

Electric immersion heaters are available factory installed in the basin of the condenser. They are sized to maintain a +40°F pan water temperature with the fans off. They are furnished with a thermostat to cycle the heater on when required. A low water protection device is included to prevent the control from energizing the heater elements unless they are completely submerged. All components are in weatherproof enclosures for outdoor use. The heater power contactors and electric wiring are not included as standard.



PAN HEATER

TABLE XIII - Electric Pan Heaters

Model No.	KW	Model No.	KW
POWER-MIZER MODELS			
PMCA-175 to 220	5	PMCA-495 to 755	(2) 6
230 to 335	(2) 4	850 to 950	(2) 8
350 to 475	8	990 to 1510	(2) 12
CENTRIFUGAL FAN MODELS			
LSCA- 33 to 80	2	LSCA- 400 to 515	7
90 to 170	3	550 to 805	(2) 5
185 to 250	4	800 to 1030	(2) 7
280 to 385	(2) 3	1180 to 1610	(2) 10
ALTERNATE PLAN MODELS			
LSCA- P280 to P380	5	LSCA- P590 to P760	(2) 5
P410 to P555	(2) 4	P820 to P1110	(2) 7

STEAM OR HOT WATER COILS

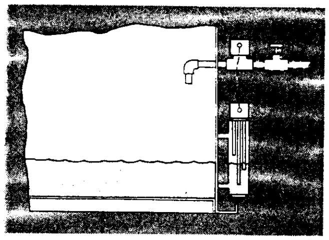
Pan coils are available as an alternate to the electric heaters described above. Constructed of galvanized pipe installed in the condenser basin, they are supplied less controls and are ready for piping to an external steam or hot water source. Pan water heater controls should be interlocked with the water circulating pump to prevent their operation when the pump is energized.

Electric Water Level Control

EVAPCO evaporative condensers are available with an optional electric water level control system in place of the standard mechanical makeup valve and float assembly. This package provides very accurate control of the pan water level and does not require field adjustment, even under widely variable operating conditions.

The control was designed by EVAPCO and consists of multiple heavy duty stainless steel electrodes. These electrodes are mounted external to the unit in a vertical stand pipe. For winter operation, the stand pipe must be wrapped with electric heating cable and insulated to protect it from freeze up.

The weather protected slow closing solenoid valve for the makeup water connection is factory supplied and is ready for piping to a water supply with a pressure between 20 psig (minimum) and 50 (maximum) psig.

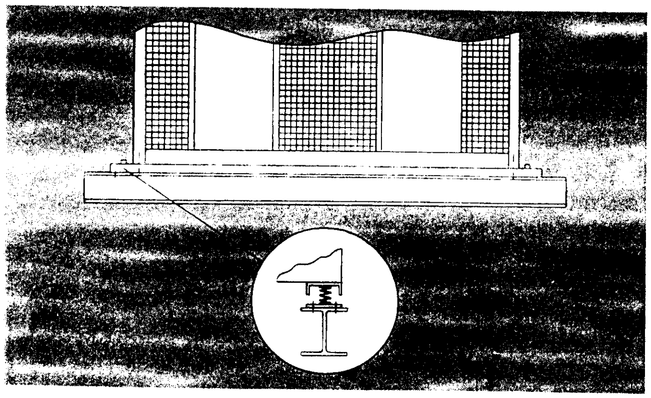

ELECTRIC WATER LEVEL CONTROL

Vibration Isolators

The fans on EVAPCO evaporative condensers are balanced and run virtually vibration free. In addition, the rotating mass is very small in relation to the total mass of the condenser, further reducing the possibility of objectionable vibration being transmitted to the building structure. As a result, vibration isolation is generally not required.

In those cases where it is determined that vibration isolation is necessary, spring type vibration isolator rails can be furnished. The rails are constructed of heavy gauge galvanized steel and coated with zinc chromatized aluminum paint for superior corrosion resistance. Rails are designed to be mounted between the cooling tower and the supporting steel framework. They are 90% efficient and have approximately 1" static deflection. Rails are designed for wind loading up to 50 MPH.

It is important to note that vibration isolation must be installed continously along the full length of the tower on both sides of the unit. Point isolators may be used between the supporting steel and building framework but not between the unit and the supporting steel.


VIBRATION ISOLATOR

Solid Bottom Panels For Ductwork

When centrifugal fan units are installed indoors and intake air is ducted to the unit, a solid bottom panel is required to completely enclose the fan section and prevent the unit from drawing room air into the fan intakes. When this is ordered, air inlet screens are omitted and the fan bearings are provided with extended lubrication fittings to facilitate maintenance from outside the duct.

Screened Bottom Panels

Protective inlet screens are provided on the front of the fan section (except as noted above) on both the Power-Mizer and the Centrifugal Fan models. Screens are not provided on the bottom of the fan section since most units are mounted on the roof or at ground level.

If units are installed in an elevated position, bottom screens are recommended for safety protection. They can be supplied by the factory at additional cost or added by the installing contractor.

Multiple Circuit Coils

Evaporative condensers may be ordered with multiple circuit coils to match various system requirements. On halocarbon refrigerant applications, multiple compressor systems are common, with each requiring an individual circuit on the condenser coil. In ammonia screw compressor applications, a separate section of the condenser coil may be used to cool water or a glycol-water mixture for the system oil cooler. Both the centrifugal and vane axial fan models are available with multiple circuit coil arrangements. Consult the factory for circuiting information.

Sub-Cooling Coils

EVAPCO's standard subcooling coil is designed to provide 10°F of refrigerant liquid subcooling on halocarbon refrigerants. The subcooling coil section is mounted between the condensing coil and the pan section and will add 7" to the height of most unit sizes. The coil assembly is tested at 350 P.S.I.G. air pressure under water and hot dip galvanized to insure maximum corrosion protection.

A subcooling coil in an evaporative condenser is not recommended for ammonia refrigeration systems. The physical properties of ammonia as a refrigerant provide lower static head losses and relatively small amounts of flash gas as compared to halocarbon refrigerants. Ammonia refrigeration systems are also less sensitive to small amounts of flash gas due to their expansion devices and basic system designs. The economical use of a subcooling coil is, therefore, limited for these applications.

Application

Design

EVAPCO units are heavy-duty construction and designed for long trouble-free operation. Proper equipment selection, installation and maintenance is, however, necessary to insure good unit performance. Some of the major considerations in the application of a condenser are presented below. For additional information, contact the factory.

Air Circulation

In reviewing the system design and unit location it is important that proper air circulation be provided. The best location is on an unobstructed roof top or on ground level away from walls and other barriers. Care must be taken when locating condensers in wells or enclosures or next to high walls. The potential for recirculation of the hot, moist discharge air back into the fan intake exists. Recirculation raises the wet bulb temperature of the entering air causing the condensing pressure to rise above design. For these cases, a discharge hood or ductwork should be provided to raise the overall unit height even with the adjacent wall, thereby reducing the chance of recirculation. Engineering assistance is available from the factory to identify potential recirculation problems and recommend solutions.

Centrifugal fan models can be installed indoors where it is desirable to hide the unit or where it is the only location available. Discharge ductwork is required for these installations. Normally it is best to use the room as a plenum for inlet air, but inlet ductwork can be used if required.

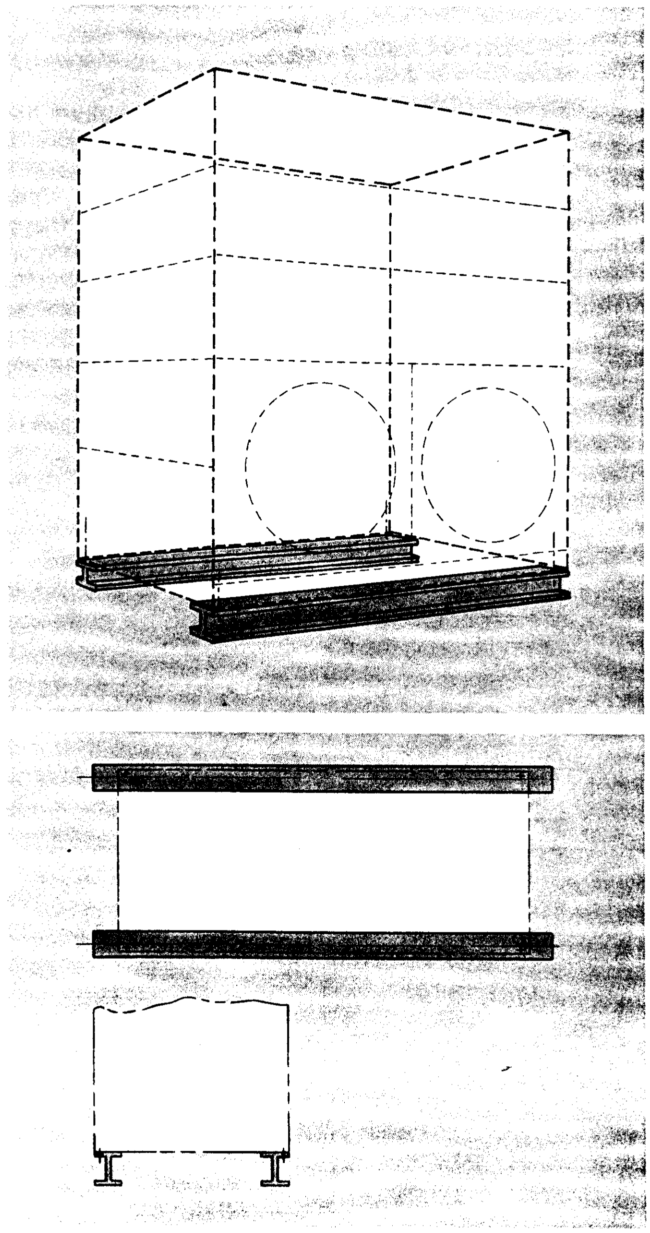
The design of ductwork should be symmetrical to provide even air distribution across both intake and discharge openings. The static pressure loss imposed by the ductwork must not exceed ½". Care must be taken to provide large access doors in the ductwork for accessibility to the unit fan section, eliminators and water distribution system for normal maintenance.

The centrifugal fan condenser can handle the external static of ductwork by using the next larger size fan motor. Units installed with inlet ductwork should also be ordered with the solid bottom panel option. Drawings are available from the factory showing how to make ductwork connections.

Structural Steel Support

The recommended method of support for EVAPCO condensers is two structural "I" beams located under the outer flanges and running the entire length of the unit. Mounting holes ¾" in diameter, are located in the bottom channels of the pan section to provide for bolting to the structural steel; refer to certified drawings from the factory for bolt hole locations.

Beams should be level to within ⅛" in 6' before setting the unit in place. Do not level the unit by shimming between it and the "I" beams as this will not provide proper longitudinal support.



STRUCTURAL STEEL SUPPORT

Maintaining the Recirculated Water System

The cooling in a condenser is accomplished by the evaporation of a portion of the recirculated spray water. As this water evaporates, it leaves behind all of its mineral content and impurities. Therefore, it is important to bleed-off an amount of water equal to that which is evaporated to prevent the build up of impurities. If this is not done, the mineral or the acidic nature of the water will continue to increase. This will ultimately result in heavy scaling or a corrosive condition.

Bleed-off

Each unit supplied with a pump mounted on the side is furnished with a clear bleed line for visual inspection and valve which, when fully open, will bleed-off the proper amount of water. If the make-up water supplying the unit is relatively free of impurities, it may be possible to cut back the bleed, but the unit must be checked frequently to make sure scale is not forming. Make-up water pressure should be maintained between 20 and 50 P.S.I.G.

Water Treatment

In some cases the make-up water will be so high in mineral content that a normal bleed-off will not prevent scaling. In this case water treatment will be required and a reputable water treatment company familiar with the local water conditions should be consulted.

Any chemical water treatment used must be compatable with the galvanized construction of the unit. If acid is used for treatment, it should be accurately metered and the concentration properly controlled. The pH of the water should be maintained between 6.5 and 9.0. Batch chemical feeding is not recommended because it does not afford the proper degree of control. If acid cleaning is required extreme caution must be exercised and only inhibited acids recommended for use with galvanized construction should be used.

Control of Biological Contamination

Water quality should be checked regularly for biological contamination. If biological contamination is detected, a more aggressive water treatment and mechanical cleaning program should be undertaken. The water treatment program should be performed in conjunction with a qualified water treatment company. It is important that all internal surfaces be kept clean of accumulated dirt and sludge. In addition, the drift eliminators should be maintained in good operating condition.

Recirculating Water System Freeze Protection

The simplest and most fool-proof method of protecting the recirculating water system from freeze-up is through the use of a remote sump located inside the building below the unit. The recirculating water pump is mounted at the remote sump and whenever it is shut off, all of the water in the condenser drains back to the warm inside sump. The Engineering Data Tables presented on pages 14-19 provide information to size the remote sump tank.

If a remote sump cannot be used, pan heaters are available, either steam, hot water, or electric type to keep the pan water from freezing when the unit is shut down. Water lines to and from the unit, the pump and pump piping up to the overflow connection must also be wrapped with electric heating cable and insulated to protect them from freeze-up. The condenser cannot be operated dry (fans on, pump off) unless water is completely drained from the pan. The pan heaters are sized to prevent pan water from freezing when the unit is shut down, but they are not sufficient to prevent freeze-up in a condenser operating dry.

Piping

Condenser piping should be designed and installed in accordance with generally accepted engineering practice. All piping should be anchored by properly designed hangers and supports with allowance made for possible expansion and contraction. No external loads should be placed upon condenser connections, nor should any of the pipe supports be anchored to the unit framework. For additional information concerning refrigerant pipe sizing and layout, see *"Piping Evaporative Condensers"* by Wilson E. Bradley. This paper was prepared by EVAPCO for the International Institute of Ammonia Refrigeration.

Evaporative Condenser Specifications

Power-Mizer/
Centrifugal Fan Models

Furnish and install as shown on the plans an EVAPCO Model __________ evaporative condenser. Each unit shall have condensing capacity of __________ BTUH heat rejection, operating with __________ refrigerant at ______°F condensing temperature and ______°F design wet bulb temperature.

Pan and Casing

The pan and casing shall be constructed of G-210 hot-dip galvanized steel for long life and durability. The heat transfer section shall be removable from the pan to provide easy handling and rigging.

The pan/fan section shall include fans, motors and drives mounted and aligned at the factory. These items shall be located in the dry entering air stream to provide maximum service life and easy maintenance. Standard pan accessories shall include circular access doors, stainless steel strainers, waste water bleed line with adjustable valve and brass make-up valve, with an unsinkable foam filled plastic float.

Model PMCA Power-Mizer Fans/Drives

Fans shall be vane-axial type constructed of cast aluminum alloy blades. They shall be arranged in a two-stage system installed in a closely fitted cowl with venturi air inlet and air stabilizing vanes. Fan shaft bearings shall be heavy-duty self aligning ball type with grease fittings extended to the outside of the unit.

The fan drive shall be solid backed Power-Band constructed of neoprene with polyester cords and designed for 150% of motor nameplate horsepower. Drives are to be mounted and aligned at the factory.

Model LSCA Centrifugal Fans/Drives

Fans shall be forwardly curved centrifugal type of hot-dip galvanized construction. The fans shall be factory installed into the pan-fan section, and statically and dynamically balanced for vibration free operation. Fans shall be mounted on either a solid steel shaft or a hollow steel shaft with forged bearing journals. The fan shaft shall be supported by heavy-duty, self-aligning bearings with cast iron housings and lubrication fittings for maintenance.

The fan drive shall be V-belt type with taper lock sheaves designed for 150% of the motor nameplate horsepower. Drives are to be mounted and aligned at the factory.

Fan Motor

__________ horsepower drip-proof ball bearing fan motor(s) with 1.15 service factor shall be furnished suitable for outdoor service on __________ volts, __________ hertz, and __________ phase. Motor(s) shall be mounted on an adjustable base.

Heat Transfer Coil

The coil(s) shall be all prime surface steel, encased in steel framework with the entire assembly hot-dip galvanized after fabrication. Coil(s) shall be designed with sloping tubes for free drainage of liquid refrigerant and tested to 350 P.S.I.G. air pressure under water.

Water Distribution System

The system shall provide a water flow rate of not less than 6 GPM over each square foot of unit face area to insure proper flooding of the coil. The spray header shall be constructed of schedule 40, PVC pipe for corrosion resistance. All spray branches shall be removable and include a threaded end lug for cleaning. The water shall be distributed over the entire coil surface by precision molded ABS spray nozzles (1" x ½" orifice) with internal anti-sludge rings to eliminate clogging. Nozzles shall be threaded into spray header to provide easy removal for maintenance.

Water Recirculation Pump

The pump(s) shall be a close-coupled, bronze fitted, centrifugal type with mechanical seal, installed vertically at the factory to allow free drainage on shut down. ________ horsepower open drip-proof motor shall be furnished suitable for outdoor service on ______volts, ______hertz, and ______phase.

Eliminators

The eliminators shall be constructed entirely of (PVC) that has been specially treated to resist ultra violet light. Assembled in easily handled sections, the eliminator blades shall be spaced on 1 inch centers and shall incorporate three changes in air direction to assure removal of entrained moisture from the discharge air stream. They shall have a hooked leaving edge to direct the discharge air away from the fans to minimize recirculation.

Finish

All pan and casing materials shall be constructed of G-210 heavy gauge mill hot-dip galvanized steel for maximum protection against corrosion. During fabrication, all panel edges shall be coated with a 95% pure zinc-rich compound. After fabrication, the completed unit shall be coated externally with zinc chromatized aluminum paint.

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