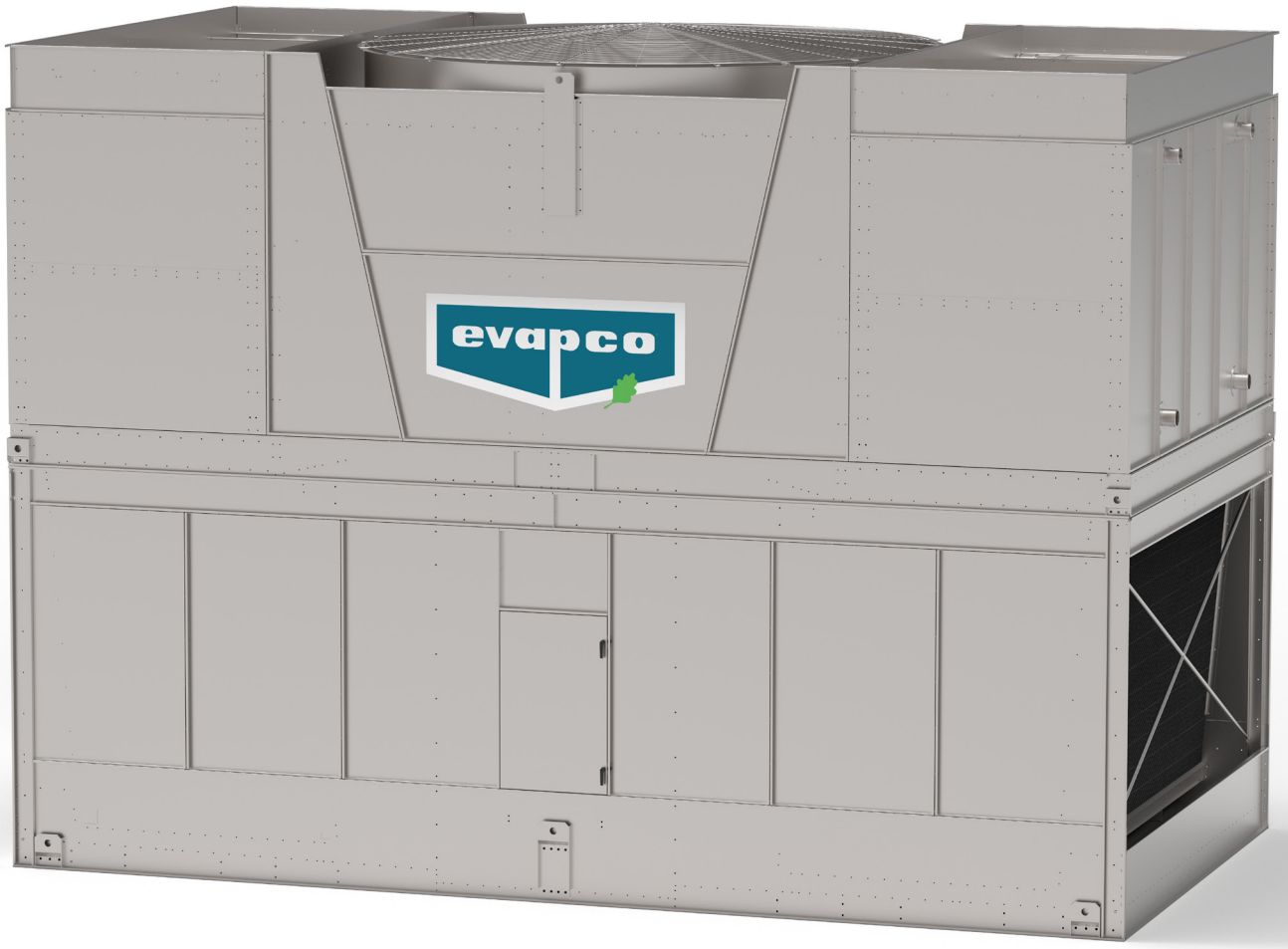
evapco for LIFE

CLOSED CIRCUIT COOLERS



PHW

Parallel Hybrid Closed Circuit Cooler

FEATURING

CROSScool INTERNALLY ENHANCED COIL TECHNOLOGY

MOTOR AND DRIVE 5 Year WARRANTY

CTI CERTIFIED †

† Mark owned by the Cooling Technology Institute

PROVEN PERFORMANCE AND DESIGN FLEXIBILITY

EVAPCO World Headquarters in Taneytown, MD

EVAPCO is more than a name.

EVAPCO is the global innovator in heat transfer solutions. It is a pledge to make everyday life easier, more comfortable, more reliable, and more sustainable for people everywhere. How do we fulfill that promise? It is simple.

We never stop innovating.

At EVAPCO, we do not just talk about innovation, It is ingrained in our workflow. Guided by our annually developed R&D plans, we set out to find groundbreaking solutions that transform the way the world works for the better. It is why we have more than 200 active patents worldwide.

We craft exceptionally built solutions.

As an employee-owned company, we take pride in our work. We are proud to be one of the most experienced teams of engineers and craftsmen in the industry. This translates into solutions that are always exceptionally built. EVAPCO has an unwavering commitment to provide "best in class" heat transfer solutions and services.

We guarantee performance.

Every EVAPCO solution is put through rigorous research and testing to ensure maximum efficiency and reliability. But we do not stop there. EVAPCO is an industry leader in independent, third-party performance certifications. These certifications guarantee our performance metrics—so that you can plan your projects with complete peace of mind.

We protect the environment.

Innovation and environmental sustainability go hand-in-hand at EVAPCO. EVAPCO's industrial heat transfer equipment not only conserves natural resources and helps reduce noise pollution, they also feature recycled steel content in their construction. Our stainless steel units are constructed of panels that contain up to 67% recycled content; over 79% in galvanized units construction. From sound reduction to water conservation to chemical elimination, we are constantly developing new technologies that deliver the ultimate operating advantages for our clients—and protect the planet for every generation that comes after us.

Wilson E. Bradley Research and Development Center

Proven Performance and Design Flexibility

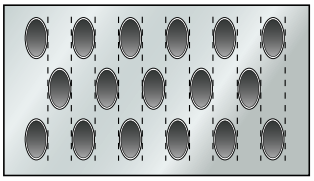
The PHW Parallel Hybrid Closed Circuit Cooler offers more system design and layout flexibility than ever before. This Induced Draft Closed Circuit Cooler design enhances EVAPCO's already extensive line of evaporative cooling technology. The PHW offers more selections for large projects: more capacity with a smaller plan area, fewer motors, and less weight. More equipment choices, and more design flexibility mean greater value for the end user.

The PHW combines high-efficiency PVC crossflow fill with EVAPCO's patented coil designs featuring the exclusive CROSSCOOL™ tube enhancement for superior induced draft, parallel flow, hybrid closed circuit cooler performance. The PHW evaporative closed circuit cooler was designed in EVAPCO's state-of-the-art research and development center as part of the company's ongoing product development program. The PHW has undergone extensive thermal testing to ensure each closed circuit cooler will perform as specified. As with all EVAPCO products, each PHW closed circuit cooler is supplied with a written Thermal Performance Guarantee.

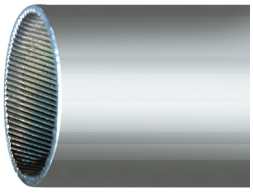
PHW – Double Air Inlet Models

Coil Technology

The PHW incorporates EVAPCO's latest high-efficiency heat transfer coils featuring EVAPCO'S exclusive internal tube enhancement CROSSCOOL™! The PHW utilizes EVAPCO's patented **Sensi-Coil**® technology which features EVAPCO's elliptical tubes assembled in a high density coil tube arrangement. The combination of these coil technologies with CROSSCOOL™ tube enhancement provides more internal and external heat transfer surface area as well as greater air and water loading over the coil versus other designs. The result is superior heat transfer performance in parallel-flow heat transfer!



Sensi-Coil®



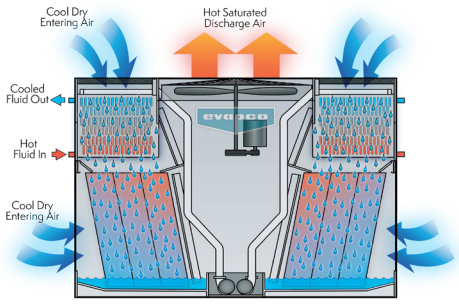
CROSSCOOL™

Principle of Operation

Hot process fluid enters the coil through the bottom coil connection(s). Cooled water from the unit basin is pumped through spray distribution nozzles and floods over the closed circuit cooler coil(s). Ambient air is simultaneously drawn into the unit at the top in parallel flow with the water through the coil. A portion of the recirculated water evaporates into the air stream. This evaporation process and the cooled water flowing over the tubes removes heat from the process fluid. The cooled process fluid leaves the coil through the top coil connection(s) for return to the system.

The recirculated water that was not evaporated falls through a crossflow fill section located below the coil. Air is drawn through the side of the unit and fill section removing additional heat from the water through evaporation. The cooled water collects in the basin for recirculation over the coil.

The hot, saturated air from both the coil and fill sections pass through internal drift eliminators to strip water droplets entrained in the air stream. The unit fan(s) then discharge the saturated air out of the top of the unit at a high velocity, where it dissipates into the atmosphere.

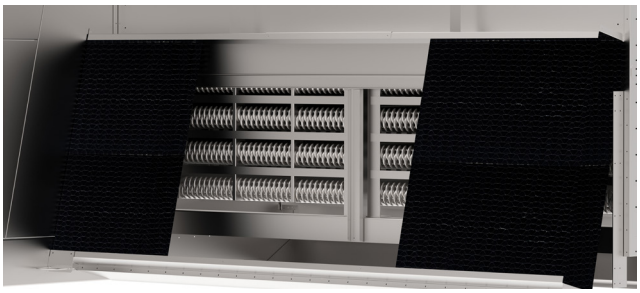


Principle of Operation

Cooling Coil

The coils are manufactured from high quality steel tubing following the most stringent quality control procedures. Each circuit is inspected to ensure the material quality and then tested before being assembled into a coil. The coil has design pressure of 300 psi and is in compliance with ANSI/ASME B31.5, Refrigeration Piping and Heat Transfer Components. The coil assembly is strength tested in accordance with ANSI/ASME B31.5 and subsequently leak tested using air under water. To protect the coil against corrosion, it is placed in a heavy steel frame and then the entire assembly is dipped in molten zinc (hot-dip galvanized) at a temperature of approximately 800°F.

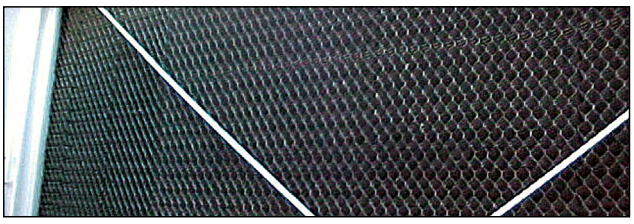
NOTE: Closed circuit coolers should only be used on sealed, pressurized systems. Continual aeration of the water in an open system can cause corrosion inside the tubes of the coil leading to premature failure.



XPak™ Crossflow Fill

The PHW Closed Circuit Cooler utilizes XPak™ Bonded Block Fill in both 14' and 12' wide units, specially designed and manufactured by EVAPCO to induce highly turbulent mixing of air and water for superior heat transfer. This fill is constructed of inert polyvinyl chloride (PVC), making it resistant to rot or decay and capable of withstanding water temperatures up to 120°F (48.9°C).

The individual crossflow fill sheets are bonded together and supported at the bottom, enhancing the structural integrity of the fill section. The assembled fill sheets form an integral inlet louver to prevent debris from entering the heat transfer fill, and an integral drift eliminator to strip water droplets entrained in the air stream. This fill material is self-extinguishing and has a flame spread rating of less than 25 per ASTM E84.



PHW Design and Construction Features - Double Air Inlet Models

PVC Spray Distribution Header with ZM® II Nozzles

- Large orifice nozzles prevent clogging (no moving parts)
- Designed for superior water distribution
- Threaded nozzles eliminate troublesome grommets
- Fixed position nozzles require zero maintenance
- Threaded end caps for ease of cleaning
- Guaranteed for life

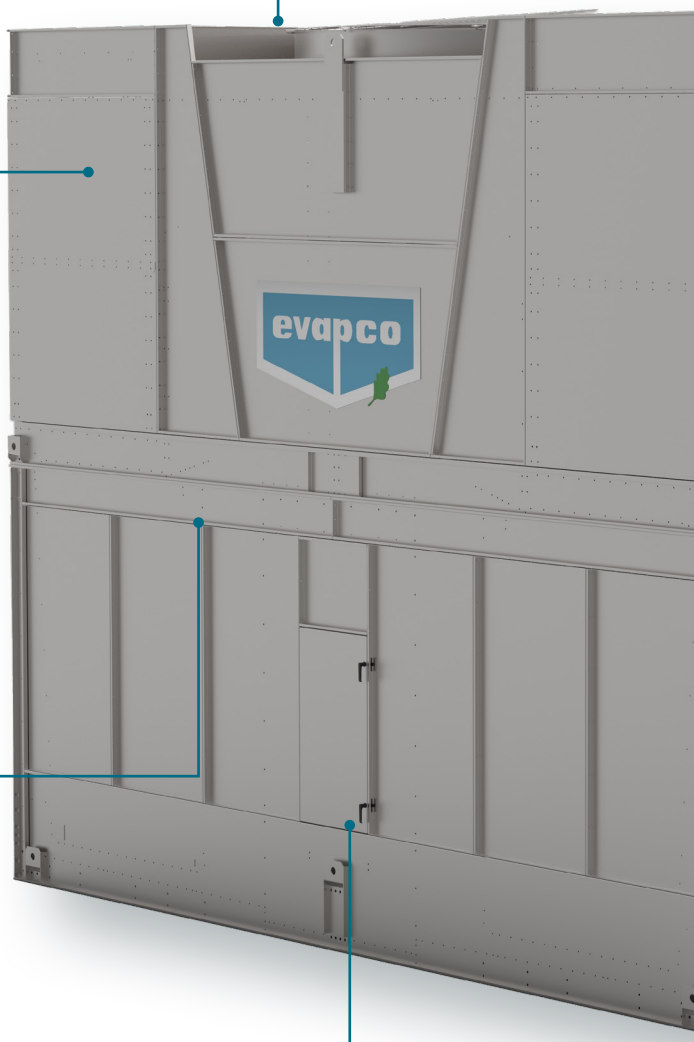
Galvanized Steel Coil

*Elliptical Sensi-Coil®** Featuring CROSSCOOL™ Internal Tube Enhancement Technology*

- Internal Tube Enhancement increases fluid turbulence providing additional capacity
- Elliptical return bends allows for more circuits per coil bundle increasing maximum capacity per footprint

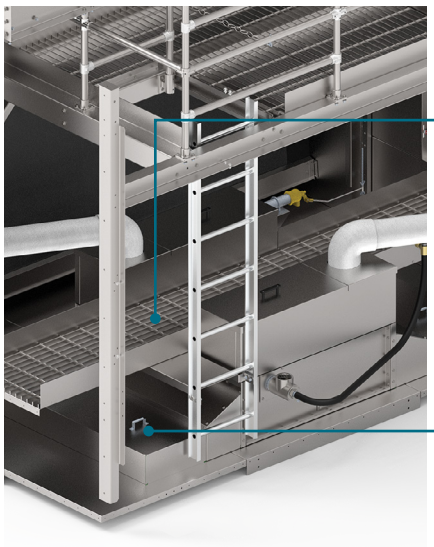
Efficient Drift Eliminators

- Patented design reduces drift rate
- Made from corrosion-resistant PVC for long life



Double-Brake Flange Joints

- Stronger than single-brake design
- Minimizes water leaks at field joints
- Greater structural rigidity



Internal Walkway

- For safe easy access to entire basin

Pump House Access

- Easy access to pump and pump motor
- Oversized for easy addition of accessories, i.e. pan heaters

Large Access Door

- Oversized access door for enhanced accessibility
- Standard on all models

Stainless Steel Strainer

- Resists corrosion better than other materials

Totally Enclosed Pump Motors

- Long, trouble-free operation

G-235 Mill Hot-Dip Galvanized Steel Construction

(Stainless steel available as affordable option)

Advanced Design Smooth Flow Fan System

- Totally enclosed fan motors provide long-lasting performance
- Power-Band belts for better lateral rigidity
- Advanced design aluminum fan blades
- Non-corroding cast aluminum sheaves
- Heavy-duty fan shaft bearings with L_{10} life of 100,000 hours
- All other components are of corrosion resistant materials
- All components covered by 5-year warranty

Easy Rig Field Seam

- Self-guiding channels improve the quality of the field seam to eliminate leaks
- Easy to install
- Lower installation cost

External Service Platform with Ladder (Optional)

- Safe access to coil
- Self-supporting
- Modular design for easy field installation

XPak™ Crossflow Fill

- High efficiency bonded block fill
- Polyvinyl Chloride (PVC)
- Impervious to rot, decay and biological attack
- Integral louvers and drift eliminators
- Easy to handle
- Flame Spread rating of <25 per ASTM E84

Other PHW Double Air Inlet Options

- Internal motor davit
- Internal upper access ladder & platform
- Low Sound Fan
- Super Low Sound Fan

PHW Construction Features

The PHW features more plan area options and fan horsepower options for the system design engineer. With more closed circuit cooler capacity, more plan area options, and greater flexibility in motor selection, the design engineer can now match the closed circuit cooler performance to the specific application requirements. More equipment choices and more design flexibility mean greater value for the end user.

ZM® II Spray Nozzle Water Distribution System

ZM® II Nozzle

Uniform and constant water distribution are paramount for reliable, scale-free evaporative cooling. EVAPCO'S **Zero Maintenance ZM® II Spray Nozzle** remains clog-free under the toughest conditions.

The heavy-duty ABS ZM® II Spray Nozzles have a 1-1/4" diameter opening and a 1-1/4" splash plate clearance. The fixed position ZM® II Spray Nozzles are mounted in corrosion-free PVC water distribution pipes that have threaded end caps. Together, these elements combine to provide enhanced water dispersion over the coil resulting in superior thermal performance and a virtually maintenance-free water distribution system.

Fewer Fasteners - Lower Installed Cost

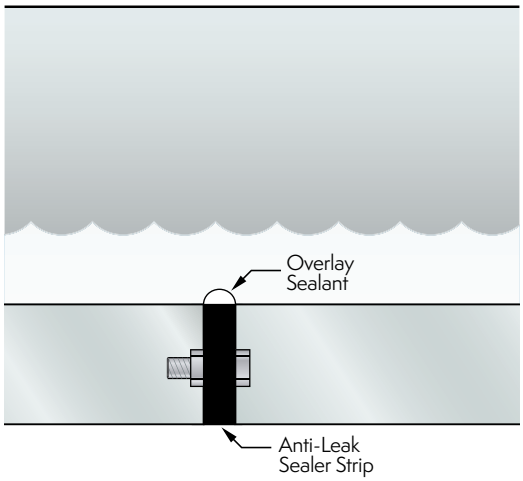
The PHW closed circuit coolers feature a field seam design which ensures easier assembly and fewer field seam leaks. The field seam incorporates self-guiding channels, which direct the coil casing section into position at the proper location on the bottom section of the closed circuit cooler. In addition, the new design eliminates up to 85% of the fasteners typically used to join closed circuit cooler sections in the field. This significantly reduces the amount of contractor labor cost to install the closed circuit cooler.

Type 304 Stainless Steel Strainers

Subjected to excessive wear and corrosion, the sump strainer is critical to the successful operation of the closed circuit cooler. EVAPCO uses only Type 304 Stainless Steel for this very important component.

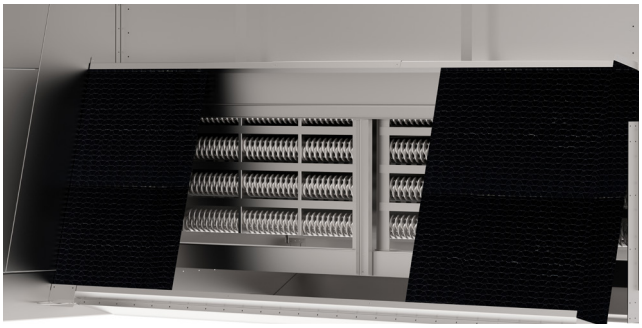
Unique Seam Design–Eliminate Field Leaks

The PHW features EVAPCO's unique pan construction, which includes a special butyl tape sealer. Each joint is then backed with a secondary caulking compound and encased in a double-brake flange for added strength and structural integrity. Units with a stainless steel basin, feature welded seams for enhanced durability. This unique sealing system has been proven effective in laboratory tests and years of field application.



Efficient Water Drift Eliminators

An efficient drift eliminator system removes entrained water droplets from the air stream to limit the drift loss from the closed circuit cooler. With a low drift rate, EVAPCO closed circuit coolers save valuable water and water treatment chemicals. The drift eliminators are constructed of an inert polyvinyl chloride (PVC) plastic material which effectively eliminates corrosion of these vital components. They are assembled in sections to facilitate easy removal for inspection of the coil.



Mechanical Drive System

Fan Motors: All PHW Closed Circuit Coolers utilize a Totally Enclosed Air Over (TEAO) fan motor designed specifically for evaporative cooling applications. Inverter duty fan motors are standard on all PHW Closed Circuit Coolers.

Power-Band Drive Belt: The Power-Band is a solid-back, multi-groove belt system that has high lateral rigidity. The belt is constructed of neoprene with polyester cords. The drive belt is designed for minimum 150% of the motor nameplate horsepower for long life and durability.

Fan Shaft Bearings: The fan shaft bearings in PHW units are specially selected for long, trouble-free life. They are rated for an L_{10} life of 100,000 hours and are the heaviest pillow block bearing available.

Aluminum Alloy Sheaves: Fan sheaves are constructed of corrosion-resistant aluminum for long life, eliminating the corrosion that exists on cast steel sheaves, thereby extending belt life.

Five-Year Drive Warranty: All drive components on PHW units are covered by EVAPCO's exclusive 5-year drive warranty—including fan motors and belts!

Maintenance Access

Large Access Door

For enhanced basin accessibility that enables maintenance personnel to quickly and easily enter the basin for float valve adjustment and unit inspection. This is provided standard on all PHW models.

Internal Walkway

Once inside the PHW Closed Circuit Coolers, maintenance personnel can safely move throughout the unit by way of a non-slip walkway. This walkway is standard on double air inlet units.

Optional Equipment

Self-Supporting External Service Platforms

PHW Closed circuit coolers are available with self-supporting service platforms that include access ladders, which are designed for easy field installation. This option offers significant savings in comparison to field-constructed, externally supported catwalks. The EVAPCO service platform option is for the air inlet end(s) of the unit.

PHW Double Air Inlet Model Shown

Stainless Steel Basin and Casing

EVAPCO offers optional Type 304 or Type 316 stainless steel construction for superior corrosion resistance. EVAPCO induced draft closed circuit coolers have a modular design which allows for specific areas to be enhanced for increased corrosion protection. The basin area of a closed circuit cooler is often subjected to high concentrations of impurities and silt. EVAPCO's stainless steel basin option includes welded seam construction as standard. For particularly corrosive environments, stainless steel construction is also available for the coil casing / fan section.

TITAN Coils – Stainless Steel Construction

EVAPCO offers the optional TITAN COIL. Constructed with Type 304L and Type 316L stainless steel, the TITAN COIL is manufactured using EVAPCO's patented elliptical tube **Sensi-Coil®** design upgraded to tough construction featuring: durability, corrosion resistance and **5 Year Coil Warranty** as standard.

Coil, Air Inlet & Sump Sun~Blocker System

EVAPCO's Sun~Blocker System is designed to prevent sunlight from entering the closed circuit cooler at the coil inlet and at the fill/air intake. As standard, these areas are open and exposed to sunlight which may promote algae growth. The Sun~Blocker System will help minimize algae, water splash out, and may reduce water treatment chemistry costs.

Electric Water Level Control

EVAPCO evaporative closed circuit coolers 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 basin water level and does not require field adjustment, even under varying operating conditions.

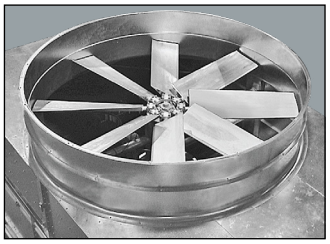
Super Low Sound Fan

9-15 dB(A) Reduction versus Standard Fan

The Super Low Sound Fan offered by EVAPCO uses an extremely wide chord blade design for very sound sensitive applications where the lowest sound levels are required. The fan is multi-piece molded heavy duty FRP construction utilizing a forward swept blade design. The Super Low Sound fan is capable of reducing the unit sound pressure levels by 9 dB(A) to 15 dB(A), depending on specific unit selection and measurement location. The fans are high efficiency axial propeller type.

Low Sound Fan

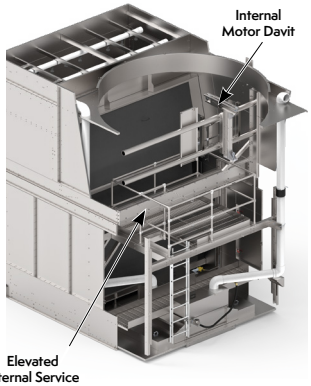
4-7 dB(A) Reduction versus Standard Fan



The Low Sound Fan offered by EVAPCO uses a wide chord blade design for sound sensitive applications where low sound levels are desired. Low Sound Fan construction uses aluminum blades and a steel fan hub. The Low Sound Fan is capable of reducing the unit sound pressure levels by 4 dB(A) to 7dB(A), depending on specific unit selection and measurement location with a minimal impact to thermal performance. The fans are high efficiency axial propeller type.

Elevated Internal Service Platform

An elevated internal service platform option can be provided on the PHW double air inlet models to provide easy access to the unit drive components. The elevated internal service platform system provides an aluminum ladder that extends from the walkway to the service platform located directly below the drive system. The service platform is constructed of galvanized steel and provides easy access to lubricate fan bearings and service the motor and drive components.

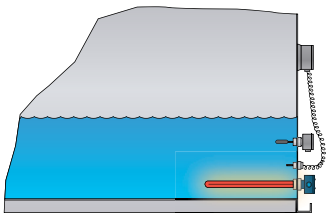


Internal Motor Davit

In order to provide for easy motor removal, the PHW double air inlet models can be provided with an internal motor davit system. The internal motor davit is constructed of galvanized steel and provides an easy method to lower the fan motor to the basin of the unit for removal through the side access door.

Basin Heater Package

Electric basin heater packages are available to help prevent freeze-up of the basin water. The packages include electric heater elements, thermostat and low water cutoff.



NOTE: External pumps should be heat traced and insulated in the field to prevent freezing.

	Box Size	Heater Sizes (kW)		
		0°F	-20°F	-40°F
Double Air Inlet Models	12' x24'	(2) 12	(4) 9	(4) 12
	14' x 26'	(2) 15	(4) 10	(4) 15

Steel Support

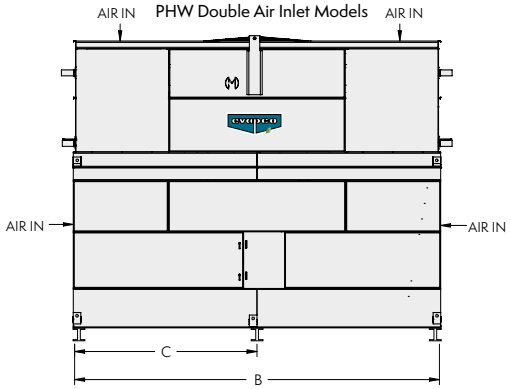
EVAPCO PHW closed circuit coolers are designed to be supported with structural I-beams located under the outer flanges and running the entire length of the unit. Mounting holes, 3/4" in diameter, are located in the bottom channels of the pan section to provide for bolting to the structural steel. (Refer to certified drawings from the factory for bolt hole locations.)

Beams should be level to within 1/8" 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.

Consult IBC for required steel support layout and structural design

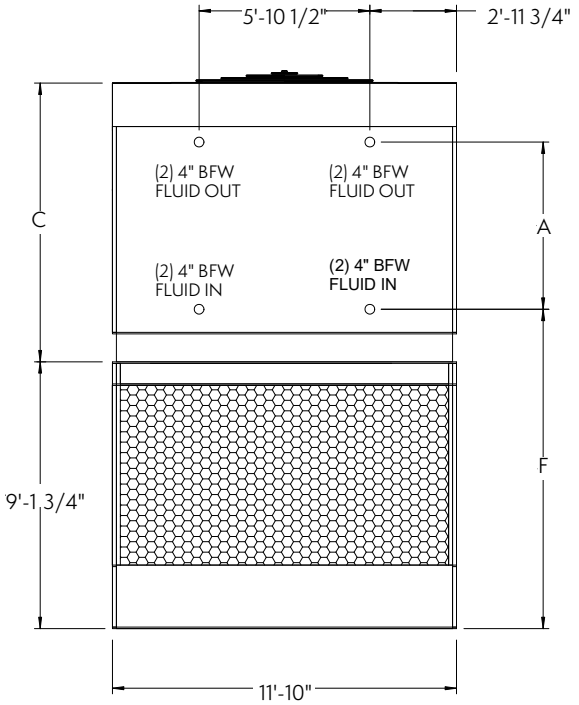
	PHW Pan Footprint Dimensions			
	Box Size	A	B	C
Double Air Inlet Models	12' x 24'	-	24'	12'
	14' x 26'	-	26'	13'

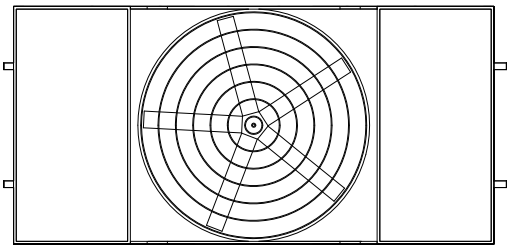
NOTE: Unit dimensions shown for reference only. Consult the PHW unit steel support drawings for specific beam dimensions and bolt locations.

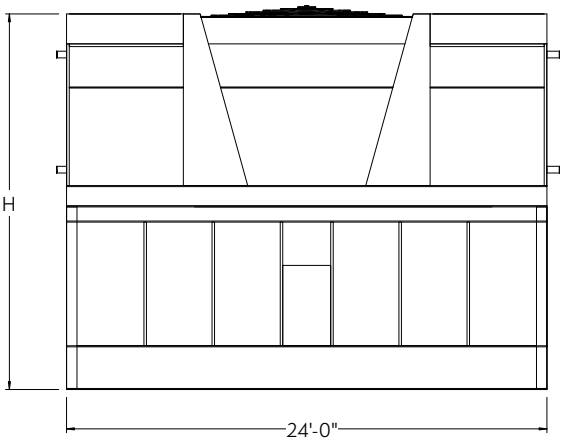


Typical Steel Support

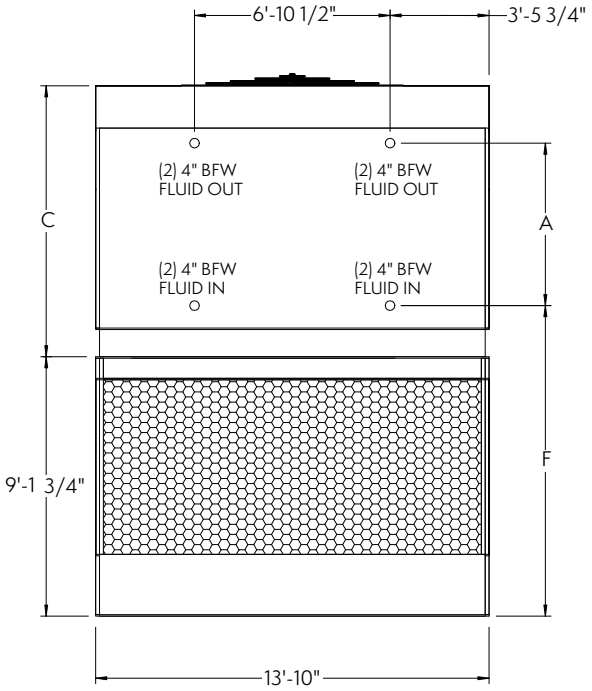
Models PHW 12-5M24 to 12-10Q24

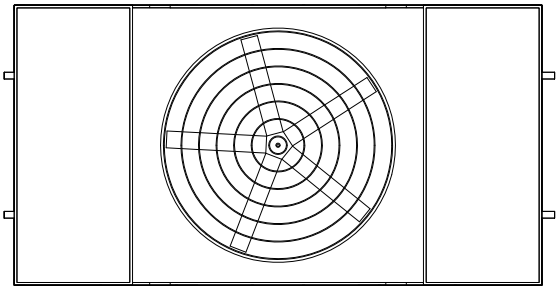


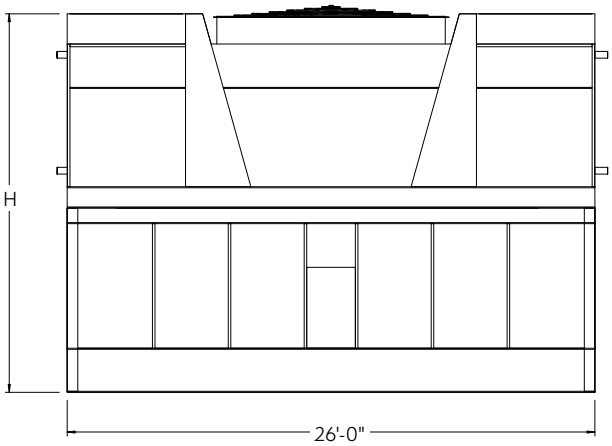




Models PHW 14-5M26 to 14-10R26







Engineering Dimensions & Data: Models PHW 12-5M24 to 12-10Q24

MODEL NO.[1]	FANS		WEIGHTS (LBS)			COIL VOL (GAL)	SPRAY PUMP		REMOTE PUMP			DIMENSIONS (IN)[3]			
	HP	CFM	SHIP	OPR	HEAVIEST SECTION[2]		HP	GPM	GAL RQD	CONN SIZE (IN)	OPR WGT	A	F	C	H
PHW 12-5M24	30	177,600	37,220	57,360	25,970	687.8	(2) 7.5	1800	1600	(1) 14	52,480	41.75	151.375	107.625	217.375
PHW 12-5N24	40	191,300	37,340	57,480	26,090	687.8	(2) 7.5	1800	1600	(1) 14	52,600	41.75	151.375	107.625	217.375
PHW 12-5O24	50	206,000	37,390	57,530	26,140	687.8	(2) 7.5	1800	1600	(1) 14	52,650	41.75	151.375	107.625	217.375
PHW 12-5P24	60	218,700	37,670	57,810	26,420	687.8	(2) 7.5	1800	1600	(1) 14	52,930	41.75	151.375	107.625	217.375
PHW 12-5Q24	75	235,600	37,730	57,870	26,480	687.8	(2) 7.5	1800	1600	(1) 14	52,990	41.75	151.375	107.625	217.375
PHW 12-6M24	30	177,400	39,940	61,160	28,690	817.7	(2) 7.5	1800	1600	(1) 14	56,280	50.75	142.375	107.625	217.375
PHW 12-6N24	40	195,200	40,060	61,280	28,810	817.7	(2) 7.5	1800	1600	(1) 14	56,400	50.75	142.375	107.625	217.375
PHW 12-6O24	50	210,200	40,110	61,330	28,860	817.7	(2) 7.5	1800	1600	(1) 14	56,450	50.75	142.375	107.625	217.375
PHW 12-6P24	60	223,200	40,390	61,610	29,140	817.7	(2) 7.5	1800	1600	(1) 14	56,730	50.75	142.375	107.625	217.375
PHW 12-6Q24	75	240,400	40,450	61,670	29,200	817.7	(2) 7.5	1800	1600	(1) 14	56,790	50.75	142.375	107.625	217.375
PHW 12-7M24	30	177,600	42,940	65,080	31,140	947.6	(2) 7.5	1,800	1,600	(1) 14	60,200	59.75	140.375	96.625	217.375
PHW 12-7N24	40	191,300	42,780	65,080	31,530	947.6	(2) 7.5	1800	1600	(1) 14	60,200	59.75	133.375	107.625	217.375
PHW 12-7O24	50	206,000	42,830	65,130	31,580	947.6	(2) 7.5	1800	1600	(1) 14	60,250	59.75	133.375	107.625	217.375
PHW 12-7P24	60	218,700	43,110	65,410	31,860	947.6	(2) 7.5	1800	1600	(1) 14	60,530	59.75	133.375	107.625	217.375
PHW 12-7Q24	75	235,600	43,170	65,470	31,920	947.6	(2) 7.5	1800	1600	(1) 14	60,590	59.75	133.375	107.625	217.375
PHW 12-8M24	30	172,600	45,620	68,520	34,370	1077.5	(2) 7.5	1800	1600	(1) 14	63,640	68.75	136.375	119.625	229.375
PHW 12-8N24	40	189,800	45,740	68,640	34,490	1077.5	(2) 7.5	1800	1600	(1) 14	63,760	68.75	136.375	119.625	229.375
PHW 12-8O24	50	204,300	45,790	68,690	34,540	1077.5	(2) 7.5	1800	1600	(1) 14	63,810	68.75	136.375	119.625	229.375
PHW 12-8P24	60	217,000	46,070	68,970	34,820	1077.5	(2) 7.5	1800	1600	(1) 14	64,090	68.75	136.375	119.625	229.375
PHW 12-8Q24	75	233,700	46,130	69,030	34,880	1077.5	(2) 7.5	1800	1600	(1) 14	64,150	68.75	136.375	119.625	229.375
PHW 12-9M24	30	171,200	48,260	72,720	37,010	1207.4	(2) 7.5	1800	1600	(1) 14	67,840	64.25	140.875	119.625	229.375
PHW 12-9N24	40	188,300	48,380	72,840	37,130	1207.4	(2) 7.5	1800	1600	(1) 14	67,960	64.25	140.875	119.625	229.375
PHW 12-9O24	50	202,700	48,430	72,890	37,180	1207.4	(2) 7.5	1800	1600	(1) 14	68,010	64.25	140.875	119.625	229.375
PHW 12-9P24	60	215,300	48,710	73,170	37,460	1207.4	(2) 7.5	1800	1600	(1) 14	68,290	64.25	140.875	119.625	229.375
PHW 12-9Q24	75	231,800	48,770	73,230	37,520	1207.4	(2) 7.5	1800	1600	(1) 14	68,350	64.25	140.875	119.625	229.375
PHW 12-10M24	30	169,800	50,940	76,480	39,690	1337.3	(2) 7.5	1800	1600	(1) 14	71,600	71.75	133.375	119.625	229.375
PHW 12-10N24	40	186,800	51,060	76,600	39,810	1337.3	(2) 7.5	1800	1600	(1) 14	71,720	71.75	133.375	119.625	229.375
PHW 12-10O24	50	201,000	51,110	76,650	39,860	1337.3	(2) 7.5	1800	1600	(1) 14	71,770	71.75	133.375	119.625	229.375
PHW 12-10P24	60	213,500	51,390	76,930	40,140	1337.3	(2) 7.5	1800	1600	(1) 14	72,050	71.75	133.375	119.625	229.375
PHW 12-10Q24	75	230,000	51,450	76,990	40,200	1337.3	(2) 7.5	1800	1600	(1) 14	72,110	71.75	133.375	119.625	229.375

NOTE: *The coil connections increase to 6" BFW when the flow rate exceeds 450 gpm. This required option is referred to as the High Flow coil configuration. Connection locations for High Flow configuration may vary slightly from those shown here. Refer to certified drawings for exact piping interface locations.*

1 Model numbers will end in "-Z" for units with Series Flow piping configuration. Series Flow will require crossover piping. Model numbers will include "-C" for units with stainless steel coil(s), "-R" for units with low sound fan(s).
2 Heaviest section is the upper section.
3 Unit dimensions may vary slightly from catalog. See factory certified prints for exact dimensions. Coil connections are 4 inch bevel for weld (BFW). Other connection types such as grooved for mechanical coupling or flanged are also available as options.

Engineering Dimensions & Data: Models PHW 14-5M26 to 14-10R26

MODEL NO.[1]	FANS		WEIGHTS (LBS)			COIL VOL (GAL)	SPRAY PUMP		REMOTE PUMP			DIMENSIONS (IN)[3]			
	HP	CFM	SHIP	OPR	HEAVIEST SECTION[2]		HP	GPM	GAL RQD	CONN SIZE (IN)	OPR WGT	A	F	C	H
PHW 14-5M26	30	209,100	43,070	68,570	30,250	808.8	(2) 7.5	1800	2110	(1) 14	62,360	41.75	151.375	107.625	217.375
PHW 14-5N26	40	229,900	43,190	68,690	30,370	808.8	(2) 7.5	1800	2110	(1) 14	62,480	41.75	151.375	107.625	217.375
PHW 14-5O26	50	247,400	43,240	68,740	30,420	808.8	(2) 7.5	1800	2110	(1) 14	62,530	41.75	151.375	107.625	217.375
PHW 14-5P26	60	262,900	43,520	69,020	30,700	808.8	(2) 7.5	1800	2110	(1) 14	62,810	41.75	151.375	107.625	217.375
PHW 14-5Q26	75	282,800	43,580	69,080	30,760	808.8	(2) 7.5	1800	2110	(1) 14	62,870	41.75	151.375	107.625	217.375
PHW 14-5R26	100	311,300	43,860	69,360	31,040	808.8	(2) 7.5	1800	2110	(1) 14	63,150	41.75	151.375	107.625	217.375
PHW 14-6M26	30	204,900	46,230	73,010	33,410	961.7	(2) 7.5	1800	2110	(1) 14	66,800	50.75	142.375	107.625	217.375
PHW 14-6N26	40	225,300	46,350	73,130	33,530	961.7	(2) 7.5	1800	2110	(1) 14	66,920	50.75	142.375	107.625	217.375
PHW 14-6O26	50	242,500	46,400	73,180	33,580	961.7	(2) 7.5	1800	2110	(1) 14	66,970	50.75	142.375	107.625	217.375
PHW 14-6P26	60	257,600	46,680	73,460	33,860	961.7	(2) 7.5	1800	2110	(1) 14	67,250	50.75	142.375	107.625	217.375
PHW 14-6Q26	75	277,200	46,740	73,520	33,920	961.7	(2) 7.5	1800	2110	(1) 14	67,310	50.75	142.375	107.625	217.375
PHW 14-6R26	100	305,100	47,020	73,800	34,200	961.7	(2) 7.5	1800	2110	(1) 14	67,590	50.75	142.375	107.625	217.375
PHW 14-7M26	30	200,800	49,430	77,490	36,610	1114.6	(2) 7.5	1800	2110	(1) 14	71,280	59.75	133.375	107.625	217.375
PHW 14-7N26	40	220,800	49,550	77,610	36,730	1114.6	(2) 7.5	1800	2110	(1) 14	71,400	59.75	133.375	107.625	217.375
PHW 14-7O26	50	237,700	49,600	77,660	36,780	1114.6	(2) 7.5	1800	2110	(1) 14	71,450	59.75	133.375	107.625	217.375
PHW 14-7P26	60	252,400	49,880	77,940	37,060	1114.6	(2) 7.5	1800	2110	(1) 14	71,730	59.75	133.375	107.625	217.375
PHW 14-7Q26	75	271,700	49,940	78,000	37,120	1114.6	(2) 7.5	1800	2110	(1) 14	71,790	59.75	133.375	107.625	217.375
PHW 14-7R26	100	299,000	50,220	78,280	37,400	1114.6	(2) 7.5	1800	2110	(1) 14	72,070	59.75	133.375	107.625	217.375
PHW 14-8M26	30	199,200	53,020	82,360	40,200	1267.5	(2) 7.5	1800	2110	(1) 14	76,150	68.75	136.375	119.625	229.375
PHW 14-8N26	40	219,000	53,140	82,480	40,320	1267.5	(2) 7.5	1800	2110	(1) 14	76,270	68.75	136.375	119.625	229.375
PHW 14-8O26	50	235,800	53,190	82,530	40,370	1267.5	(2) 7.5	1800	2110	(1) 14	76,320	68.75	136.375	119.625	229.375
PHW 14-8P26	60	250,400	53,470	82,810	40,650	1267.5	(2) 7.5	1800	2110	(1) 14	76,600	68.75	136.375	119.625	229.375
PHW 14-8Q26	75	269,500	53,530	82,870	40,710	1267.5	(2) 7.5	1800	2110	(1) 14	76,660	68.75	136.375	119.625	229.375
PHW 14-8R26	100	296,700	53,810	83,150	40,990	1267.5	(2) 7.5	1800	2110	(1) 14	76,940	68.75	136.375	119.625	229.375
PHW 14-9M26	30	197,600	56,020	86,640	43,200	1420.4	(2) 7.5	1800	2110	(1) 14	80,430	64.25	140.875	119.625	229.375
PHW 14-9N26	40	217,200	56,140	86,760	43,320	1420.4	(2) 7.5	1800	2110	(1) 14	80,550	64.25	140.875	119.625	229.375
PHW 14-9O26	50	233,900	56,190	86,810	43,370	1420.4	(2) 7.5	1800	2110	(1) 14	80,600	64.25	140.875	119.625	229.375
PHW 14-9P26	60	248,400	56,470	87,090	43,650	1420.4	(2) 7.5	1800	2110	(1) 14	80,880	64.25	140.875	119.625	229.375
PHW 14-9Q26	75	267,300	56,530	87,150	43,710	1420.4	(2) 7.5	1800	2110	(1) 14	80,940	64.25	140.875	119.625	229.375
PHW 14-9R26	100	294,300	56,810	87,430	43,990	1420.4	(2) 7.5	1800	2110	(1) 14	81,220	64.25	140.875	119.625	229.375
PHW 14-10M26	30	196,000	59,220	91,120	46,400	1573.3	(2) 7.5	1800	2110	(1) 14	84,910	71.75	133.375	119.625	229.375
PHW 14-10N26	40	215,500	59,340	91,240	46,520	1573.3	(2) 7.5	1800	2110	(1) 14	85,030	71.75	133.375	119.625	229.375
PHW 14-10O26	50	232,000	59,390	91,290	46,570	1573.3	(2) 7.5	1800	2110	(1) 14	85,080	71.75	133.375	119.625	229.375
PHW 14-10P26	60	246,400	59,670	91,570	46,850	1573.3	(2) 7.5	1800	2110	(1) 14	85,360	71.75	133.375	119.625	229.375
PHW 14-10Q26	75	265,200	59,730	91,630	46,910	1573.3	(2) 7.5	1800	2110	(1) 14	85,420	71.75	133.375	119.625	229.375
PHW 14-10R26	100	292,000	60,010	91,910	47,190	1573.3	(2) 7.5	1800	2110	(1) 14	85,700	71.75	133.375	119.625	229.375

NOTE: *The coil connections increase to 6" BFW when the flow rate exceeds 450 gpm. This required option is referred to as the High Flow coil configuration. Connection locations for High Flow configuration may vary slightly from those shown here. Refer to certified drawings for exact piping interface locations.*

1 Model numbers will end in "-Z" for units with Series Flow piping configuration. Series Flow will require crossover piping. Model numbers will include "-C" for units with stainless steel coil(s), "-R" for units with low sound fan(s).
2 Heaviest section is the upper section.
3 Unit dimensions may vary slightly from catalog. See factory certified prints for exact dimensions. Coil connections are 4 inch bevel for weld (BFW). Other connection types such as grooved for mechanical coupling or flanged are also available as options.

Design

EVAPCO equipment is constructed of the highest quality materials and designed to provide years of reliable service when properly installed and maintained. The following sections present items that must be considered prior to the selection and installation of equipment.

Equipment Layout Planning

Proper equipment layout is essential to ensure that the fluid cooler operates at its rated capacity. Since evaporative cooling equipment requires large quantities of fresh air for cooling, it is important that the unit be located where the air supply is fresh and unobstructed.

The unit should also be located so that recirculation of the moist discharge air is minimized. Recirculation, also known as short-cycling, occurs when some of the warm, moist air discharge flows back to the unit's air inlet. The recirculation effect results in higher wet bulbs to the unit, which has a negative impact on the unit's field performance.

Our Equipment Layout Manual presents the layout guidelines for EVAPCO cooling towers, fluid coolers and evaporative condensers. Download it at evapco.com.

The closed circuit cooler should be located away from fresh air intakes, operable windows, kitchen exhaust and prevailing winds directed toward public areas.

Closed Circuit Applications

Closed Circuit Coolers are designed to be used on closed loop systems where the cooling loop is sealed and pressurized. These units are not intended for use in "Open Systems" where the cooling fluid has atmospheric contact.

If applied in open systems, the coil may corrode from the inside with rust deposition throughout the cooling loop.

The cooling fluid must be compatible with the coil material; standard coils are fabricated from black steel with the outer surface hot dip galvanized.

Piping

Supply and return piping for fluid coolers should be designed and installed in accordance with generally accepted engineering practice. The piping layout should be symmetrical for systems with multiple units, and should be sized for a low water velocity and pressure drop.

Since these units are intended for closed loop applications, the loop piping should include an expansion tank to allow for fluid expansion and to purge excess air from the system.

The piping system should include air vents and drain valves at the coil piping so that the coil can be drained if the need arises.

All piping external to the unit should be secured and anchored by properly designed hangers and supports. No external loads should be placed upon the coil connections nor should any pipe supports be anchored to the unit.

Recirculating Water Quality

Proper water treatment is an essential part of the maintenance required for evaporative cooling equipment.

A well-designed and consistently implemented water treatment program will help to ensure efficient system operation while maximizing the equipment's service life.

A qualified water treatment company should design a site specific water treatment protocol based on equipment (including all metallurgies in the cooling system), location, makeup water quality and usage.

Bleed off

Evaporative cooling equipment requires a bleed or blowdown line, located on the discharge side of the recirculating pump, to remove concentrated (cycled up) water from the system. EVAPCO recommends an automated conductivity controller to maximize the water efficiency of your system. Based on recommendations from your water treatment company, the conductivity controller should open and close a motorized ball or solenoid valve to maintain the conductivity of the recirculating water. If a manual valve is used to control the rate of bleed, it should be set to maintain the conductivity of the recirculating water during periods of peak load at the maximum level recommended by your water treatment company.

Water Treatment

The water treatment program prescribed for the given conditions must be compatible with the unit's materials of construction, including any galvanized components. The initial commissioning and passivation period is a critical time for maximizing the service life of galvanized equipment. EVAPCO recommends that your site specific water treatment protocol includes a passivation procedure that details water chemistry, any necessary chemical addition, and visual inspections during the first six (6) to twelve (12) weeks of operation. During this passivation period, recirculating water pH should be maintained above 7.0 and below 8.0 at all times. Batch feeding of chemicals is not recommended.

Control of Biological Contaminants

Evaporative cooling equipment should be inspected regularly to ensure good microbiological control. Inspections should include both monitoring of microbial populations via culturing techniques and visual inspections for evidence of biofouling.

Poor microbiological control can result in loss of heat transfer efficiency, increase corrosion potential, and increase the risk of pathogens such as those that cause Legionnaires' disease. Your site specific water treatment protocol should include procedures for routine operation, startup after a shut-down period, and system lay-up, if applicable.

If excessive microbiological contamination is detected, a more aggressive mechanical cleaning and/or water treatment program should be undertaken.

Heat Exchanger Coil

The simplest and most foolproof method of protecting the heat exchanger coil from freeze-up is to use a glycol solution. If this is not possible, an auxiliary heat load must be maintained on the coil at all times so that the water temperature does not drop below 50°F when the cooler is shut down. Also, a minimum recommended flow rate per unit must be maintained. Refer to Heat Loss Data Table below.

Minimum Flows	Standard Flow GPM	Series Flow GPM
12' Wide Models		
PHW 12x24	700	350
PHW 14x24	820	410

Heat Loss Data (MBH)

PHW Model	Standard Unit
12-5x24	769
12-6x24	821
12-7x24	837
12-8x24	957
12-9x24	1077
12-10x24	1198
14-5x24	905
14-6x24	966
14-7x24	986
14-8x24	1126
14-9x24	1268
14-10x24	1410

Each unit shall be capable to cool _____ GPM of water entering at _____° F leaving at _____° F at a design wet bulb of _____° F with a pressure drop across the coil not to exceed _____ psi.

IBC Compliance

The closed circuit cooler shall be designed and constructed to meet the International Building Code (IBC) specifications for installed components per ASCE.

Basin and Casing

The basin and casing shall be constructed of G-235 hot-dip galvanized steel for long life and durability. Standard basin accessories shall include overflow, drain, type 304 stainless steel strainers, and brass makeup valve with plastic float.

Fan Motor

_____ horsepower totally enclosed air over ball bearing fan motor(s), with 1.15 service factor shall be furnished suitable for service on _____ volts, _____ hertz, and _____ phase.

Drive

The fan drive shall be a multi-groove, solid back V-belt type with taper lock bushings designed for 150% of the motor nameplate horsepower. The belt material shall be neoprene reinforced with polyester cord and specifically designed for evaporative closed circuit cooler service. Fan and motor sheaves shall be aluminum alloy construction. The fans and fan sheaves shall be mounted on the shaft with a specially coated bushing to provide maximum corrosion protection. Belt adjustment shall be accomplished from the interior of the unit.

Axial Propeller Fans

Fans shall be heavy duty axial propeller type statically balanced. The fans shall be constructed of aluminum alloy blades, installed in a closely fitted cowl with venturi air inlet. Fan screens shall be galvanized steel mesh and frame, bolted to the fan cowl.

Fan Shaft Bearings

Fan shaft bearings shall be heavy duty self-aligning ball type with grease fittings extended to the outside of the unit. Bearings shall be designed for a minimum L_{10} life of 100,000 hours.

Water Recirculation Pump

The pump(s) shall be a close-coupled, centrifugal type with mechanical seal, installed at the factory. _____ horsepower totally enclosed motor(s) shall be furnished suitable for outdoor service on _____ volts, _____ hertz, and _____ phase.

Water Distribution System

Spray nozzles shall be zero-maintenance precision molded ABS with large 1-1/4" diameter orifice threaded into branch piping with internal sludge ring to eliminate clogging. Spray header, branches, and riser shall be Schedule 40 Polyvinyl Chloride (PVC) for corrosion resistance.

Heat Transfer Coil & Drift Eliminators

Cooling coil(s) shall be all prime surface steel, encased in a steel framework and hot-dip galvanized after fabrication as a complete assembly. The coil(s) shall be designed with sloping tubes for free drainage. Coils shall have a design pressure of 300 psig and shall be in compliance with ANSI/ASME B31.5 Refrigerant Piping and Heat Transfer Components. The coil shall be strength tested in accordance with ANSI/ASME B31.5 and subsequently leak tested using air under water.

The eliminators shall be constructed entirely of inert polyvinyl chloride (PVC) in easily handled sections. The eliminator design shall incorporate three changes in air direction to assure complete removal of all entrained moisture from the discharge air stream. Maximum drift rate shall be less than 0.002% of the circulating water rate.

Heat Transfer Fill

The closed circuit cooler shall be designed with a bank of heat transfer fill constructed of polyvinyl chloride (PVC) that is impervious to rot or decay. The fill sheets shall be bonded together and supported from the base to provide greater structural integrity. The support channels shall be designed to provide for easy cleaning below the fill bundles.

The fill bundle shall form an integral inlet louver to prevent debris from entering the heat transfer surface and a drift eliminator to remove water droplets from the air discharging the side of the fill.

Finish

All basin and casing materials shall be constructed of G-235 heavy gauge mill hot-dip galvanized steel. During fabrication, all panel edges shall be coated with a 95% pure zinc-rich compound for superior protection against corrosion.

SECTION 23 65 00 – FACTORY-FABRICATED COOLING TOWERS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

1.2 SUMMARY:
- A. This Section includes factory assembled and tested, closed circuit, parallel hybrid cooling tower (also known as a closed circuit cooler).

1.3 SUBMITTALS
- A. General. Submit the following:
  1. Certified drawings of the closed circuit cooler, sound data, recommended steel support indicating weight loadings, wiring diagrams, installation instructions, operation and maintenance instructions, and thermal performance guarantee by the manufacturer.

1.4 QUALITY ASSURANCE
- A. Verification of Performance:
  1. Test and certify closed circuit cooler thermal performance according to CTI Standard 201.
  2. Test and certify closed circuit cooler sound performance according to CTI ATC-128.
- B. Meet or Exceed energy efficiency per ASHRAE 90.1.

1.5 WARRANTY
- A. Motor/Drive System: Five (5) year comprehensive warranty against materials and workmanship including motor, fan, bearings, mechanical support, sheaves, bushings and belt.
- B. Unit: One (1) year from start-up, not to exceed eighteen (18) months from shipment on the unit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
- A. Manufacturers: Subject to compliance with requirements, provide closed circuit coolers manufactured by one of the following:
  1. EVAPCO, Inc.
  2. Approved Substitute

2.2 MATERIALS
- A. Galvanized Sheet Steel complying with ASTM A 653/A 653M and having G-235 designation.
- B. Optional Type 304 and/or 316 Stainless Steel as specified.

2.3 INDUCED-DRAFT, Parallel Hybrid CLOSED CIRCUIT COOLERS
- A. Description: Factory assembled and tested, induced draft parallel hybrid closed circuit cooler complete with crossflow fill, drift eliminators, fan, accessories, and rigging supports.
- B. Closed Circuit Cooler Characteristics and Capacities: Refer to the closed circuit cooler schedule.
- C. Fan(s):
  1. Type and Material: Axial propeller, individually adjustable wide chord blade extruded aluminum installed in a closely fitted cowl with venturi air inlet for maximum efficiency, covered with a heavy gauge hot dipped Galvanized Steel fan guard.
  2. Maximum sound pressure level of _____dB(A) measured at 5 feet above the fan discharge during full speed operation in accordance with CTI Standard ATC-128.
- D. Water Distribution System: Non-corrosive materials.
  1. Even distribution of water over fill material with pressurized spray tree.
     a. Pipes: Schedule 40 PVC, Non-corrosive Materials
     b. Nozzles: Non-clogging, nylon, threaded into branch piping.
  2. Maximum pressure at inlet shall be ____ psig.
- E. IBC Compliance: The unit structure shall be designed, analyzed, and constructed in accordance with the latest edition of the International Building Code (IBC) Regulations for seismic loads up to _____ g and wind loads up to __ psf.
- F. Collection Basin Material: Galvanized Steel. Type 304 or 316 Stainless Steel Optional:
  1. Removable stainless-steel strainer with openings smaller than nozzle orifices.
  2. Joints: Bolted and sealed watertight or welded.
  3. Overflow, makeup and side drain connections
  4. Flume plate between cells (for multiple-cell units) or Equalizer connection (for multiple- closed circuit cooler system).
- G. Heat Transfer Media:
  1. Coil: Heavy Gauge G-235 Galvanized Steel encased in a steel framework, assembly hot-dip galvanized after construction. Type 304 or 316 Stainless Steel Optional. Coil assembly completely enclosed and protected from sunlight exposure, environmental elements and debris. Tubes sloped for free drainage of the coil and designed for low pressure drop. The coil shall have design pressure of 300 psi and shall be in compliance with ANSI/ASME B31.5, Refrigeration Piping and Heat Transfer Components. The coil assembly shall be strength tested in accordance with ANSI/ASME B31.5 and subsequently leak tested using air under water. Coil connections beveled for weld, flanged (optional) or grooved (optional).
  2. Fill media and integral drift eliminators shall be constructed of Polyvinyl Chloride (PVC) and suitable for inlet water temperatures up to 120°F. The bonded block fill and integral drift eliminators shall be bottom supported to prevent sag and allow for at least a 3" space between the bottom of the fill and the pan bottom to facilitate cleaning. Fill and integral drift eliminators shall be self-extinguishing, have a flame spread of less than 25 under ASTM E84, and shall be resistant to rot, decay and biological attack.
- H. Casing: Galvanized Steel. Type 304 or 316 Stainless Steel Optional:
  1. Casing panels shall totally encase the heat transfer coil.
  2. Fasteners: Corrosion resistance equal to or better than materials being fastened.
  3. Joints: Sealed watertight.
  4. Welded Connections: Continuous and watertight
- I. Drift Eliminators: PVC, for long life and durability resistant to rot, decay and biological attack; formed, bonded together for strength and durability in block format for easy removal and replacement; self extinguishing with flame spread rating of 5 per ASTM E84-81a; 0.002% drift rate.
- J. Water Level Control: Brass mechanical makeup water valve and plastic float with an adjustable linkage.
- K. Water Recirculation Pump: Close-coupled, centrifugal type with mechanical seal. The pump motor shall be ____ horsepower totally enclosed for outdoor service on ____ volts, ____ hertz, and ____ phase.

2.4 MOTORS AND DRIVES
- A. General requirements for motors are specified in Division 15 Section "Motors".
- B. Enclosure Type: TEAO.
- C. Motor Speed: Premium Efficient VFD Duty (Option: 2-speed)
- D. Drive: Power-Band Belt designed for 150% of the motor nameplate HP.
  1. Belt: Multi-groove, solid back V-belt type neoprene reinforced with polyester cord.
  2. Sheaves: Aluminum alloy if located inside the airstream.
  3. Bearings: Heavy duty, self-aligning pillow block bearings with lubrication lines extended to side access door. Minimum L-10 life for bearings shall be 100,000 hours. Provide extended grease lines and fittings.
  4. Vibration Cutout Switch: (optional) Mechanical switch to de-energize fan motors if excessive vibration in NEMA 4 enclosure.

2.5 MAINTENANCE ACCESS
- A. Internal Walkway
  1. An internal walkway shall be provided at the level of the basin door to provide access to the interior of the unit for routine maintenance. The walkway extends the length of the basin for easier travel through multiple units.

WORLDWIDE MANUFACTURING LOCATIONS

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