# **EVAPORATIVE CONDENSERS**

# **PMRC**

# PERFORMANCE MAINTENANCE RELIABILITY CONDENSER



Available with optional
304L or 316L Stainless Steel

Capacities from 124 to 1,516 ammonia tons!













# PMRC Design and Construction Features







# Get to Know EVAPCO

Since its founding in 1976, EVAPCO, Incorporated has become an industry leader in the engineering and manufacturing of quality heat transfer products around the world. EVAPCO's mission is to provide first class service and quality products for the following markets:

- Industrial Refrigeration
- Commercial HVAC
- Industrial Process
- Power

# Learn More Now

Visit evapcoasia.com to download product catalogs, view complete product specifications, and more.



# PVC Water Distribution with ZM®II Nozzles

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

# Thermal-Pak II® Heat Transfer Technology

- More surface area per plan area than competitive designs.
- Improved heat transfer efficiency due to tube geometry and orientation of tubes.
- Lower refrigerant charge.
- Optional 304L or 316L TITAN stainless steel coil technology.

# Improved Water Distribution Piping

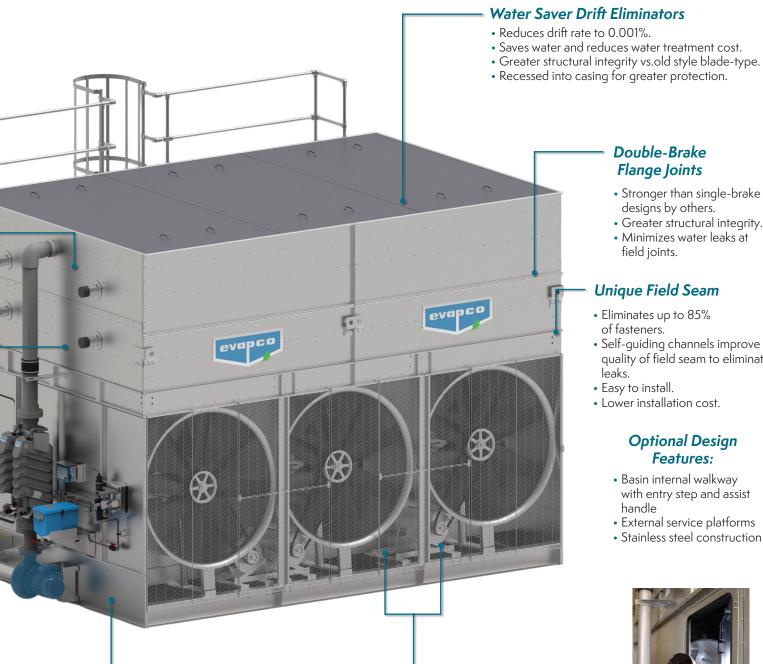
- Horizontally mounted pumps allow for reduced basin water level.\*
- Simplified piping for easier basin access.
- Totally enclosed pump motors assure long, trouble-free life.

\*Refer to engineering data for availability.



### Optional Super Low Sound Fan

- Extremely wide chord fan blades for sound sensitive applications.
- One piece molded heavy duty construction.
- 10-13 dB(A) sound reduction on fan side at 50 ft (15m).



# Sloped-Pan Bottom

- Pan bottom slopes to drain.
- Easy to clean.
- Stainless steel strainer resists corrosion.

# **Individual Fan Drive System**

- Increased flexibility for improved capacity control.
- Greater reliability through redundancy.
- Easy motor replacement.
- Front-mounted drives for improved maintenance accessibility.

### Double-Brake Flange Joints

- Stronger than single-brake designs by others.
- Greater structural integrity.
- Minimizes water leaks at field joints.

### **Unique Field Seam**

- Eliminates up to 85% of fasteners.
- Self-guiding channels improve quality of field seam to eliminate leaks.
- Easy to install.
- Lower installation cost.

#### **Optional Design** Features:

- Basin internal walkway with entry step and assist handle
- External service platforms
- Stainless steel construction



Man-sized Access Door

# **PMRC Design Features**

### Proven Performance & Design Flexibility

The PMRC Evaporative Condenser offers more capacity and greater system design flexibility than ever before. EVAPCO's research and development team has invested hundreds of hours in laboratory testing to develop the next generation in forced draft condenser technology. These efforts have produced an efficient fan section design combined with the proven Thermal-Pak II® coil technology to offer improved condenser performance.

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



### Thermal-Pak II® Coil Design

#### Lower Refrigerant Charge

Only EVAPCO condensers offer the unique Thermal-Pak II® Coil which assures greater operating efficiency. Its unique elliptical tube design allows for closer tube spacing resulting in more surface area per plan area than traditional round tube designs. The Thermal-Pak II® Coil design has a lower resistance to air flow and permits greater water loading, making the Thermal-Pak II® Coil the most efficient design available to yield a low refrigerant charge.



Thermal-Pak II® Coil by EVAPCO

Round Tube Coil by Others

# **Energy Efficient for Lowest Operating Cost**

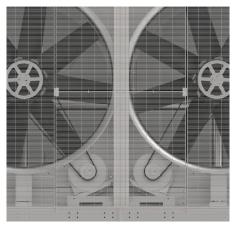
#### **Lower Horsepower Options**

The fan drive system of the PMRC utilizes large diameter vane-axial fans in a single-stage arrangement to provide more efficient air flow and reduced power consumption. When compared to the traditional centrifugal fan condenser models, the vane-axial fan design can offer up to a 50% reduction in energy consumption. And, with the new PMRC model selections **even more low** horsepower options are available to obtain greater energy savings.

# **Individual Fan Drive System**

#### Capacity Control Flexibility & Operating Redundancy

The PMRC fan drive system provides individual motor-to-fan configuration as standard equipment on all models. The dedicated fan-to-motor arrangement ensures less "wear and tear" on the drive system versus tandem fan motor drive arrangements resulting in less maintenance. The individual motor-to-fan design offers greater capacity control flexibility to match the system load requirements. In addition, all EVAPCO condensers are equipped with an internal baffle system, which extends from the pan bottom vertically through the coil bundle. This unique design allows the user to cycle fan motors independently without harmful effects of air bypass inside the unit. The individual motor-to-fan design ensures maximum operating redundancy in the condenser fan system when critical operation is necessary.



# Inverter Duty Motors as STANDARD

Inverter Duty motors are standard on PMRC Condensers. Inverter Duty motors are totally enclosed, offering high efficiency and inverter capable (VFD by others).

**NOTE:** Variable Frequency Drive (VFD) control may require other component modification such as motor shaft grounding brushes, AC load reactors, low pass filters and tuned trap filters to ensure proper motor performance and service life.

# **PMRC Design Features**

# **Easy Field Assembly**

#### Fewer Fasteners Lower Installed Cost

The PMRC features a field seam design which ensures easier assembly and fewer field seam leaks. The field seam incorporates self-guiding channels to guide the coil casing section into position and set in place on the bottom fan section of the condenser. In addition, the design eliminates up to 85% of the required fasteners typically used to join the condenser sections in the field significantly reducing the contractor labor costs for installation.



# **Improved Maintenance**

#### Fan Drive Accessibility

The drive components of the PMRC are easily accessed for routine maintenance from the front of the unit. Bearing grease fittings are extended to the outside of the unit for ease of lubrication. All drive sheaves have been relocated to the front of the fan section and motors are positioned on a platform base to allow for easy belt tension adjustment.

#### **Optional Basin Access Package**

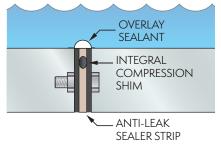
An external basin access step and grab bar is provided at each exterior access door for easier basin access. Also, an internal walkway is provided at the level of the basin door to provide access to the interior of the unit for routine maintenance. The walk extends the length of the basin for easier travel through the unit.



#### **Construction Features**

#### Unique Seam Design—Eliminate Field Leaks

The PMRC features EVAPCO's unique panel construction design which includes a special butyl tape sealer with an integral sealing gasket. Each joint is then backed with a secondary caulking compound and encased in a double-brake flange for added strength and structural integrity. This unique sealing system has been proven effective in both laboratory tests and years of field application.



#### **Superior Water Saver Drift Eliminators**

The PMRC condensers incorporate a highly efficient PVC drift eliminator. The eliminator removes entrained water droplets from the air stream to limit the drift rate to less than 0.001% of the recirculating water rate. With a low drift rate, PMRC condensers save valuable water and water treatment chemicals. The eliminators feature a honeycomb design which offers greater structural integrity and are recessed in the top of the casing and UV protected for longer life. They are constructed of inert polyvinyl chloride (PVC) which eliminates corrosion in this critical area of the condenser. The eliminators are assembled in sections for easy handling and removal for coil and water distribution system inspection.



### **PMRC Selection Procedure**

#### **Selection Procedure**

Two methods of selection are presented, the first is based on the total heat of rejection as described immediately below. The second, and simpler, method is based on evaporator tons. The evaporator ton method is only applicable to systems with open type reciprocating compressors.

The heat of rejection method 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 compressors as an alternate to the evaporator ton method.

The evaporator ton method is based on the estimated heat of compression. The heat of rejection method of selection is more accurate and should be used whenever possible.

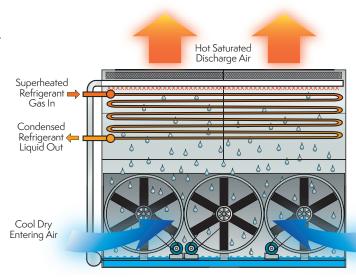
Refer to the factory for selections on systems with centrifugal compressors.

### **Principle of Operation**

The refrigerant gas is discharged from the compressor into the inlet connection of the evaporative condenser. Water from the condenser's sump is continuously flooded over the condenser coil, while ambient air is simultaneously forced into the unit. As the ambient air moves up through the coil section, a portion of the spray water is evaporated into the air stream.

The evaporative process cools the spray water, which in turn cools the tubes containing the refrigerant gas. The cool tube walls cause the refrigerant gas to give up heat and condenseinto a liquid. The condensed liquid flows out of the coil's sloping tubes to the high pressure liquid receiver for return to the system.

The hot, saturated air is driven through the drift eliminators, where any entrained water droplets are removed. The condenser's fan then discharges this air stream out of the top of the unit at a high velocity,



where it can dissipate harmlessly into the atmosphere. The water which was not evaporated falls into the sump and is recirculated by the spray pump to the water distribution system above the condensing coil section.

# Heat of Rejection Method

In the heat of rejection method, a factor for the specified operating conditions (condensing temperature and wet bulb) is obtained from **Table 1** or **2** and multiplied times the heat of rejection.

The resultant figure is used to select a unit from Table 3 on page 8. Unit capacities are given in Table 3 in kW.

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

Open Compressors: Heat of Rejection (kW) = Evaporator Load (kW) + Compressor BHP (kW)

Hermetic Compressors: Heat of Rejection (kW) = Evaporator Load (kW) + kW Compressor Input (kW)

# **Optional Equipment**

#### Smart Shield® Solid Chemistry Water Treatment System

EVAPCO's Smart Shield® solid chemistry water treatment system is an innovative solution to conventional liquid chemical programs. Smart Shield® was developed specifically for evaporative condensers and closed circuit coolers. The system



comes factory mounted and includes all the components required for an effective water treatment system. Solid products eliminate the potential for liquid spills making it easier and safer to use. Controlled release chemistry provides uniform treatment over a 30-day period.

#### **Self-Supporting Service Platforms**

Condensers 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 may be installed on either side, or the end opposite the connections.

#### Remote Sump Configuration

For units operating in areas where temperatures may be very low, or where low temperatures may occur during periods when the unit is not operating, a sump located inside the building is the preferred means of ensuring that the basin water will not freeze. For these applications, the condenser will be supplied without the spray pump, suction strainers and all associated piping, but with an oversize bottom outlet.

#### **Electric Water Level Control**

Evaporative condensers may be ordered with an electric water level control in lieu of the standard mechanical float and makeup assembly. This package provides accurate control of water levels and does not require field adjustment.



#### Water Level Indicator

Condensers may be supplied with a water level indicator to provide a visual indication of basin water level without opening access doors or air inlet louvers. The level indicator can be furnished with an optional low and high level alarm switches or a transmitter for continuous level monitoring.

#### **Super Low Sound Fan**

EVAPCO's Super Low Sound Fan utilizes an extremely wide chord blade design and is ideal for low energy, sound-sensitive installations without sacrificing thermal performance. This revolutionary technology is one-piece molded, heavy-duty fiberglass reinforced polyester hub and blade construction utilizing a forward swept blade design. The Super Low Sound



Super Low Sound Fan

Fan is capable of reducing the unit sound pressure levels 10 dB(A) to 13 dB(A) depending on specific unit selection and measurement location.

#### **ASME Coils**

Evaporative condensers can be furnished with condensing coils manufactured in accordance with the ASME Pressure Vessel Code Section VIII, Division I. Coils built with this option will bear a ASME stamp U designator indicating their compliance with the ASME code.

#### TITAN Coils — Stainless Steel Construction

EVAPCO offers the option of Type 304L or Type 316L stainless steel construction using the Thermal-Pak II® coil design. These highly efficient heat transfer coils offer the ultimate corrosion protection.



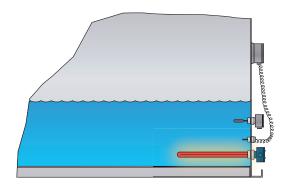
#### **Multiple Circuit Coils**

Condensers may be supplied with multiple circuit coils to match various system requirements such as split systems, or if a glycol or water circuit is desired for compressor head cooling.

# **Electric Heaters/Steel Support**

### **Electric Heaters**

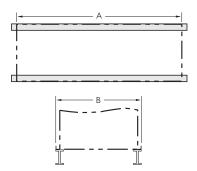
Electric immersion heaters are available factory installed in the basin of the condenser. They are sized to maintain a 40°F (+4°C to +5°C) pan water temperature with the fans off and an ambient air temperature of 0°F (-18°C), -20°F (-29°C), or -40°F (-40°C). They are furnished with a combination thermostat/low water protection device to cycle the heater on when required and to prevent the heater elements from energizing unless they are completely submerged. All components are in weather proof enclosures for outdoor use. The heater power contactors and electric wiring are not included as standard.



PMRC Heater Sizes			
Models	-18°C	-29°C	-40°C
PMC-175E to PMC-240E	5	7	9
PMC-250E to PMC-375E	(2) 4	(2) 5	(2) 7
PMRC-332 to PMRC-530	8	12	16
PMRC-503 to PMRC-792	(2) 6	(2) 9	(2) 12
PMRC-725 to PMRC-1056	(2) 8	(2) 12	(2) 15
PMRC-1006 to PMRC-1586	(2) 12	(4) 9	(4) 12
PMRC-376 to PMRC-678	10	15	20
PMRC-568 to PMRC-1012	(2) 7	(2) 12	(2) 15
PMRC-715 to PMRC-1074	(2) 8	(2) 12	(2) 15
PMRC-816 to PMRC-1362	(2) 9	(2) 15	(2) 18
PMRC-1137 to PMRC-2024	(2) 15	(4) 10	(4) 15
PMRC-1705 to PMRC-2138	(2) 15	(4) 12	(4) 15

# Steel Support

The recommended support for EVAPCO condensers is structural I-beams located under the outer flanges and running the entire length of the unit. Mounting holes, 3/4" (19mm) 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' (1.5mm in 1m) 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.



PMRC Dimensions			
1.9m Wide Models	A (mm)	B (mm)	
PMC-175E to 240E	3648	1930	
PMC-250E to 375E	5490	1930	
3m Wide Models	A (mm)	B (mm)	
PMRC-332 to PMRC-530	3651	2991	
PMRC-503 to PMRC-792	5490	2991	
PMRC-725 to PMRC-1056	7337	2991	
PMRC-1006 to PMRC-1586	11024	2991	
3.6m Wide Models	A (mm)	B (mm)	
PMRC-376 to PMRC-678	3651	3616	
PMRC-568 to PMRC-1012	5490	3616	
PMRC-715 to PMRC-1074	6102	3616	
PMRC-816 to PMRC-1362	7337	3616	
PMRC-1137 to PMRC-2024	11024	3616	
PMRC-1705 to PMRC-2138	12243	3616	

# **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 ensure 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 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 the 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. Good engineering practice dictates that the evaporative condenser's discharge air not be directed or located close to or in the vicinity of building air intakes. Engineering assistance is available from the factory to identify potential recirculation problems and recommend solutions.

For additional information regarding layout of evaporative condensers, see the EVAPCO bulletin entitled *Equipment Layout Manual*.

#### **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 the EVAPCO bulletin entitled *Piping Evaporative Condensers*.

#### Super Low Sound Fan

EVAPCO's Super Low Sound Fan on the PMRC condenser utilizes an extremely wide chord blade design available for sound sensitive applications where the lowest sound levels are desired. The fan is one pieces molded heavy duty FRP construction utilizing a forward swept blade design. The Super Low Sound Fan reduces sound levels 10 to 13 dB(A) compared to the standard PMRC fan. For a detailed analysis, please contact your local EVAPCO sales representative.

#### Maintaining the Recirculated Water System

The heat rejection 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. These impurities and contaminants, which continue to recirculate in the system, must be controlled in order to avoid excessive concentration that can lead to corrosion, scale, and/or biological fouling.

#### Bleed or Blowdown

Each unit supplied with a pump mounted on the side is furnished with a clear bleed or blowdown line for visual inspection and a valve which, when fully open, will bleed off the proper amount of concentrated (cycled up) water from the system. If the makeup 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. Makeup water pressure should be maintained between 20 and 50psig (140~340kPa).

#### **Water Treatment**

In some cases the makeup will be so high in mineral content that a normal bleed or blowdown 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 compatible with the 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 8.0. Units constructed of galvanized steel operating with circulating water having a pH of 8.3 or higher will require periodic passivation of the galvanized steel to prevent the formation of "white rust".

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. For more information see the EVAPCO bulletin entitled Operation and Maintenance Instructions.

### 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.

# **Mechanical Specifications**

Furnish and instal	l, as shown on the plans	, an EVAPCO
model	evaporative cond	enser. Each unit
shall have conde	nsing capacity of	kW
heat rejection, op	perating with	refrigerant at
°C conde	nsing temperature and _	°C design
wet bulb tempera	ature.	

#### **IBC** Compliance

The condenser shall be designed and constructed to meet the International Building Code specifications for installed components per ASCE 7-05. The manufacturer shall provide a certificate of compliance to demonstrate that the equipment/unit has been independently tested and certified in accordance with the IBC program.

#### Pan and Casing

The pan and casing shall be constructed of G-235 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 maintenaince. The pan bottom shall be sloped to the drain to ensure easy draining and to facilitate cleaning. Standard pan accessories shall include circular access doors, stainless steel strainers, wastewater bleed line with adjustable valve and brass makeup valve, with an unsinkable foam filled plastic float.

#### **PMRC Fan Drives**

Fans shall be vane-axial type constructed of glass-reinforced polypropylene blades. They shall be arranged in a single-stage system installed in a closely fitted cowl with a venturi air inlet. Fan shaft bearings shall be a 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 designed for 150% of motor nameplate horsepower. Drives are to be mounted and aligned at the factory.

Each fan shall be driven individually by a dedicated fan motor. Fan motors may be cycled independently without harmful moist air bypass.

#### Fan Motor

kW totally enclosed	d fan cooled motor	·(s) shall be
furnished suitable for outdoor	service on	volts,
hertz, and	phase. Motor(s)	shall be
mounted on an adjustable bas	se.	

#### **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 2.69MPa air pressure under water.

#### **Water Distribution System**

The system shall provide a water flow rate of 4l/s over each square meter (6GPM over each square foot) of the unit face area to ensure 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 plug for cleaning. The water shall be distributed over the entire coil surface by heavy-duty ABS spray nozzles with large 1-1/4" (32mm) diameter opening and internal sludge ring to eliminate clogging. Nozzles shall be threaded into a spray header to provide easy removal for maintenance.

#### **Water Recirculation Pump**

The pump(s) shall be	a close-coupled, cen	itrifugal type with
mechanical seal, inst	alled at the factory	kW
totally enclosed, mo	tor shall be furnished s	suitable for
outdoor service on _	volts, _	hertz,
and	phase.	

#### **Eliminators**

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 0.001% of the circulating water rate.

#### **Finish**

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

#### **Oversized Access Door**

For enhanced basin accessibility, the oversized access door enables maintenance personnel to quickly and easily enter the basin for float valve adjustment and unit inspection.



#### Optioanl Basin Access Package (Internal Walkway, Basin Access Step, and Basin Entry Assist Handle)

An external basin access step and grab bar is provided at each exterior access door for easier basin access. Also, an internal walkway is provided at the level of the basin door to provide access to the interior of the unit for routine maintenance. The walk extends the length of the basin for easier travel through the unit

# Notes



#### **North America**



# EVAPCO, Inc. World Headquarters

Westminster, MD USA 410.756.2600 marketing@evapco.com



**EVAPCO East**Taneytown, MD USA



EVAPCO East Key Building Taneytown, MD USA



EVAPCO Midwest

Greenup, IL USA 217.923.3431 evapcomw@evapcomw.com



**Evapcold Manufacturing** Greenup, IL USA



EVAPCO West

Madera, CA USA 559.673.2207 contact@evapcowest.com

EVAPCO Alcoil, Inc.



York, PA USA 717.347.7500 info@evapco-alcoil.com



EVAPCO Iowa

Lake View, IA USA

EVAPCO Iowa

Sales & Engineering Medford, MN USA 507.446.8005 evapcomn@evapcomn.com



#### EVAPCO LMP ULC

Laval, Quebec, Canada 450.629.9864 info@evapcolmp.ca



# **EVAPCO Select Technologies, Inc.** Belmont, MI USA

844.785.9506 emarketing@evapcoselect.com



Refrigeration Vessels & Systems Corporation Bryan, TX USA

979.778.0095 rvs@rvscorp.com



#### Tower Components, Inc.

Ramseur, NC USA 336.824.2102 mail@towercomponentsinc.com



#### EvapTech, Inc.

Edwardsville, KS USA 913.322.5165 marketing@evaptech.com

#### EVAPCO Dry Cooling, Inc.

Bridgewater, NJ USA 908.379.2665 info@evapcodc.com

#### EVAPCO Dry Cooling, Inc.

Littleton, CO USA 908.895.3236 info@evapcodc.com

#### EVAPCO Power México S. de R.L. de C.V.

Mexico City, Mexico (52) 55.8421.9260 info@evapcodc.com

#### **Asia Pacific**

# EVAPCO Asia Pacific Headquarters

Baoshan Industrial Zone Shanghai, P.R. China (86) 21.6687.7786 marketing@evapcochina.com



# EVAPCO (Shanghai)

Refrigeration Equipment Co., Ltd.
Baoshan Industrial Zone, Shanghai, P.R. China



# EVAPCO (Beijing) Refrigeration Equipment Co., Ltd.

Huairou District, Beijing, P.R. China (86) 10.6166.7238 marketing@evapcochina.com



#### EVAPCO Air Cooling Systems (Jiaxing) Company, Ltd.

Jiaxing, Zhejiang,P.R. China (86) 573.8311.9379 info@evapcochina.com



#### EVAPCO Australia (Pty.) Ltd.

Riverstone, NSW, Australia (61) 02.9627.3322 sales@evapco.com.au

# EvapTech (Shanghai)

Cooling Tower Co., Ltd Baoshan District, Shanghai, P.R. China. Tel: (86) 21.6478.0265

# **EvapTech Asia Pacific Sdn. Bhd.** Puchong, Selangor, Malaysia

(60) 3.8070.7255 marketing-ap@evaptech.com

#### Europe | Middle East | Africa

#### EVAPCO Europe EMENA Headquarters

Tongeren, Belgium (32) 12.39.50.29 evapco.europe@evapco.be



#### EVAPCO Europe BV

Tongeren, Belgium



#### EVAPCO Europe, S.r.l.

Milan, Italy (39) 02.939.9041 evapcoeurope@evapco.it



# **EVAPCO Europe, S.r.l.** Sondrio, Italy

EVAPCO Europe A/S Aabybro, Denmark (45) 9824.4999 info@evapco.dk

#### **EVAPCO Europe GmbH**

Meerbusch, Germany (49) 2159.69560 info@evapco.de

#### EVAPCO Middle East DMCC

Dubai, United Arab Emirates (971) 56.991.6584 info@evapco.ae



#### Evap Egypt Engineering Industries Co.

A licensed manufacturer of EVAPCO, Inc. Nasr City, Cairo, Egypt [20] 10.054.32.198 evapco@tiba-group.com



#### EVAPCO S.A. (Pty.) Ltd.

A licensed manufacturer of EVAPCO, Inc. Isando, South Africa (27) 11.392.6630 evapco@evapco.co.za

#### **South America**



#### **EVAPCO** Brasil

Equipamentos Industriais Ltda Indaiatuba, São Paulo, Brazil (55) 11.5681.2000 vendas@evapco.com.br



#### FanTR Technology Resources

Itu, São Paulo, Brazil (55) 11.4025.1670 fantr@fantr.com

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