

# Operation and Maintenance Instructions

For EVAPCO Air Cooled, Adiabatic and Spray Fluid Coolers and Condensers



**IARW** International Association of Refrigerated Warehouses

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**iiar**  
International Institute of Ammonia Refrigeration  
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**AHRI** Air-Conditioning, Heating, and Refrigeration Institute

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## Introduction

Congratulations on the purchase of your EVAPCO air cooled unit. EVAPCO equipment is constructed of the highest quality materials and designed to provide years of reliable service when properly maintained.

Thoroughly clean road salt, dirt and debris from unit immediately after delivery. Residue left on product surfaces can cause damage that is not covered by any warranty. All new cooling equipment and associated piping should be pre-cleaned and flushed to remove grease, oil, dirt, debris and other suspended solids prior to operation. Any pre-cleaning chemistry should be compatible with the cooling equipment's materials of construction. Alkaline formulations should be avoided for systems which include galvanized materials of construction.

Closed hydronic systems connected to a dry fluid cooler should be pre-cleaned and flushed to remove debris, grease, flash rust, oil, and other suspended solids prior to operation. EVAPCO recommends the use of inhibitor chemistry or inhibited glycol to minimize corrosion and scale during normal operation.

Air cooled equipment is often remotely located and periodic maintenance checks are often overlooked. It is important to establish a regular maintenance program and be sure that the program is followed. This bulletin should be used as a guide to establish a program. A clean and properly serviced unit will provide a long service life and operate at peak efficiency.

This bulletin includes recommended maintenance and maintenance intervals for unit start up, unit operation and unit shutdown. Please note: the maintenance intervals are minimums. Maintenance should be performed more often when operating conditions necessitate.

Become familiar with your air cooled equipment. Refer to the isometric drawings located on pages 21-23 for information on the arrangement of components in your equipment.

If you should require any additional information about the installation, operation or maintenance of this equipment, contact your local EVAPCO representative. You may also visit [www.evapco.com](http://www.evapco.com) or [www.mrgoodtower.com](http://www.mrgoodtower.com) for more information.

## Safety Precautions

Qualified personnel should use proper care, procedures and tools when operating, maintaining or repairing this equipment in order to prevent personal injury and/or property damage. The warnings listed below are to be used as guidelines only.



**Never operate this equipment without fan screens and access panels properly secured and in place.**



**Each coil in this unit ships from the factory with a nitrogen charge on the coils. Verify that the nitrogen charge is still applied before installing unit. Release pressure in each coil before installing heat transfer fluid piping.**



**An optional factory provided disconnect switch may be located on the unit for each fan motor associated with this equipment. Before performing any type of service or inspection of the unit make certain that all power has been disconnected and locked in the "OFF" position.**



**The top horizontal surface of any unit is not intended to be used as a working platform. No routine service work is required from this area.**



**Closed hydronic systems connected to either a closed-circuit cooler or dry cooler should be pre-cleaned and flushed to remove debris, grease, flash rust, oil, and other suspended solids prior to operation. EVAPCO recommends the use of inhibitor chemistry or inhibited glycol to minimize corrosion and scale during normal operation**



**EVAPCO requires that all external piping and fittings be externally supported, the supplied connections are not designed to support external piping or fitting weights. Additional weight to the connections or coil in any way could cause damage to the unit not covered under warranty.**

## Terminology

Throughout this manual, the terms “Flat” and “V Coil” are used. Below is a list of EVAPCO eco-Air Dry Fluid Cooler and Air Cooled Condenser product offerings and associated terminology.

eco-Air Series equipment includes the following product models:

### ■ Flat Air Cooled

- EAFWD - Dry Fluid Cooler
- EAFCD - Air Cooled Condenser

### ■ V Coil Air Cooled

- EAVWD - Dry Fluid Cooler
- EAVCD - Air Cooled Condenser

### ■ V Coil Adiabatic

- EAVWA - Adiabatic Fluid Cooler
- EAVCA - Adiabatic Air Cooled Condenser

### ■ V Coil Spray

- EAVWS - Spray Fluid Cooler
- EAVCS - Spray Air Cooled Condenser

## Receiving

Carefully inspect all units upon arrival to assure that no damage has occurred during shipment. This includes searching for dirt and debris caused by shipping, as well as inspecting all components and accessories for physical damage. If any units have been damaged during transit, immediately notify the carrier and file a claim with that carrier.

The coils on all EVAPCO eco-Air series coolers and condensers are shipped from the factory with a low-pressure nitrogen charge. Maintain the nitrogen charge until connecting the unit to the system piping.

To confirm this nitrogen charge, quickly open then close the valve located on the coil header and listen or feel for escaping nitrogen. A coil without the factory nitrogen charge may be an indication of damage during shipment. In this case, the coil should be pressure tested with dry nitrogen gas to assure that it is leak free prior to installation. Please notify your EVAPCO representative before installing any unit that has lost the factory nitrogen charge during shipment.

## Structural Steel Support

Two structural “I” beams running the length of the unit are required for supporting the eco-Air series units. These beams should be located underneath the outer flanges of the unit as shown in Figure 1. See Table 1 for Steel Support Dimensions.

Mounting holes, 3/4” in diameter, are provided for bolting the unit to the structural steel. Refer to the recommended structural steel support drawing and certified print for exact bolt hole location.

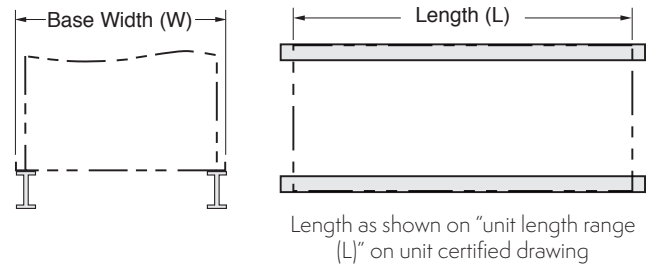
Beams should be sized in accordance with accepted structural practices. Maximum deflection of the beam under the unit should be 1/360 of the unit length, not to exceed 1/2”.

The supporting “I” beams should be level before setting the unit in place. Do not level the unit by shimming between it and the beams as this will not provide proper longitudinal support.

Support beams and anchor bolts are to be provided by others.

eco-Air Series Supporting Steel Dimensions		
V Models	Dry & Spray Unit Base Width (W)	Adiabatic Unit Base Width (W)
4' Wide	4' 2"	5' 10"
7' Wide	7' 2-1/2"	8' 9-1/2"
8' Wide	7' 3-3/4"	9' 3/4"
F Models	Base Width (W)	-
6' Wide	5' 7-5/16"	-
7' Wide	6' 11-1/8"	-
8' Wide	7' 7"	-

**Table 1** – Structural Steel Support Dimensions



**Figure 1** – Supporting Steel Diagram

## Rigging

All eco-Air Series air cooled units covered in this manual are designed to be removed from the truck via crane. Smaller units that are less than 27 feet in length also have provisions for removal from the truck via forklift. These units can be installed onto the structural steel in the same manner as removed from the truck.

Ensure that the crane operator and/or the truck driver lift the unit securely. Always consider the weight of the unit with regard to crane or forklift.

Tubes, return bends, coil connections and headers are never to be used for lifting.

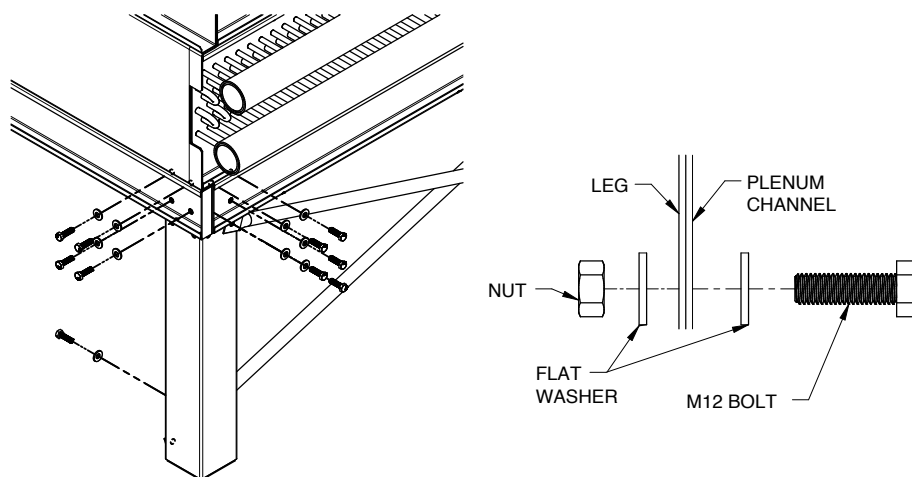
Remove any packaging material and verify that no damage has occurred. Slightly bent fins can be repaired easily using a fin comb or needle nose pliers.

Damaged tubes are only to be repaired by a qualified welder. If the damaged tubes cannot be repaired by your welder contact your local EVAPCO representative to arrange for inspection and/or repairs.

### Flat Coil Configuration Products (EAFWD/EAFCD):

Flat coil units are typically shipped with legs attached. However there could be instances when flat coil units are strapped to a wooden pallet or enclosed in an open slatted or fully enclosed crate. To avoid handling damage, EVAPCO recommends that the product is off-loaded from the vehicle while still attached to its pallet or in its crate if provided.

When flat units are shipped crated with the legs removed, the legs will need to be attached before placing the unit on the structural steel. Below is a drawing showing proper attachment of the legs to the unit.



**Figure 2** – Flat Unit Leg Attachment

## Forklift Lift:

Ensure that the forklift truck is large enough to handle the size and weight of the product required to be off-loaded. Unit weights can be found on the unit certified drawing. Units with a length less than 27 feet are provided with standard EVAPCO steel forklift channels positioned under the unit. Forklift channels will be identified by a label on the unit. If labels and forklift channels are not present, **STOP!**, the unit will need to be rigged via a crane. Forklift channels are only provided on units that are capable of being rigged via forklift. Larger units will need to be lifted via a crane or else unit and coil damage may occur.

Below is a diagram representing the location of the forklift channels on flat units.

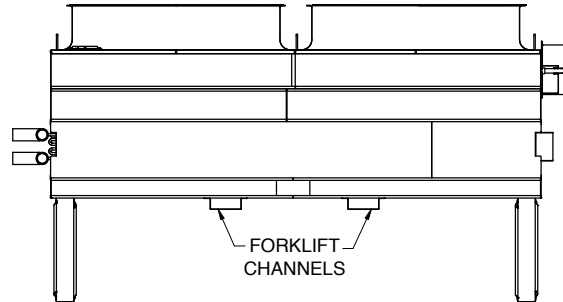


Figure 3– Flat Coil Forklift Channel Locations

The forks must be long enough to protrude at least 12 inches (30 cm) beyond the width of the product.



Figure 4 – Flat Coil Units Forklift Lifting Requirements

Under no circumstances, even if forklift channels are fitted, should 'short forks' be used as this will result in damage to the unit casing and/or coil of the unit. Ensure that the weight is evenly distributed before attempting to lift the product. Follow industry standard forklift recommendations and guidelines.

## Crane Lift:

Ensure that the crane operator uses adequate straps, chains, spreader bars etc., to safely and securely handle the weight of the product. The minimum angles for lifting by crane, when viewed from the unit end, must **NEVER** be less than a 60° angle from horizontal as shown in Figure 5. When viewed from the side of the unit the lifting angle must always be perpendicular to the unit; any angle could cause damage to the unit and coil.

To achieve a minimum 60° angle, the chains attached to the lifting device must be a minimum dimension "H" above the unit casing to prevent undue strain on the lifting ears. See Table 2 for the minimum "H" dimension. These lifting devices should not be used for extended lifts or where any hazard exists unless safety slings are employed under the unit.

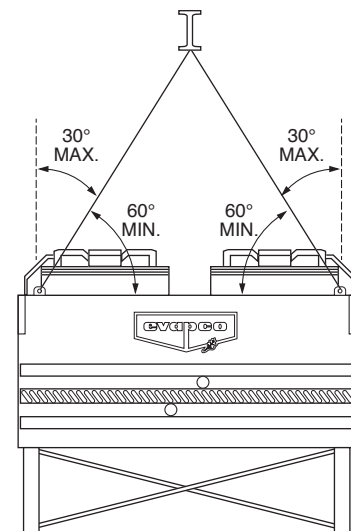
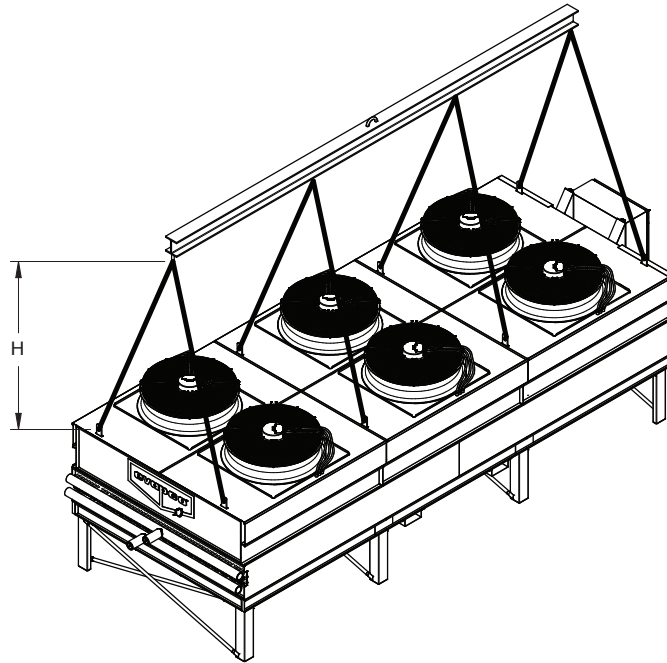


Figure 5 – Minimum Crane Lifting Angles



**Figure 6** – Rigging Beam Height Requirements

Unit Width	Minimum Height (H) Dimension (ft.)
5' (1.8m)	3.5
7' (2.2m)	5.0
8' (2.4m)	5.0

**Table 2** – Minimum “H” Dimensions

Carefully and securely attach chains to unit lifting ears based on the below information. Lifting ears are provided on the top of the fan sections for lifting the unit into final position. The unit will only be supplied with the lifting ears required, **THEREFORE USE ALL LIFTING EARS THAT ARE PROVIDED.** The lifting ear requirements vary depending on incremental fin length, or distance between tube sheets and lifting ears, therefore you will need to refer to the unit model number to accurately determine which of the below details describes your unit.

The 6th digit after the first hyphen in the model number depicts incremental fin length. For example in the model number:

EAVCD-15S2Z**K**xxxx-xxxxxxxx the **K** depicts the incremental fin length. Possible incremental fin length characters are **B**, **K**, and **I**. This can be further broken down by the type of fans.

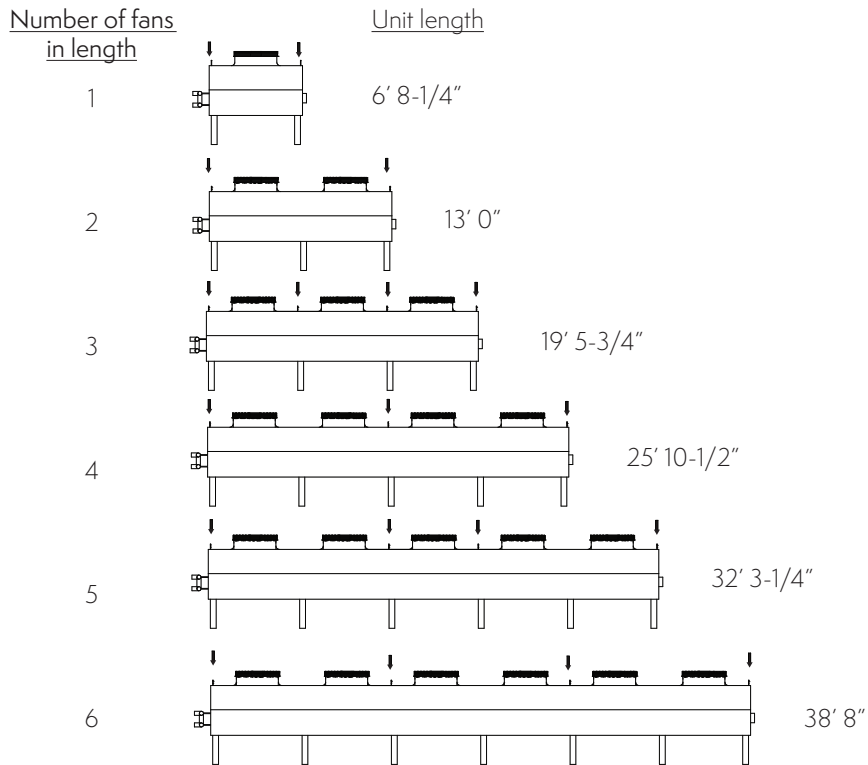
Below is a table for a quick reference guide, showing which unit type applies to which lifting ear requirement figure.

Incremental Fin Length Designator	Incremental Fin Length	Fan Type	Figure Number
B	5' 9" (1755mm)	EC	N/A
		NEMA	9
K	6' 4" (1950mm)	EC	7
		NEMA	N/A
I	7' 8" (2340mm)	EC	8
		NEMA	10

**Table 3** – Lifting Ear Requirement Reference

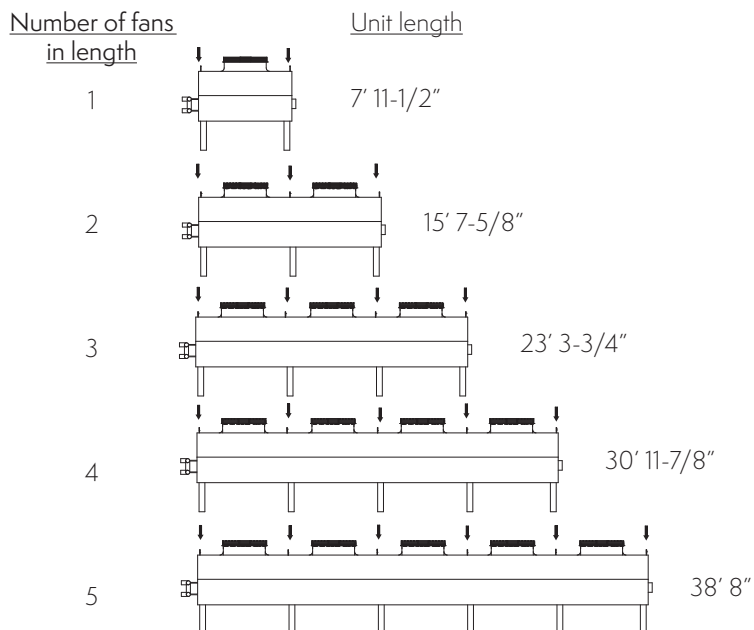
## Required Lifting Requirements – Flat EC Fan Models

Units with EC Fans will have either a **K** (6' 4" [1950mm]), or **I** (7' 8" [2340mm]) incremental fin length designator. Below are the **K** unit lifting requirements. The arrows shown on the unit drawings below indicate (2) lifting ears per arrow.



**Figure 7** – Lifting Ear Requirements for 6' 4" Incremental Fin Length

Below are **I** (7' 8" [2340mm]) incremental fin length units rigging requirements: The arrows shown on the unit drawings below indicate (2) lifting ears per arrow.



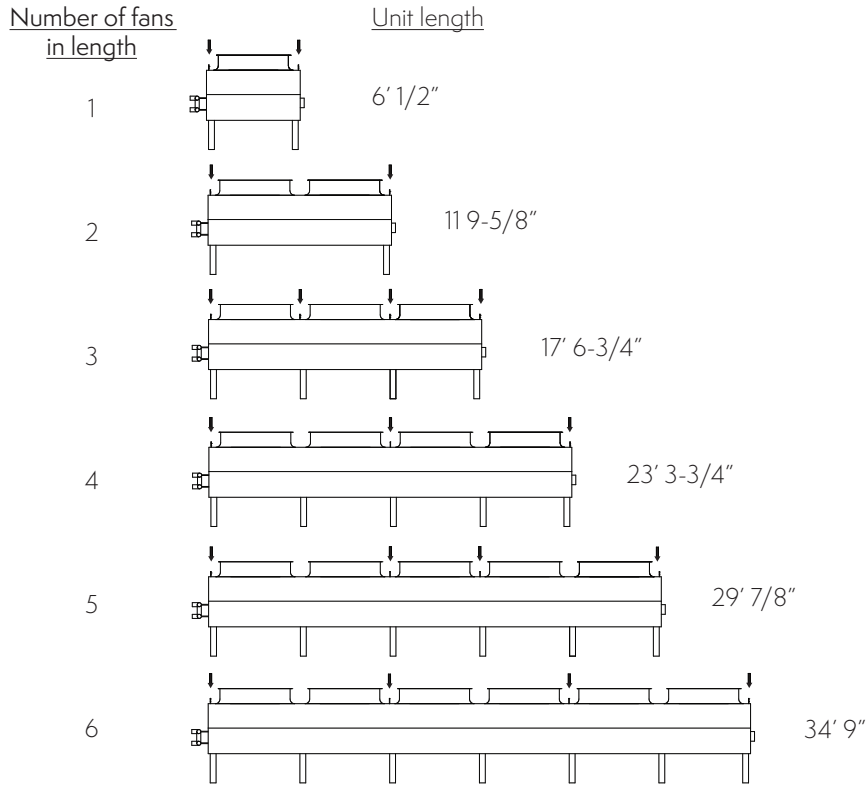
**Figure 8** – Lifting Ear Requirements for 7' 8" Incremental Fin Length



## Required Lifting Requirements – Flat NEMA Fan Models

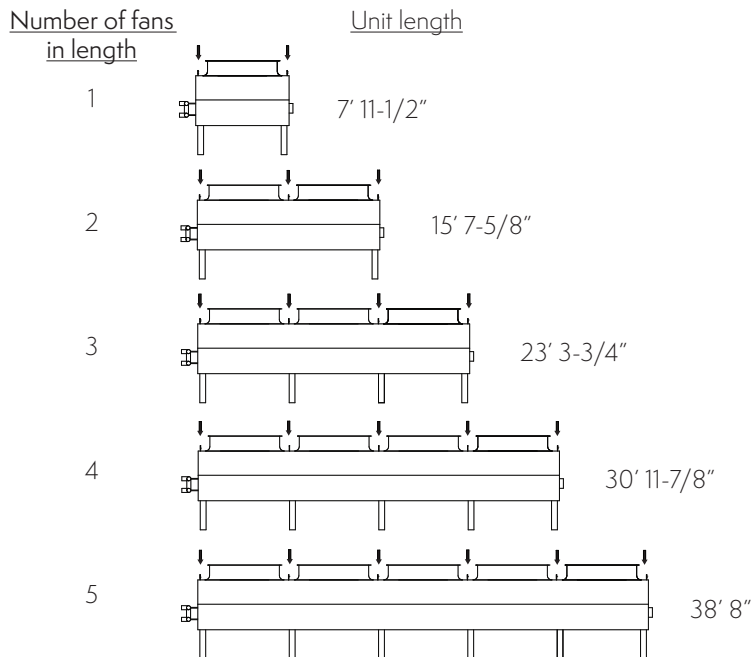
Units with NEMA Fans will have either a **B** (5' 9" [1755mm]) or **I** (7' 8" [2340mm]) incremental fin length designator. Below are the **B** unit lifting requirements.

The arrows shown on the unit drawings below indicate (2) lifting ears per arrow.



**Figure 9** – Lifting Ear Requirements for 6' 4" Incremental Fin Length

Below are **I** (7' 8" [2340mm]) incremental fin length units rigging requirements:  
The arrows shown on the unit drawings below indicate (2) lifting ears per arrow.



**Figure 10** – Lifting Ear Requirements for 7' 8" Incremental Fin Length

## V Coil Configuration Products (EAVWD/EAVCD, EAVWA/EAVCD and EAVWS/EAVCS)

EVAPCO eco-Air V Coil units utilize a skidless design allowing for ease of installation and transportation.

### Forklift Lift:

Ensure that the forklift truck is large enough to handle the size and weight of the product required to be off-loaded. Unit Weights can be found on the unit certified drawing.

Units with a length less than 27 feet are provided with standard EVAPCO steel forklift channels positioned under the unit. Forklift channels will be identified by a label on the unit. If labels and forklift channels are not present, **STOP!** the unit will need to be rigged via a crane. Forklift channels are provided on all units that are capable of being rigged via forklift. Larger units will need to be lifted via a crane or unit and coil damage may occur.

Below is a diagram representing the location of the forklift channels on V Coil units.

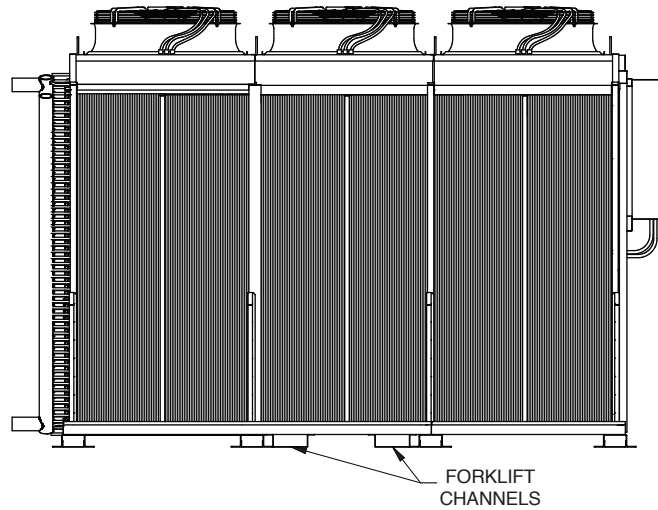


Figure 11 – V Coil Forklift Channel Locations

The forks must be long enough to protrude at least 12 inches (30 cm) beyond the width of the product.



Figure 12 – V Coil Unit Forklift Lifting Requirements

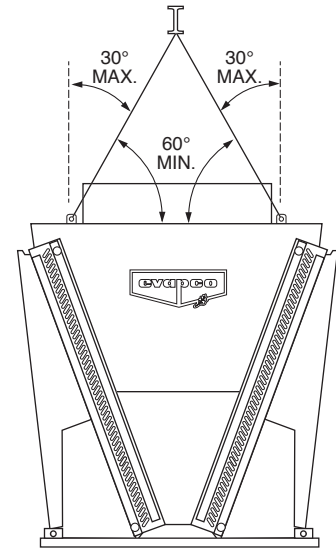
Under no circumstances, even using forklift channels, should 'short forks' be used as this will result in damage to either the unit casing or coil of the unit.

Ensure that the weight is evenly distributed before attempting to lift the product. Follow industry standard forklift recommendations and guidelines.

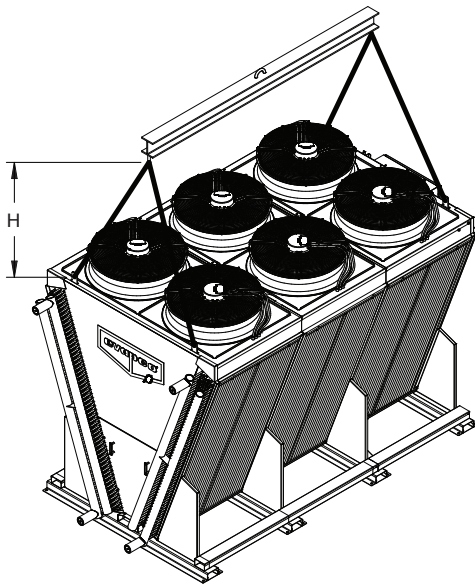
**Crane Lift:**

Ensure that the crane operator uses adequate lifting straps, chains, spreader bars etc., to safely and securely handle the weight of the product. The minimum angles for lifting by crane when viewed from the unit end, must **NEVER** be less than a 60° angle from horizontal as shown in Fig 13. When viewed from the side of the unit the lifting angle must always be perpendicular to the unit; any angle could cause damage to the unit and coil.

To achieve a minimum 60° angle, the chains attached to the lifting device must be a minimum dimension "H" above the unit casing to prevent undue strain on the lifting ears. See Table 4 for the minimum "H" dimension. These lifting devices should not be used for extended lifts or where any hazard exists unless safety slings are employed under the unit.



**Figure 13 – Minimum Crane Lifting Requirements**



**Figure 14 – Rigging Beam Height Requirements**

Unit Width	Minimum Height (H) Dimension (ft.)
4' (1.2m)	2.5
7' (2.2m)	5.0
8' (2.4m)	5.0

**Table 4 – Minimum "H" Dimensions**

Carefully and securely attach chains to unit lifting ears based on the below information. Lifting ears are provided on the top of the fan sections for lifting the unit into final position. Unit will only be supplied with the lifting ears required, **THEREFORE USE ALL LIFTING EARS THAT ARE PROVIDED**. The lifting ear requirements vary depending on incremental fin length, or distance between tube sheets and lifting ears, therefore you will need to refer to the unit model number to accurately determine which of the below details describes your unit.

The 6th digit after the first hyphen in the model number depicts incremental fin length. For example in the model number:

EAVCD-15S2Z**K**xxxx-xxxxxxxxx the **K** depicts the incremental fin length. Possible incremental fin length characters are **A, J, B, K,** and **I**. This can be further broken down by the type of fans.

Below is a table for a quick reference guide, showing which unit type applies to which lifting ear requirement figure.

Incremental Fin Length Designator	Incremental Fin Length	Fan Type	Figure Number
A	3' 10" (1170mm)	EC	15
J	4' 3" (1300mm)	EC	15
B	5' 9" (1755mm)	NEMA	16
K	6' 4" (1950mm)	NEMA	16
I	7' 8" (2340mm)	NEMA	17

**Table 5 – Lifting Ear Requirement Reference**

## Required Lifting Requirements – V Coil EC Fan Models

Units with EC fan assemblies will have either an **A** (3' 10" [1170mm]) or **J** (4' 3" [1300mm]) incremental fin length designator. Below are the lifting requirements for these units. The arrows shown on the unit drawings below indicate (2) lifting ears per arrow.

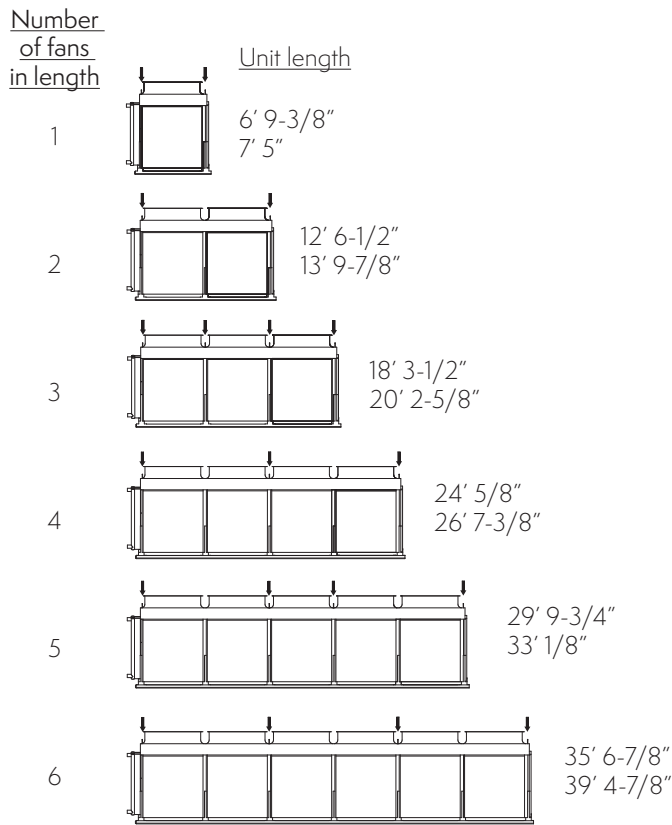
Number of fans in length	Unit length
1	4' 10-3/8" 5' 3-3/8"
2	8' 8-3/8" 9' 6-5/8"
3	12' 6-1/2" 13' 9-3/4"
4	16' 4-1/2" 18' 0"
5	20' 2-5/8" 22' 4-1/8"
6	24' 5/8" 26' 7-3/8"
7	27' 10-3/4" 30' 10-1/2"
8	31' 8-3/4" 35' 1-3/4"
9	35' 6-7/8" 39' 4-7/8"
10	39' 4-7/8"

**Figure 15** – Lifting Ear Requirement for 3' 10" and 4' 3" Incremental Fin Lengths

## Required Lifting Requirements – V Coil NEMA Fan Models

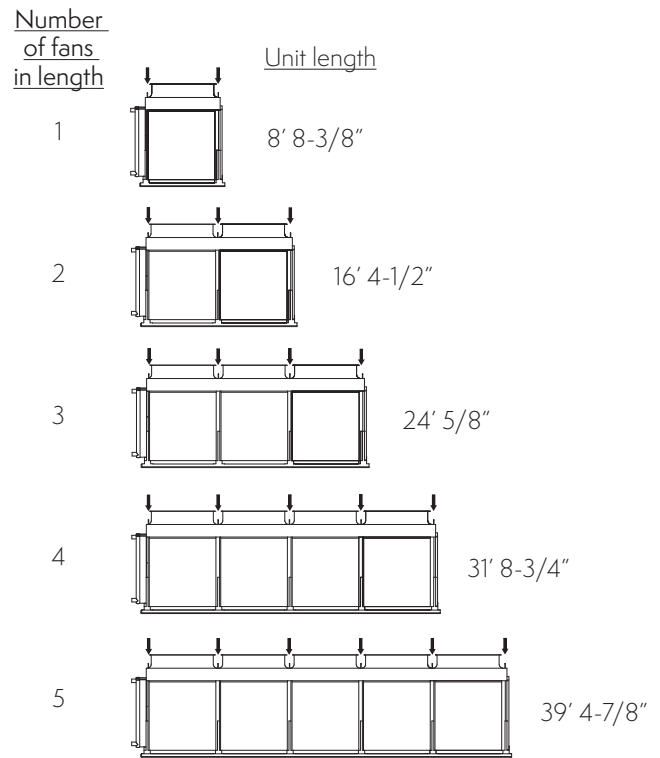
Units with NEMA Fans will have either a **B** (5' 9" [1755mm]), **K** (6' 4" [1950mm]), or **I** (7' 8" [2340mm]) incremental fin length designator. The arrows shown on the unit drawings below indicate (2) lifting ears per arrow.

Below are the **B** and **K** unit lifting requirements.



**Figure 16** – Lifting Ear Requirement for 5' 9" and 6' 4" Incremental Fin Lengths

Below are **I** unit lifting requirements.



**Figure 17** – Lifting Ear Requirement for 7' 8" Incremental Fin Lengths

## Initial Storage and/or Idle Period Recommendations

If the unit will remain inactive for an extended period of time prior to installation it is recommended that the following be performed in addition to all component manufacturers recommended maintenance instructions.

- The fans must be turned by hand at least once every three months. This can be accomplished by tagging and locking out the unit's disconnect, grasping the fan assembly and rotating it several turns.
- If unit remains inactive longer than one month, insulation test motor windings semi-annually.
- See motor manufacturer maintenance and long term storage instructions for more detailed instructions.
- Thoroughly clean road salt, dirt and debris from unit immediately after delivery. Residue left on product surfaces can cause damage that is not covered by any warranty.

## International Building Code Provisions

The International Building Code (IBC) is a comprehensive set of regulations addressing the structural design and installation requirements for building systems – including HVAC and industrial refrigeration equipment. The code provisions require that the cooling equipment and all other components permanently installed on a structure must meet the same seismic design criteria as the building.

All items attached to EVAPCO eco-Air Series coolers and condensers must be independently reviewed and isolated to meet applicable wind and seismic loads. This includes piping, ductwork, conduit, and electrical connections. These items must be attached to the EVAPCO unit so as not to transmit additional loads to the equipment as a result of seismic or wind forces. EVAPCO requires that all external piping and fittings be externally supported, the supplied connections are not designed to support external piping or fitting loads. Additional forces to the connections or coil in any way could cause damage to the unit not covered under warranty.

## Initial and Seasonal Start-Up and Shut-Down

### General

1. Verify that the overall installation reflects the requirements of the installation guidelines found in EVAPCO Bulletin #320. – Equipment Layout Manual available at [www.evapco.com](http://www.evapco.com).
2. Verify all safety interlocks work properly.
3. Examine wiring for loose connections or other obvious damage (quarterly).
4. For units supplied with an EVAPCO controls system see the Controls Operating Manual for motor and controls startup. For units not supplied with controls see motor manufacturer's and controls manufacturer's start up recommendations.
5. If the unit is going to remain inactive for an extended period of time, follow all manufacturer's fan motor for long term storage. Properly ventilated plastic sheets or tarps can be used to protect a unit during storage. See your local EVAPCO representative for additional information on unit storage.

**BEFORE BEGINNING ANY MAINTENANCE, BE CERTAIN THAT THE POWER IS TURNED OFF AND THE UNIT IS PROPERLY LOCKED AND TAGGED OUT!**

### Initial and Seasonal Start-Up

1. Clean and remove any debris, such as leaves and dirt from the coil face, adiabatic pads (if equipped), and fan screens. Flush the adiabatic pads to remove any sediment or dirt.
2. If equipped, the factory set flow setter devices on the adiabatic system piping may need to be adjusted to maintain equal distribution of water flow on both sides of the unit.
3. Fins can be brushed clean with a soft bristle brush or pressurized water, not aimed at an angle, but directly onto the fins to clean accumulated deposits. A fin comb or needle nose pliers can be used to straighten any fins that have become bent. Fins that had been damaged and straightened with a fin comb may not look like new but will function normally if air spaces remain open.
4. Turn the fan(s) by hand to ensure it turns freely without obstructions.
5. Visually inspect the fan blades. Blade clearance should be approximately 1/4" from tip of blade to the fan cowl.
6. For fluid coolers only, fill the heat exchanger coil with the specified heat transfer fluid and purge air from the system before pressurizing, using factory supplied coil vents.

**NOTE: Dry fluid coolers should only be used on sealed, pressurized systems. Continual aeration of the heat transfer fluid in an open system can cause corrosion inside the tubes of the cooler leading to premature failure.**

For fluid coolers or condensers with optional controls, see EVAPCO Controls Operating Manual for proper start up procedure.

### **After the unit has been energized, check the following:**

1. Verify fans are rotating in proper direction based on arrow sticker affixed to fan housing.
2. Measure voltage and current on all three power leads of fan motors. The current should not exceed the motor nameplate full load amp rating.
3. Start the EVAPCO Air Pre-Cooling System if equipped. For Adiabatic units, check for proper pad wetting. For spray units, check to ensure all nozzles are free from debris and have a uniform spray pattern. If the adiabatic or spray system is not operating correctly, consult the troubleshooting guide in this manual.

### **Seasonal Shutdown**

Steps should be taken to ensure that when the equipment is shut down for prolonged periods, the unit is managed in the correct fashion.

### **Dry, Adiabatic or Spray Fluid Coolers**

1. Ensure the process is shut down and the system temperature has reached safe shut down condition.
2. If unit is equipped with an adiabatic or spray system ensure that all valves are open and system is completely drained.
3. Switch off the fans and power to the unit.
4. Close the isolating valves by others, if equipped.
5. If the cooler will be subjected to sub-zero temperatures and is not filled with a suitable antifreeze, open the air vent and drain connection(s) and drain the heat transfer fluid. Applying a positive pressure to the air vent connection(s) will help ensure that there is no heat transfer fluid retention, which could lead to frost damage.

### **Air Cooled, Adiabatic or Spray Condensers**

1. Ensure that the refrigeration load is removed.
2. If unit is equipped with an adiabatic or spray system ensure that all valves are open and system is completely drained.
3. Switch off the fans and power to the product.

## **Basic eco-Air Series Sequence of Operation**

**NOTE: For units with an EVAPCO Controls system refer to the EVAPCO Controls Operating Manual for detailed sequence of operation.**

### **System Off / No Load**

The unit's fans are off. Adiabatic or spray systems should be off, if equipped.

### **System/Condensing Temperature Rises**

The fans turn on. For a variable speed controller, the fans are turned on to minimum speed, all fans maintaining the same speed. If the system temperature continues to rise, then the fan speed is increased as required, up to full speed.

If temperatures continues to rise and an adiabatic or spray system is equipped then the water solenoid valve should open and completely wet adiabatic pads, or spray water from nozzles. Fan speeds are increased and decreased as needed after adiabatic or spray system is initiated.

**NOTE: If the adiabatic or spray unit is equipped with the 2-stage operation accessory, 2 solenoid valves are provided, and the pre-cooling systems are actuated in 2 stages to reduce overall water consumption.**

### **System/Condensing Temperature Stabilizes**

Control the leaving fluid temperature (fluid coolers) or condensing temperature (condensers) by modulating the fan speeds with equipped controls system.

### **System/Condensing Temperature Drops**

Decrease the fan speed, as required. If equipped, shut off adiabatic or spray system and continue to modulate fan speed.

### System Off / No Load

The system fans turn off. The adiabatic or spray system should not be used as a means of capacity control, and should not be cycled frequently. Excessive cycling can lead to scale build-up on the pads or coils (in case of spray).

**NOTE: MINIMUM CONTROL POINT FOR PROCESS FLUID SHOULD NEVER BE LOWER THAN 6° F ABOVE PROCESS FLUID FREEZING TEMPERATURE.**

## Maintenance Instructions

It is essential to understand that fouled or dirty fins reduce heat transfer.

1. After operation for a month, check for fouling of the fins. Inspect with a light between the fins to observe the accumulations of dirt and dust.
2. Dry dust can normally be removed by compressed air, a soft brush, or by a suitable industrial vacuum cleaner. Sweep along the fins and under no circumstances across the fins.
3. Moist or sticky blemishes or grease should be removed by means of hot water or steam jet cleaning appliances (against the air direction).
4. Keep the jet of the cleaning appliance at an angle of no more than 15° from vertical position, to avoid bending the fin edges.

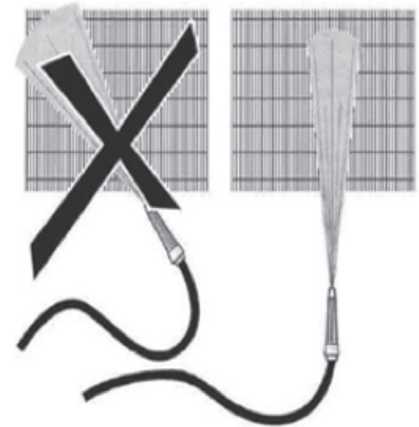
### Cleaning Hydraulically

When cleaning the coil hydraulically, EVAPCO recommends using water only. If cleaning products are used ensure that they are compatible with the unit materials of construction. When cleaning with water under pressure, use a power washing device designed for a maximum of 600psig or less.

Always clean in the vertical direction. Never across the fins, as this will damage the fins. And always from the top down to avoid the water spray entering the fans (this can short circuit the fan motors).

For oily or otherwise difficult to remove dirt, it is possible to add a chemical cleaning agent to the water used in the power washer. Ensure that the cleaning agent is compatible with the materials used in the unit and that it is an environmentally friendly agent.

List of recommended cleaning solutions are shown in Table 6 below.



**Figure 18** – Always Clean Fins in Vertical Direction

STAINLESS STEEL/ALUMINUM COILS	
Trade Name	Manufacturer
CL-122	NALCO
CL-127	NALCO
LMC-44	LW Chemical
SoilSolv	DuChem
FS Process Cleaner	Zep
Formula 940	Zep

**Table 6** – Acceptable Cleaning Solutions



## Cleaning with Compressed Air

When cleaning with compressed air, use a compressor designed for a maximum of 1,000psig or less. For the purpose of removing dirt and debris, please ensure that the air stream is COMPLETELY VERTICAL to the fins as the compressed air stream can damage the fins.

## Cleaning with Brushes

Dry dust and some dirt can be removed with brushes, possibly in conjunction with compressed air or an industrial vacuum cleaner.

However, ensure that soft brushes are used and when possible all cleaning should be from the top down. **ALWAYS** brush along the fins. **NEVER** across the fins, as this will damage the fins.

## Cleaning the Fans

**ALWAYS** ensure that the power to fans has been locked and tagged out prior to cleaning and ensure that the fans cannot be accidentally started during maintenance.

It is recommended to clean the fans either by means of brushes or with compressed air. When cleaning with compressed air, use a compressor designed for a maximum discharge air pressure of 125psig or less.

## Adiabatic Pre-Cooling System – If Equipped

Adiabatic air pre-cooling systems are supplied with many dry fluid coolers and air cooled condensers to enhance the performance of the unit. The below figure shows the major components of the adiabatic water system.

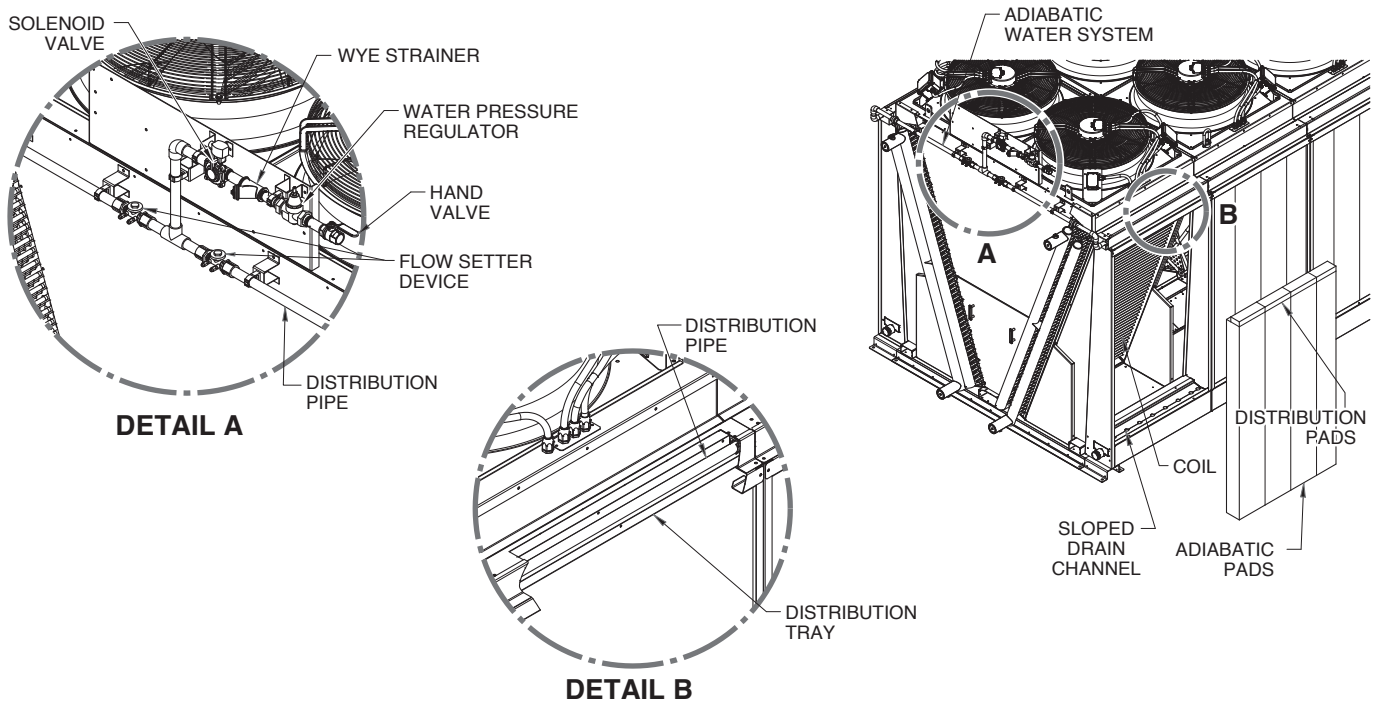


Figure 19 – Adiabatic Air Pre-Cooling System Components

## Operation (Adiabatic Pre-Cooling System)

All connecting piping to the unit **MUST** be externally supported. The piping on the unit is not designed to bear additional piping weight.

EVAPCO recommends visually inspecting adiabatic pads and the distribution system regularly during operation and before seasonal startup. When in operation the pads should be completely wetted (there will be a noticeable color difference). If portions of the pad are not wetted, inspect the water distribution system for clogs.

Allow the pads to completely dry once every 24 hours with the fans running.

A water pressure regulator (WPR) is located at the end of each unit as shown in Figure 19. The WPR must be set to 50psig using the provided pressure gauge located between the discharge of the WPR and the inlet of the hand shut off valve.

The water distribution system comes preset from the factory with the correct water flow rate to ensure minimal but even water distribution. When the adiabatic system is in operation and the flow setters are set correctly a small amount of water will be present in the sloped drain channel. **If it becomes necessary to adjust the water flow rate, adjust the percentage closed of the flow setter devices using a philips screw driver until only a small amount of water is in the sloped drain channel but ensuring that the adiabatic pads are completely wetted.**

Note that on longer units there are two flow setter devices on each side of the unit and the flow setter percentage closed settings are different for each. The flow setter device that supplies the longest portion of the unit is designed to be as open as possible.

## Maintenance (Adiabatic Pre-Cooling System)

Rinse the adiabatic pads to remove loose sediment or dirt. If further cleaning is required use only a mild and environmentally responsible cleaning agent that is compatible with the unit and pads materials of construction.

To remove the adiabatic pads use the following instructions. Installation is the reverse of removal.

1. Remove the bolts on the top of the distribution system cover. This allows the distribution cover to be repositioned revealing the water distribution tray, and the distribution pad.
2. Carefully remove the distribution pad, which is the 2" tall pad positioned between the distribution tray and the large vertical adiabatic pads.
3. Lift the large vertical adiabatic pad to clear the lower support (at the bottom) and remove. It is recommended to start with the center pad per module. This will allow for the pads adjacent to the tube sheets to clear metal brackets attached to the tube sheets.
4. Installation is reverse of removal.

Ensure the sloped drain channel and outlet connection are free of debris that would impede water flow by removing the adiabatic pads and then removing the slotted sloped drain channel cover.

The pad material is a bonded cellulose UV Resistant material. Refer to local codes and ordinances for disposal methods.

Remove and clean the Wye strainer annually to prevent the build up of debris and decreased water flow rate to the adiabatic pads.

## Spray System – If Equipped

Spray systems are supplied with many dry fluid coolers and air-cooled condensers to enhance the performance of the unit. The below figure shows the major components of the spray system.

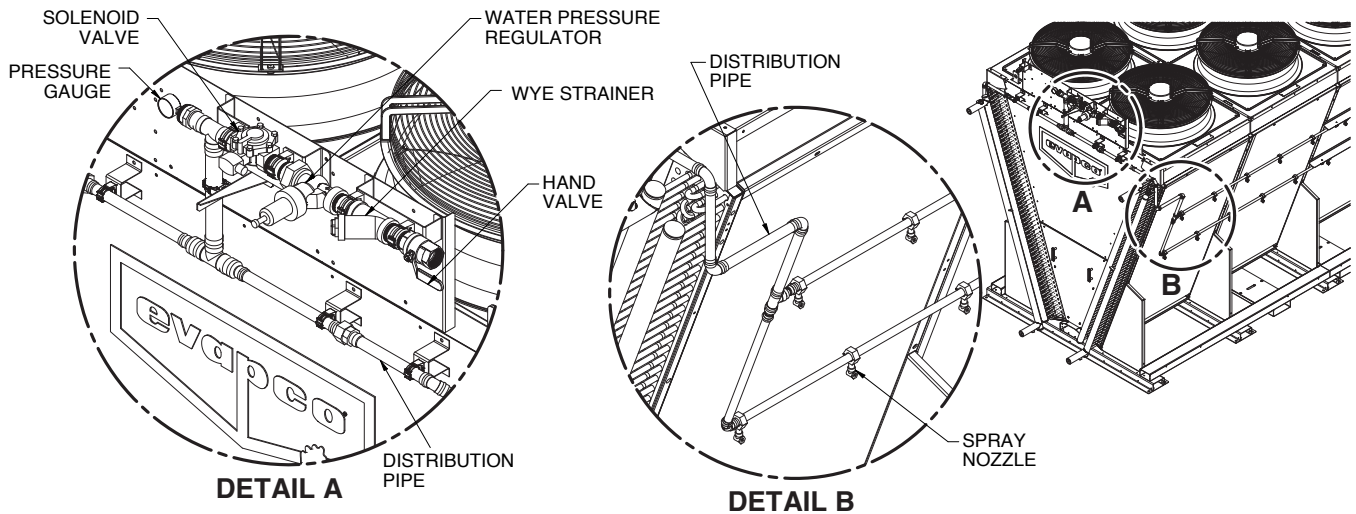


Figure 20 – Spray System Components

### Operation (Spray System)

All connecting piping to the unit **MUST** be externally supported. The piping on the unit is not designed to bear additional piping weight. EVAPCO recommends visually inspecting spray system regularly during operation and before seasonal startup. When in operation the spray nozzles should be spraying outwards and evenly. If any nozzle isn't operating correctly, inspect the water distribution system for clogs.

A water pressure regulator (WPR) is located at the end of each unit as shown in Figure 20. For units equipped with spray systems, the discharge water pressure must be set once the unit is installed in the field. Refer to the technical data sheet in the factory submittal for the WPR setting required for the submitted design conditions. The provided pressure gauge located at the discharge of the solenoid valve can be used to validate WPR setting. There are no flow setters on the spray system. Inlet water pressure set correctly on the WPR and a clean water distribution system will ensure proper operation of the spray system.

**NOTE: In addition to the outlined water chemistry guidelines, EVAPCO recommends that dry fluid coolers and air-cooled condensers equipped with Spray systems limit spray operation to peak ambient and load conditions, about 200 hours a year, to help limit scale build-up, corrosion and to extend the life of the coil.**

### Maintenance (Spray System)

Clean the finned coils using the recommendations outlined under "Cleaning Hydraulically."

Remove the spray nozzles, inspect for debris and clean as necessary.

Remove and clean the Wye strainer annually to prevent the build up of debris and decreased water flow rate to the spray system.

### Inlet Water (Adiabatic & Spray Systems)

The water supply temperature and pressure are typically around +50°F and +50 psig, respectively for standard city water main lines. The adiabatic & spray systems require a minimum water pressure of 50 psig at the inlet connection. The adiabatic system piping (see Figures 19 & 20) includes a water pressure regulator to enable the use of high pressure supply water, up to 140 psig, to be connected. The inlet connection is the highest point on the EVAPCO adiabatic and spray pre-cooling systems, allowing for free drainage of water, after the solenoid valve, upon system shutoff. Please refer to the Freeze Protection section of this O&M for more information on protecting the adiabatic and spray water piping.

Normal municipal and ground water supplies are suitable for use with the adiabatic & spray systems. If other water sources, cleaning agents, or treatments are to be used, ensure that they are compatible with all of the eco-Air product line materials of construction including PVC, copper, brass, bonded cellulose, galvanized steel and 304L stainless steel.

## Water Quality Guidelines (Adiabatic Pad Systems)

EVAPCO recommends the below outlined water chemistry guidelines applicable to **ADIABATIC PAD** air pre-cooling systems for dry fluid coolers and air-cooled condensers. The water quality guidelines shown below apply to the water which is dripped over the pads. These guidelines are recommended to extend pad life and limit scale build up on the pads.

Property	Adiabatic Pads
pH	6.0 - 9.0
Conductivity (mhos/cm)	<1,500
Alkalinity as CaCO <sub>3</sub> (ppm)	<250
Calcium Hardness as CaCO <sub>3</sub> (ppm)	<300
Alkalinity + Calcium	<500
Chloride as Cl (ppm)	<250
Sulfate (ppm)	<250
Chloride + Sulfate	<400
Silica as SiO <sub>2</sub> (ppm)	<150

**Table 7** – Recommended Water Chemistry Guidelines for Inlet Water to Adiabatic Pad Systems

## Water Quality Guidelines (Adiabatic Spray Systems)

EVAPCO recommends the below outlined water chemistry guidelines applicable to **ADIABATIC SPRAY** air pre-cooling systems for dry fluid coolers and air-cooled condensers. The water quality guidelines shown below apply to the water which passes thru the adiabatic spray system. Although the adiabatic spray nozzles spray water away from the coils, the coils and structure of the unit will get wet when the spray system is on. Thus, the water quality guidelines shown below are recommended to limit scale build-up and corrosion on the finned tube bundles.

In addition to the water quality guidelines shown below, EVAPCO recommends designing the system for a maximum of 200 hours of spray operation per year to help limit the possibility for scale build-up and corrosion.

Property	Adiabatic Spray System	
	Scenario 1	Scenario 2
pH	6.0 - 8.5	6.0 - 8.5
Conductivity (mhos/cm)	<1,500	<1,000
Alkalinity as CaCO <sub>3</sub> (ppm)	<250	<200
Calcium Hardness as CaCO <sub>3</sub> (ppm)	<350	<250
Alkalinity + Calcium	<550	<400
Chloride as Cl (ppm)	<175	<150
Sulfate (ppm)	<225	<200
Chloride + Sulfate	<350	<300
Silica as SiO <sub>2</sub> (ppm)	<150	<150

**Table 8** – Recommended Water Chemistry Guidelines for Inlet Water to Adiabatic Spray Systems

\***Scenario 1** applies when the entering **Process Fluid or Superheated Refrigerant** temperature is equal to or less than 120F.

\***Scenario 2** applies when the entering **Process Fluid or Superheated Refrigerant** temperature is above 120F.

\*For Process Fluid and Superheated Refrigerant temperatures in excess of 212F, please consult with Evapco.

“Process Fluid” or “Superheated Refrigerant” is the fluid that is circulated and cooled inside the coils. The water chemistry guidelines outlined for Scenario 2 are more stringent than Scenario 1 because entering process fluid or refrigerant temperatures above 120°F can accelerate the rate of scale formation and corrosion on the finned coil bundles when the Spray System is operational.

**If the water chemistry guidelines are not followed or if the spray system is run for prolonged periods of time (>200 hours per year) or cycled excessively, excessive scale buildup is possible and is not covered under unit warranty.**



## MAINTENANCE CHECKLIST

PROCEDURE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1. Check fins for clogging or debris – <b>monthly</b>												
2. Check unit for damage – <b>quarterly</b>												
3. Check unit for leaks – <b>quarterly</b>												
4. Clean the coil(s) – <b>semi-annually</b>												
5. Check cooler coil connections for tightness – <b>annually</b>												
6. Check the fan blades for cracks, missing balancing weights, and vibration – <b>quarterly</b>												
7. Examine all wiring for signs of loose connections or obvious damage – <b>quarterly</b>												
8. Check unit control sequence and assure proper operation – <b>quarterly</b>												
9. Inspect and clean unit surfaces – <b>annually</b>												
a. Galvanized: scrape blemishes and coat with ZRC												
b. Stainless: clean and polish with a stainless steel cleaner												

Adiabatic & Spray Units (During Operation):	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1. Check adiabatic pad and water distribution system for damage or incorrect pad wetting – <b>monthly</b>												
2. Confirm water piping integrity including flow setter adjustment. The flow setter can be used to adjust the amount of water distributed to the adiabatic pads. Check to ensure holes are un-clogged – <b>bi-monthly</b>												
3. Check spray nozzles and water distribution system for damage and uniform spray pattern – <b>monthly</b>												
4. Remove and clean wye strainer – <b>annually</b>												

## Fan System

Fan motors have permanently sealed bearings; therefore, no lubrication is required. Be sure to verify any instructions for special motors that have been ordered. A motor data sheet and specific motor instructions are shipped with each unit.

Please refer to EVAPCO's Control Operations and Maintenance Manual for details about control systems.

## Cold Weather Operation

EVAPCO eco-Air Series air cooled equipment is well suited to operate in cold weather conditions. The lack of required water makes air cooled equipment ideal for low ambient conditions. When the air cooled unit is going to be used during cold weather conditions, several items need to be considered including unit layout, adiabatic or spray system piping (if equipped), and unit heat transfer coils.

### Unit Layout

Adequate unobstructed air flow must be provided for both the intake and discharge from the unit. For additional information on unit layout, please refer to EVAPCO's Equipment Layout Manual Bulletin #320.

### Freeze Protection

EVAPCO is not responsible for ensuring that the product is adequately protected against the heat transfer fluid freezing. If the product has occasion to operate in close-to or sub-freezing temperatures then either the heat transfer fluid should be dosed with an adequate anti-freeze additive or provision has to be made to either manually or automatically drain the fluid from the cooler. **NOTE: Opening the air vent and drain connections as a means to fully drain the fluid from the dry cooler is not sufficient to fully empty all the fluid and thus prevent freeze damage. In particular for large dry coolers, air pressure assisted drainage is required.**

The sequence of control for a unit operating at low ambient conditions is much the same as a cooler or condenser operating under summer conditions provided that the ambient temperature is above freezing. When the ambient temperatures are below freezing, additional precautions must be taken to avoid the potential for damaging ice formation.

It is very important to maintain close control of the cooler or condenser during winter operation. EVAPCO recommends that the leaving heat transfer fluid temperature NEVER be less than 6° F above the fluids freezing temperature.

If the adiabatic (optional) fluid cooler or air cooled condenser is to be located in an area that experiences ice storms and freezing conditions EVAPCO recommends the removal and dry storage of the adiabatic pads (if equipped).

**Heat tracing all adiabatic and spray water piping upstream and including the solenoid valve is required, unless the incoming water supply lines are drained during low ambient conditions and all valves are left open (recommended). Adiabatic and spray systems are not intended to be operated in low ambient conditions.**

## Troubleshooting

Problem	Possible Cause	Remedy
<b>Overramping Fan Motors</b>	Electrical issue	1. Check voltage across all three legs of the motor. 2. Verify that the motor is wired per the wiring diagram, and connections are tight. 3. Refer to EVAPCO's control O&M for further details
	Fan rotation	Verify that the fan is rotating in the correct direction using visible arrow sticker on fan cowl. If not, switch the leads so it runs correctly.
	Mechanical failure	If fan motor does not turn freely by hand, replace fan/motor assembly.
	Motor running single- phase	Stop motor and attempt to start it. Motor will not start again if single phased. Check wiring, controls and motor.
<b>Unusual Motor Noise</b>	Motor leads connected incorrectly	Check motor connections against wiring diagram on motor.
	Electrical unbalance	Check voltage and current of all three lines. Correct if required.
	Fan hitting cowl	Replace fan/motor or assembly.
	Defective motor	Replace fan motor or assembly.
<b>Capacity Not Reached</b>	Insufficient fluid flow	Check piping system and components.
	Heat transfer fluid change	Compare with design fluid and adjust if required
	De-energized fans	1. Verify motor has power. 2. If motor has power and is still de-energized, replace fan/motor assembly.
	Adiabatic pads not wetted	Check for complete wetting of pads 1. If pads are only partially wetted, clean out water distribution pipe and check distribution holes for clogs. 2. If pads have excessive scale they will need to be replaced.
	Fouled heat Transfer surface	Carefully clean fins, see page 16 for more details.
	Spray nozzles not spraying water uniformly	1. Check for clogged/fouled nozzles 2. Check pressure gauge to ensure correct incoming water pressure, pressure requirements can be verified on the technical data sheet of the submittal.
<b>Fans Not Rotating</b>	Damaged or unbalanced fan blade or motor	Replace fan/motor assembly.
<b>Vibration</b>	Loosely attached fan/motor assembly	Tighten fan/ motor assembly.
	Unbalanced fan	(NEMA equipped units only) balance fan blade using spacers.

## Replacement Parts

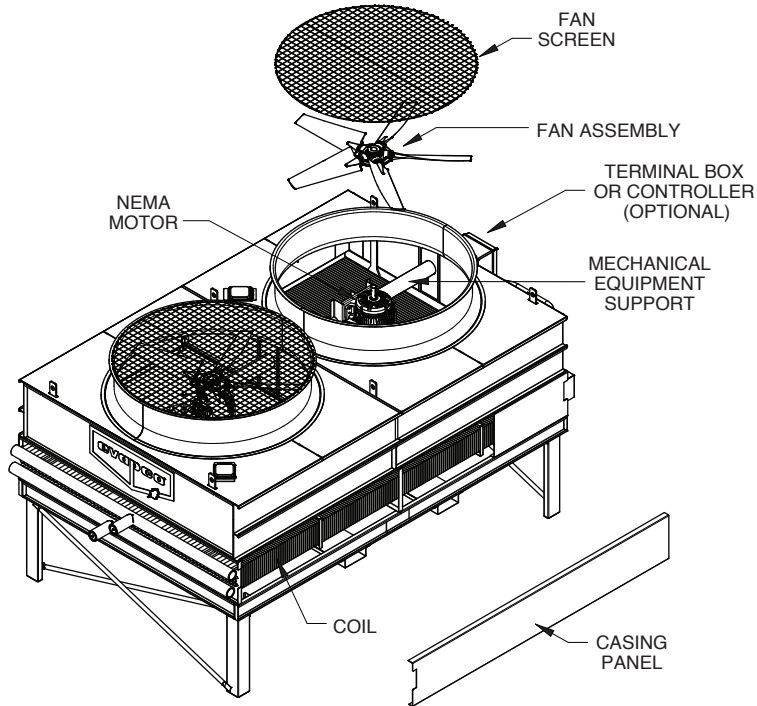
EVAPCO has replacement parts available for immediate shipment. Most orders ship within 24 hours from time of order!

The following pages contain exploded view drawings of all current EVAPCO eco-Air closed circuit coolers and condensers. Please use these drawings to help identify the major parts of your unit. To order replacement parts, please contact your local EVAPCO representative or Mr. GoodTower Service Center. The EVAPCO representative contact information is located on the unit's nameplate or can be found by visiting either [www.evapco.com](http://www.evapco.com) or [www.mrgoodtower.com](http://www.mrgoodtower.com).

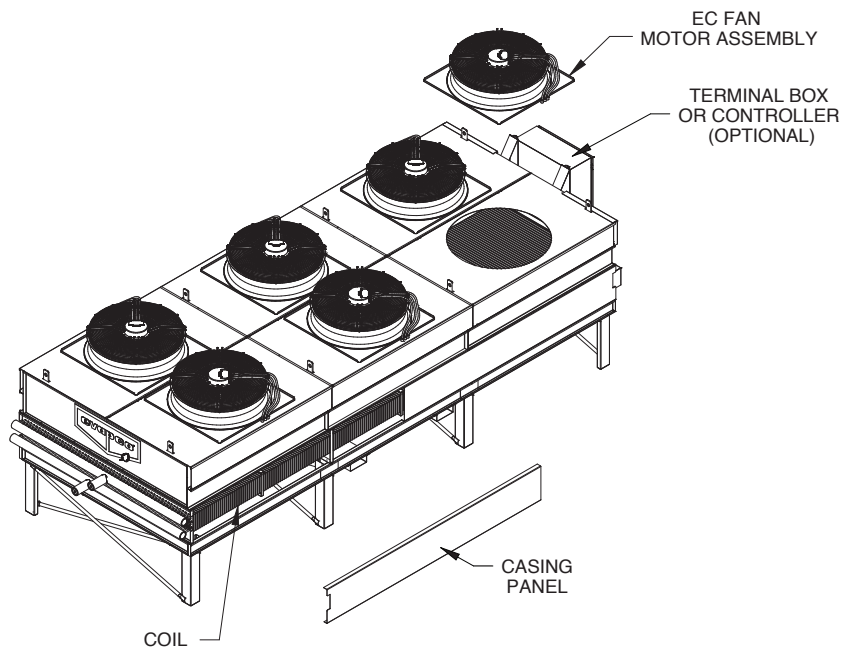
Additionally, your local EVAPCO representative or Mr. GoodTower Service Center can provide FREE unit inspections to help ensure your equipment operates at peak performance regardless of the original manufacturer!

# Replacement Part Drawings

## eco-Air Flat Coil Configuration with NEMA Fans

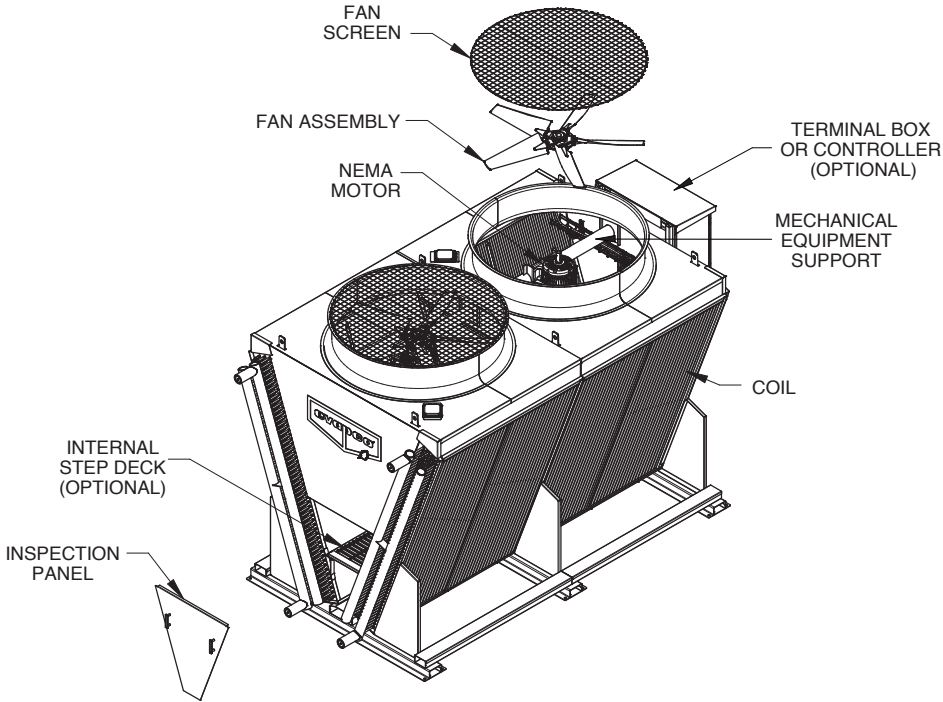


## eco-Air Flat Coil Configuration with EC Fans

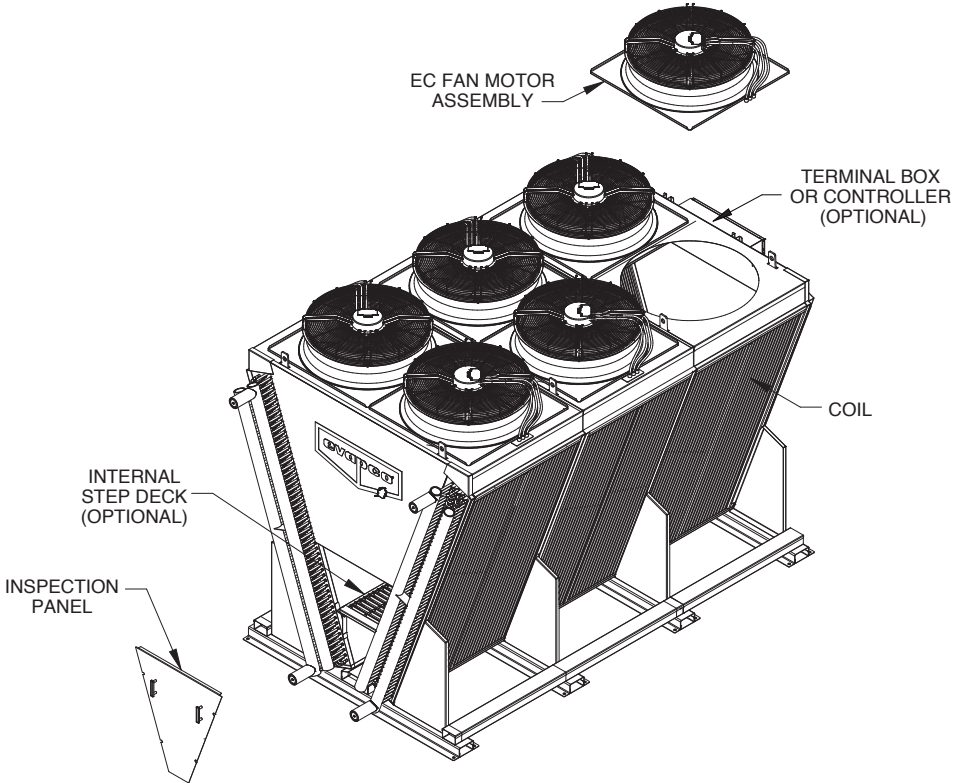




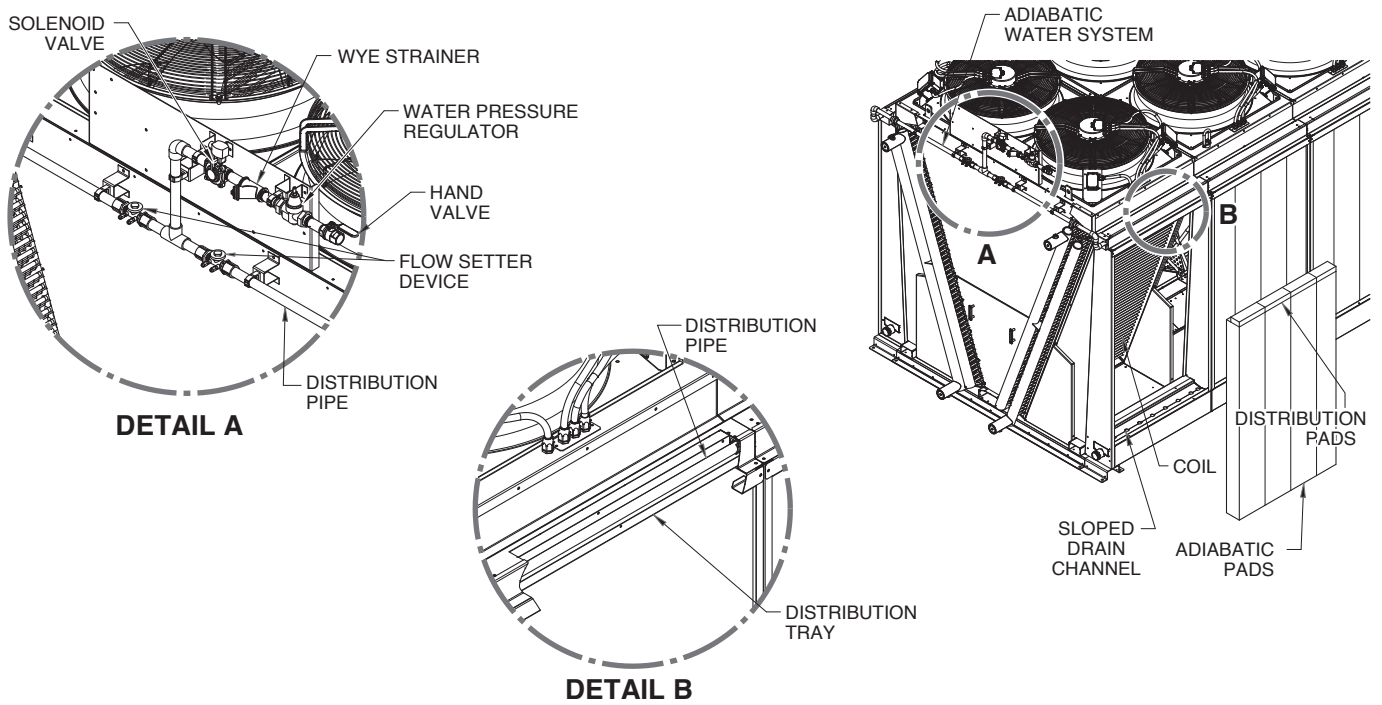
# eco-Air V Coil Configuration with NEMA Fans



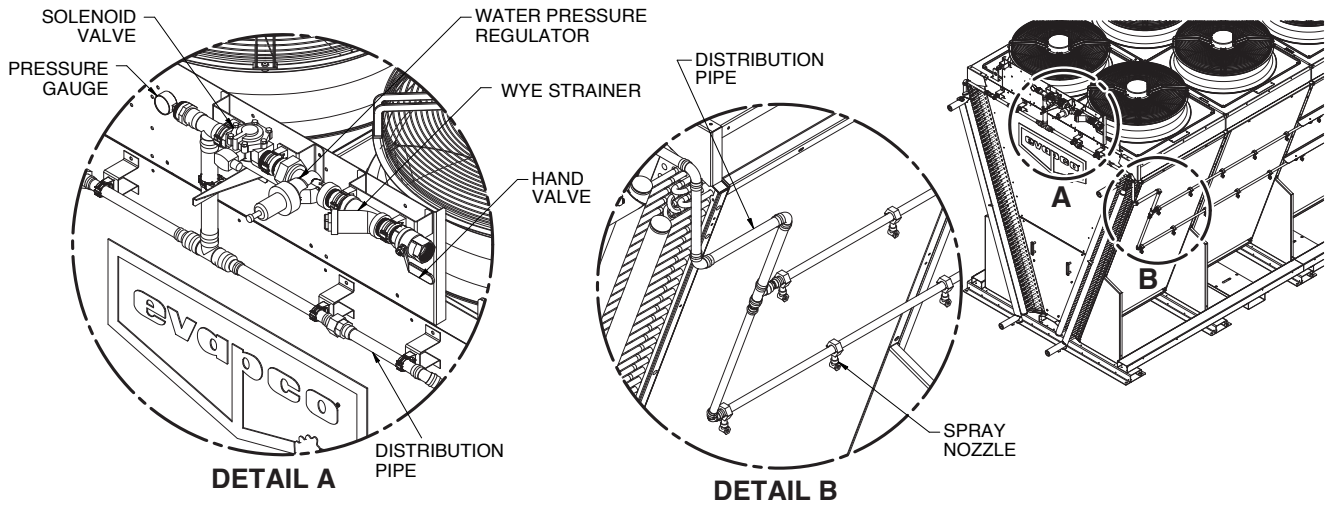
# eco-Air V Coil Configuration with EC Fans



## eco-Air Adiabatic System Components



## eco-Air Spray System Components



Note: If the adiabatic or spray system is provided with the "2-stage" accessory, quantity (2) solenoid valves will be provided.



For EVAPCO Authorized Parts and Service, Contact Your Local EVAPCO Representative or the Local Mr. GoodTower® Service Provider

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