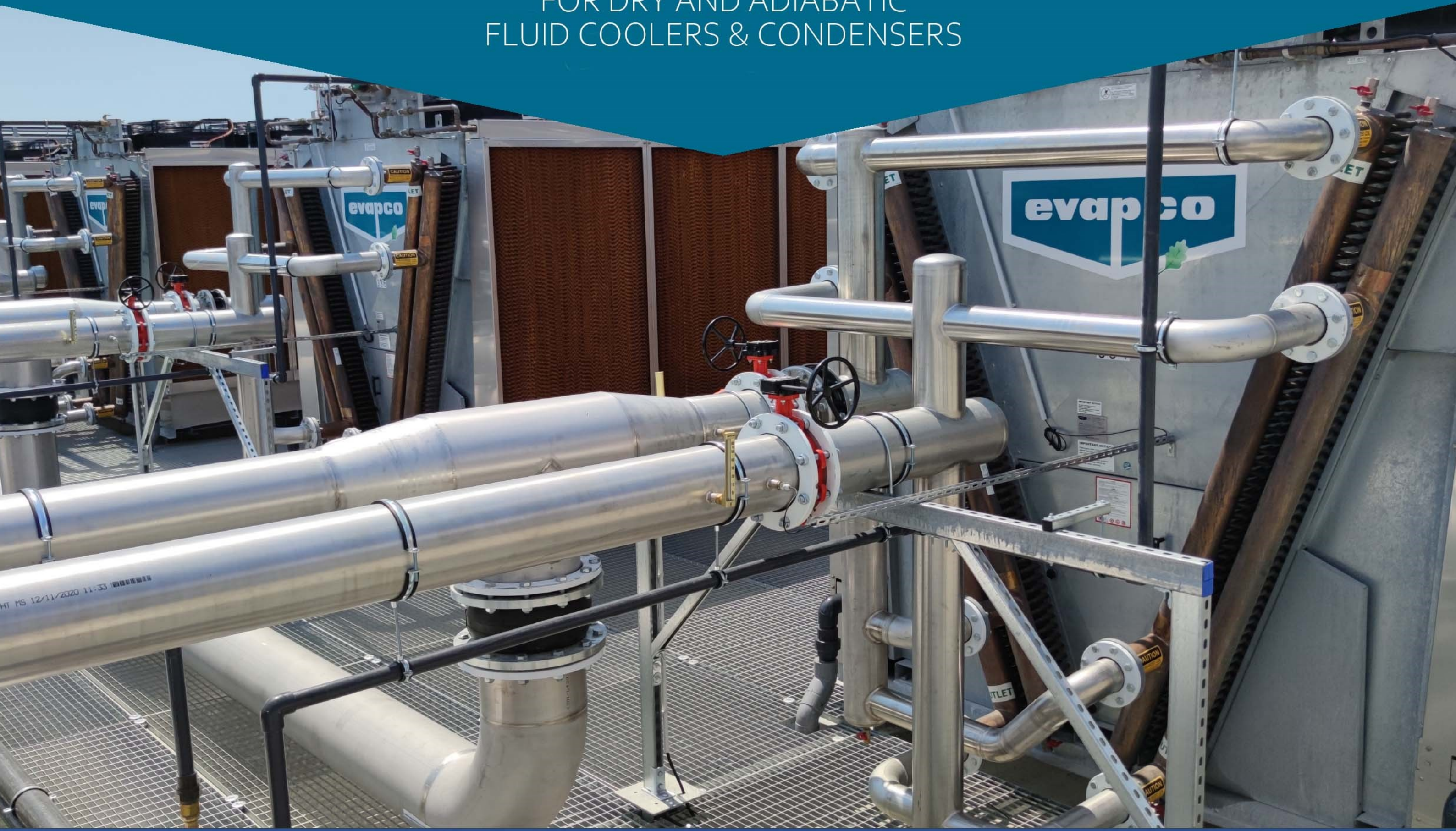
eco-Air Series

Equipment Layout Manual

FOR DRY AND ADIABATIC
FLUID COOLERS & CONDENSERS



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Introduction

This manual provides EVAPCO's layout recommendations to ensure that the eco-Air unit(s) will operate at their rated capacity. These units use large quantities of air as the main source of cooling; therefore, maintaining adequate clearances around the units is crucial to their performance. This manual includes layout information such as clearances from walls and other eco-Air units, different types of enclosures, and large scale installations.

Prior to consulting EVAPCO's recommended layout guidelines, consider context of the specific installation pertaining to space limitations, surrounding structures, existing units, proximity of neighbors, prevailing winds, piping, and any possible future expansion plans. For any alternate layouts which aren't included in this manual, please contact EVAPCO or your local EVAPCO representative for assistance.

Product Lines Included In this Manual

This equipment layout manual provides guidelines for the eco-Air Series of Dry & Adiabatic Coolers & Condensers:

EAW-FD Flat Dry Cooler
EAW-VD V-Coil Dry Cooler
EAW-DD Double Stack Dry Cooler
EAW-VA V-Coil Adiabatic Cooler
EAW-DA Double Stack Adiabatic Cooler

EAFCD Flat Dry Condenser
EAVCD V-Coil Dry Condenser
EAVCA V-Coil Adiabatic Condenser

The guidelines for fluid coolers and condensers are the same. This manual will refer to these products as Flat, V-Coil or Double Stack units. Any guidelines that are different for units equipped with adiabatic system are specifically outlined throughout this document.

Recirculation & Wind Considerations

EVAPCO's recommended location of installation for any dry or adiabatic unit would be in an area free from any obstructions or structures. This ensures the hot discharge air is not recirculated into the pathway of the air inlets. When the discharge air is recirculated, the entering air will be hotter than the specified ambient conditions which, in turn, can cause the unit to underperform. Therefore, the position of the unit to an adjacent wall, building, or other structure must be considered to ensure proper airflow.

The first consideration in minimizing recirculation is the height of the unit relative to the height of the surrounding structure. The top of the unit must be equal to or higher than the structure. See the two following cases (Figure 1 and Figure 2) that show the effects of positioning the top of the unit lower than that of a nearby structure. If the wind is moving toward the structure, as shown in Figure 1, it will force the hot discharge air into the structure where it could be pushed into the direction of the unit's air inlets. If the wind moves in the opposite direction, as shown in Figure 2, then the negative pressure created by the wind flowing over the structure and unit could force the discharge air back into the air inlets.

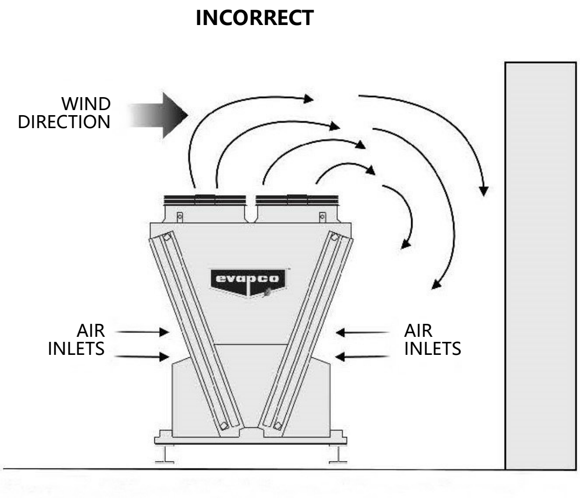


Figure 1 — Effect of Wind Directed Toward Surrounding Structure when Top of Unit is Lower Than Adjacent Structure

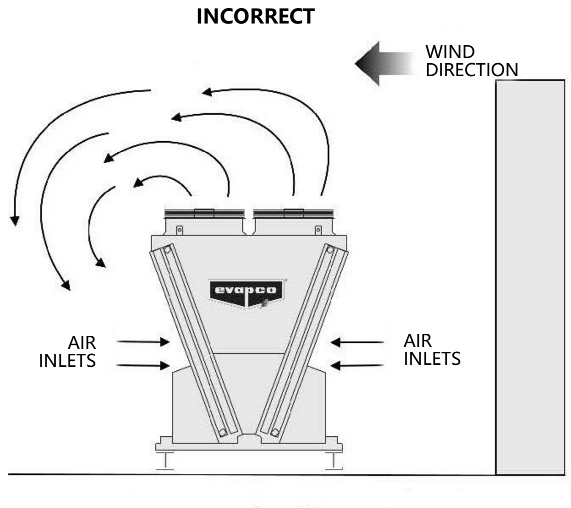


Figure 2 — Effect of Wind Directed Away from Surrounding Structure when Top of Unit is Lower Than Adjacent Structure

The negative impact of the conditions shown in Figure 1 and 2 can be reduced by elevating the unit on structural steel such that the top of the fan cowl is level with or higher than the adjacent structure, as shown in Figure 3.

For installations where this option is not possible, an experienced engineering decision must be made regarding the potential impact to thermal performance.

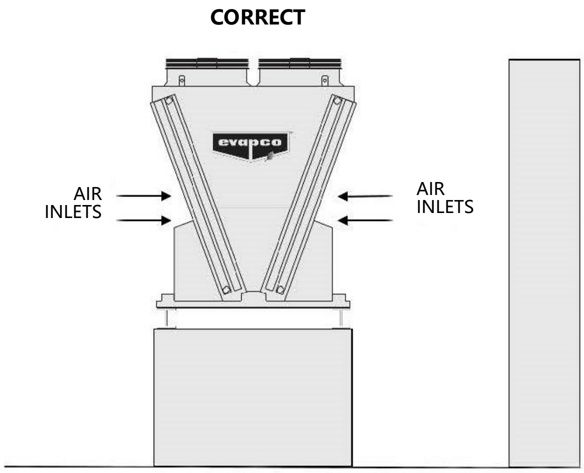
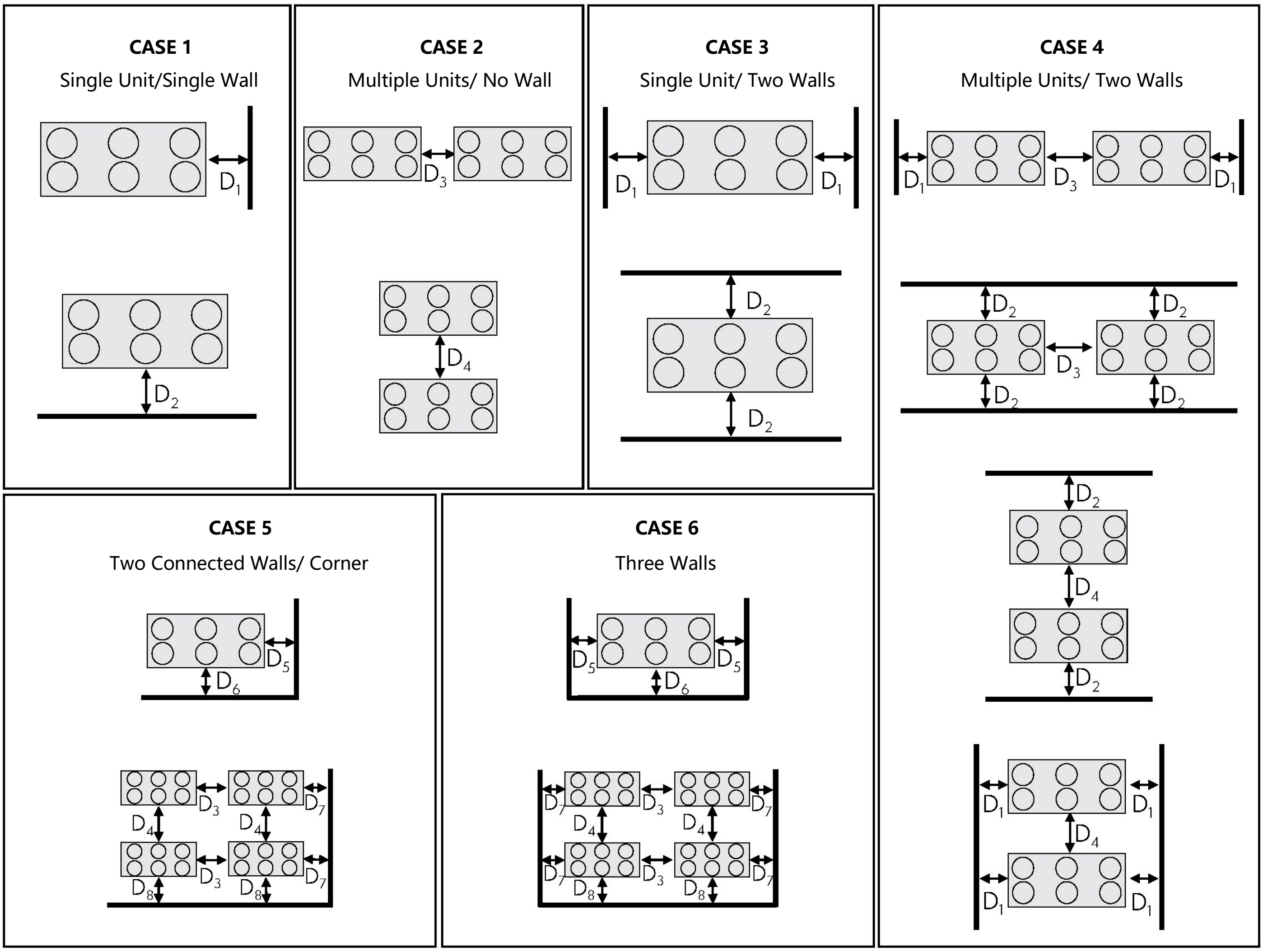


Figure 3 — Elevated Installation so Top of Unit is Level with or Higher than Adjacent Structure

Single & Multiple Unit Installations & Recommended Layout Clearances

Adequate clearances between eco-Air units and obstructions must be maintained to ensure that unit(s) have proper airflow and to minimize the possibility of recirculation. EVAPCO has developed recommended distances, D1 – D8 in Table 1, for various layouts shown in Cases 1-6 below.



Model	Length	Width	D1	D2	D3	D4	D5	D6	D7	D8
Flat	All	1.8m	0.9m	0.9m	1.8m	1.8m	0.9m	0.9m	0.9m	0.9m
Flat	All	2.1m&2.4m	1.2m	1.2m	2.4m	2.4m	1.2m	1.2m	1.2m	1.2m
V-Coil	Less than 3m	All	0.9m	0.9m	1.8m	1.8m	0.9m	0.9m	0.9m	0.9m
V-Coil	3m~6m	All	0.9m	1.5m	1.8m	3m	0.9m	1.5m	0.9m	1.5m
V-Coil	6m~9m	All	0.9m	1.8m	1.8m	3.7m	0.9m	1.8m	0.9m	1.8m
V-Coil	9m~12.2m	All	0.9m	2.1m	1.8m	4.3m	0.9m	2.1m	0.9m	2.1m
Double Stack	4m	All	1.2m	1.5m	2.4m	3m	1.2m	1.5m	1.2m	1.5m
Double Stack	8m	All	1.2m	2.4m	2.4m	4.9m	1.2m	2.4m	1.2m	2.4m
Double Stack	12m	All	1.2m	3m	2.4m	6.1m	1.2m	3m	1.2m	3m

Dimension Key

D1, D5 & D7- end to wall clearance

D2, D6 & D8- side to wall clearance

D3- end to end clearance

D4- side to side clearance

Table 1 — EVAPCO's Recommended Clearances for Dry and Adiabatic Units, Dimensions D1 – D8

Large Installations

For large dry and adiabatic unit installations that have four or more units, it is imperative that the unit layout be carefully examined during the design of the system. Very large multiple unit installations can create their own environment. Under certain weather and atmospheric conditions, the large quantity of discharge air will cause the dry bulb temperature in the immediate area to be higher than the local design data. The minimum dimensions shown in Table 1 should be increased whenever possible in order to allow for an additional safety factor. The potential increase in temperature is dependent on the number of units, type of installation, existing equipment, unit surroundings, and atmospheric conditions.

Locating a large installation in a valley or between buildings can change the surrounding environment by creating a higher dry bulb, which must be considered for layout and will not abide by the dimensions in Table 1. Prevailing winds must also be considered for these installations, specifically during the portion of the year with highest ambient temperatures. Figure 4 shows EVAPCO's recommendation for unit layout relative to prevailing wind direction during the hottest part of the year.

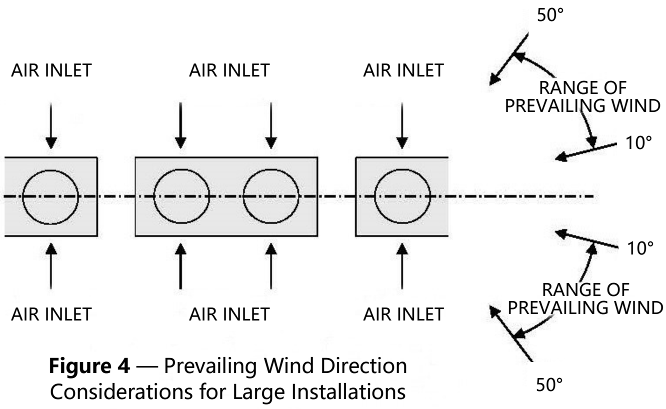


Figure 4 — Prevailing Wind Direction Considerations for Large Installations

Consult your local EVAPCO representative for recommended layout guidelines for very large multiple unit installations.

Expansions to Existing Systems

Expansions to existing systems present the same concerns as multiple/large unit installations. However, there are additional concerns that must be evaluated when planning a system expansion. Since in an expansion the new unit may not be identical to the existing one, it is important to examine the heights of the new and the existing units. Whenever possible, the tops of **ALL** of the units should be at the same level to avoid recirculation from one unit to another. If the unit discharge heights are different one or a combination of the following should be implemented. Either structural steel should be used to raise the air discharges of both units to the same level as shown, or the units should be spaced further apart than normally recommended.

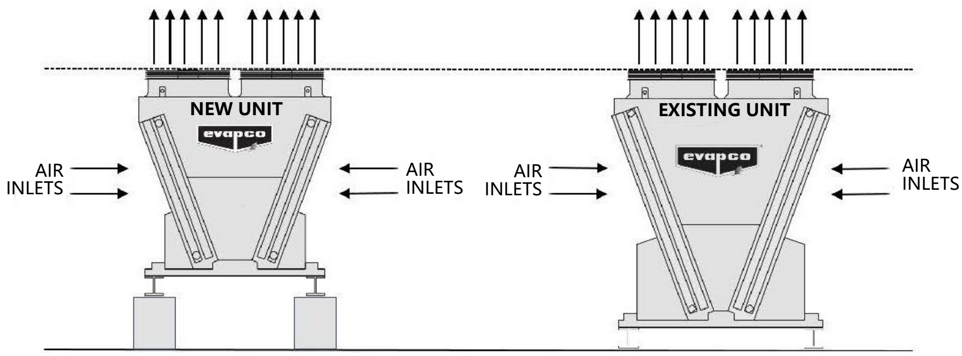


Figure 5 — Expansion into Existing System

Maintenance & Electrical Spacing Considerations

When a unit is located in close proximity to other structures, walls or equipment, there are minimum clearances required for periodic maintenance, piping connections, control panels or other obstructions. Unit drawings must be reviewed to ensure there is room for any future repair work. If the EVAPCO eco-Air unit is equipped with factory-wired enclosure, like a terminal box or control panel, local and national electrical codes must be consulted for adequate clearance requirements.

Solid & Louvered Enclosures (Enclosures & Well)

Example: A 2.2mx2.2m EAW-VD is centered in a 6mx7.3m well enclosure with the unit's discharge even with the top of the surrounding walls. Is this an acceptable equipment layout?

Unit & Enclosure Specifications:

Unit Area = 2.2x2.2=4.84m^2, Unit Airflow = 18.9m^3/s,

Well Area = 6mx7.3m=43.8m^2

Recommended Minimum Clearances (from Table 1):

D1 = 0.9m, D2= 0.9m

Calculations:

Actual D1 = (7.3m – 2.2m)/2 = **2.55m√**

Actual D2 = (6.m – 2.2m)/2 = **1.9m√**

Net Usable Well Area = 43.8m^2-4.84m^2= 38.96m^2

Downward Velocity = 18.9m^3/s÷38.96m^2= **0.485m/s √**

This example IS an acceptable layout with the given unit and enclosure specifications, as it meets all three recommendations.

Solid Wall Enclosures & Wells

When units are placed in solid enclosures and wells, there are three main considerations to ensure the chance for hot air recirculation is minimized.

#1. Clearances

The unit must follow clearance dimensions in Table 1 (page 4), and in many cases these dimensions must be increased when placed next to four solid walls. Accessory and electrical clearances must also be considered. The unit should also be oriented such that air can flow uniformly through on all four sides.

#2. Discharge Height

To diminish any opportunity for recirculation, the air discharge must be at level or higher than the enclosure or well walls. See page 3 for more information on this.

#3. Downward Air Velocity

The downward air velocity must be kept below 2m/s (400 FPM). Downward air velocity is the unit airflow divided by the usable well area, the space between the four sides of the unit and the walls (see the shaded portion of Figure 6). See the example calculation of the downward air velocity.

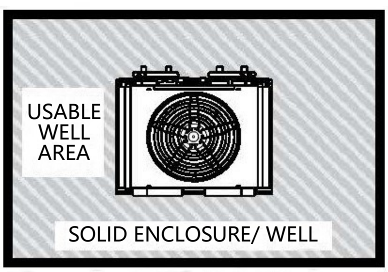


Figure 6 — Unit in Solid Enclosure

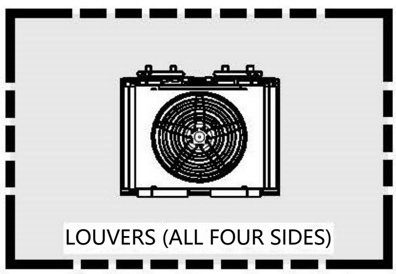


Figure 7 — Unit in Louvered Enclosure

Louvered Wall Enclosures

Dry and adiabatic units can also be installed in enclosures with louvered or slotted walls (Figure 7). With this type of enclosure, the air flow patterns will be a mixture of the open type and well installations. The inlet air will be drawn from the top and through the louvers or slotted openings. Since the air will follow the path of least resistance, the pressure drop across the louvers will determine how much air is drawn through them. To minimize the potential for recirculation, it is better to draw most of the air through the louvers.

Therefore, it is important that the louvers are designed for minimum pressure drop. To achieve this goal, the velocity through the louvers should be maintained at or below 3m/s (600 FPM), the louvers should have a minimum of 50% net free area, and the air inlets should face the louvers.

The first step in checking a louvered type of enclosure is to treat it as a well enclosure and calculate the downward air velocity assuming that all the air must enter from the top. If the downward air velocity is equal to or less than 2m/s (400 FPM), then the louvered enclosure will work regardless of the size of the louvers.

If the downward air velocity into the enclosure is greater than 2m/s (400 FPM), then another formula must be used. This formula assumes that ALL the air is drawn through the louvers. The total air flow (m^3/s) for the unit is divided by the net free louver area (m^2). The resultant air velocity must be below 3m/s (600 FPM). In addition to meeting this minimum louver velocity, the minimum air inlet to louver dimension must be 0.9m (3′) and the layout must meet the minimum space requirements for maintenance and unit accessories.

Elevated Unit Installations

Flat Models

Flat models can be elevated for those layouts where they must be placed closer together than EVAPCO's recommended guidelines. In Figure 8, the Z is elevation distance beyond standard leg height.

Elevation (Z)			0m	0.15m	0.3m	0.6m	≥ 1.2m
Spacing (Y)	Unit Width	1.8m	1.8m	1.8m	1.2m	0.6m	0m
		2.2m&2.4m	2.4m	1.8m	1.2m	0.6m	0m

Table 2 — Flat Model Elevation and Spacing Measurements

For example, if a 2.2m wide Flat unit is raised 0.6m (Z=0.6m), then only 0.6m (Y=0.6m) of side to side clearance is needed instead of 2.4m per Table 1.

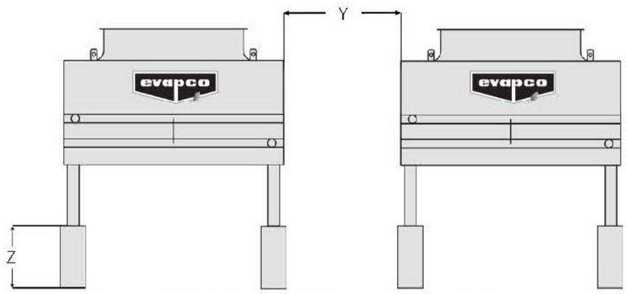


Figure 8 — Flat Model Elevation and Spacing Measurements Positions

V-Coil Models

V-Coil models can be elevated for those layouts where they must be placed closer together than this manual allows. The chart below shows spacing in elevated unit installations. See notes at bottom regarding adiabatic units and large unit layouts.

Elevation (Z)			0m	0.6m	1.2m	1.8m	2.4m	≥3m
Spacing (Y)	Unit Length	Less than	1.8m	1.2m	0.9m	0.8m	0.6m	0.6m
		3m-6m	3.0m	2.6m	2.3m	2.0m	1.8m	1.5m
		6m-9m	3.7m	3.2m	2.9m	2.6m	2.4m	2.1m
		9m-12.2m	4.3m	4.0m	3.7m	3.4m	3.0m	2.9m

Table 3 — V-Coil Model Elevation and Spacing Measurements

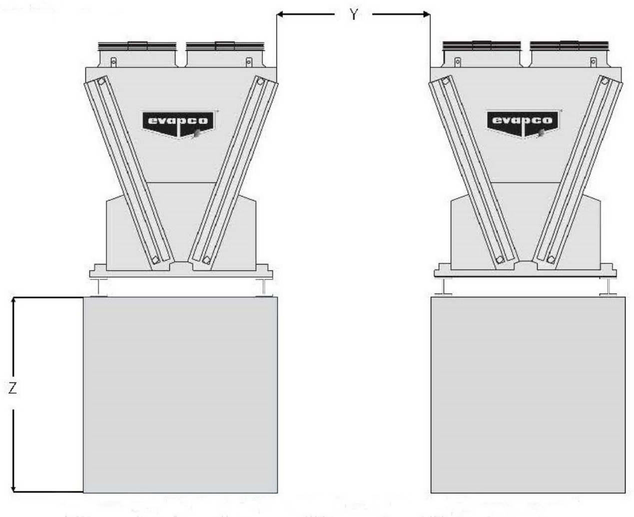


Figure 9 — V-Coil & Double Stack Model Elevation and Spacing Positions

Double Stack Models

See the following chart for spacing in elevated Double Stack unit installations.

Elevation (Z)			0m	0.6m	1.2m	1.8m	2.4m	≥3m
Spacing (Y)	Unit Length	4m	3.0m	2.3m	2.0m	1.8m	1.5m	1.4m
		8m	4.9m	4.3m	4.0m	3.7m	3.4m	3.0m
		12m	6.1m	5.8m	5.5m	5.0m	4.7m	4.6m

Table 4 — Double Stack Model Elevation and Spacing Measurements

Adiabatic eco-Air units can be elevated, but grade level layout guidelines apply. They cannot be elevated in lieu of spacing. This also applies to any dry cooler or condenser that would be retrofitted with adiabatic pad systems.

Large unit layouts won't necessarily see the same benefits from elevation. If you have any questions about layout scenarios not covered by this manual, please contact your local EVAPCO Sales Representative for confirmation of layout design.

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