



Layout Guidelines

Included are the design layout guidelines for evaporative cooling products in several situations typically encountered by designers. These guidelines represent minimum spacing requirements. If available, greater spacing should be utilized whenever possible.

> Overview

Operational efficiency of evaporative cooling equipment depends upon an adequate supply of fresh, ambient air to provide design capacity. Other important considerations, such as the proximity to building air intakes or discharges, also must be taken into account when selecting and designing the equipment site.

As the size of an installation increases, the total amount of heat being rejected into the atmosphere and the volume of discharge air increases — to the point where the units can virtually create their own environment. As a result, it becomes increasingly difficult to apply a set of general guidelines to each case. In such installations, particularly those in wells or enclosures, some air will recirculate. The recirculation should be minimized or design wet-bulb temperature must be adjusted to allow for the recirculation. Consequently, any job that involves four or more cells should be referred to your local BAC Representative for review.

Axial fan units are not generally suited for indoor or ducted applications. In such situations, a Series V centrifugal fan unit is recommended.

This section covers the general layout guidelines for the following BAC products:

1. Series 3000 Cooling Towers
2. Series 1500 Cooling Towers
3. FXT Cooling Towers
4. Series V Cooling Towers, Closed Circuit Cooling Towers, and Evaporative Condensers
5. Vertex™ Evaporative Condensers
6. FXV Closed Circuit Cooling Towers
7. HXV Hybrid Coolers
8. TrilliumSeries™ Adiabatic Coolers
9. CXVB and CXVT Evaporative Condensers
10. Nexus® Modular Hybrid Coolers

For PT2, PFi and PCC layout guidelines, see the separate layout guideline document. For TrilliumSeries™ Adiabatic Condensers, refer to the *Rigging, Installation, Operation & Maintenance Manual* at www.BaltimoreAircoil.com.



DID YOU KNOW?

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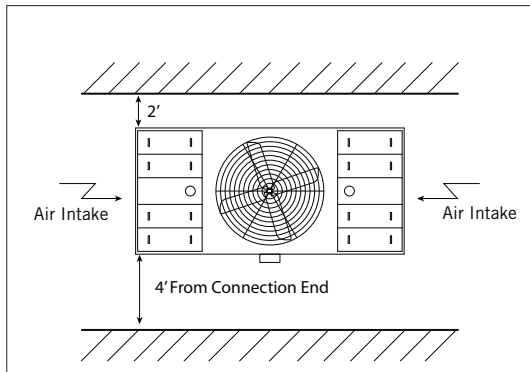


Figure 1a. Plan View of the Recommended Unit Servicing and Maintenance Spacing for a Dual Air Intake Unit: Series 3000 Cooling Towers, Dual Air Intake FXV Closed Circuit Cooling Towers, and CXVT Evaporative Condensers (Series 3000 Cooling Tower Shown)

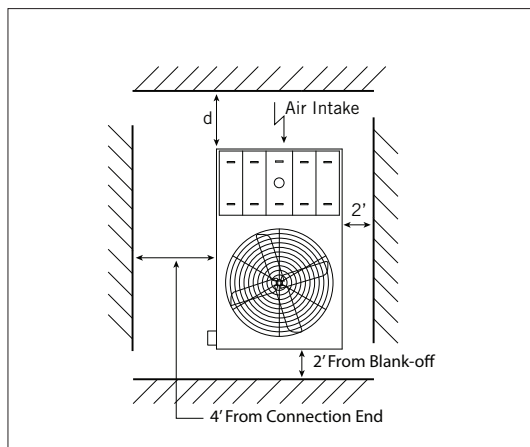


Figure 1b. Plan View of Recommended Unit Servicing and Maintenance Spacing for Single Air Intake Units: Series 1500 Cooling Towers, FXV Closed Circuit Cooling Towers, CXV Evaporative Condensers, and Series V Cooling Towers¹, Closed Circuit Cooling Towers, and Evaporative Condensers (Series 1500 Cooling Tower Shown)



NOTE: 1. On Models VT0-12 through 176, VC1-10 through 205, VF1-009, 018, 027, 036, and VF1-048 clearance equal to the length of the unit should be provided on one end to facilitate fan shaft removal.

> General Considerations

When selecting the site, consider the following factors:

1. Locate the unit to prevent the warm discharge air from being introduced into the fresh air intakes of the unit's building(s), intakes of neighboring buildings, or from being carried over any populated area such as a building entrance.
2. Consider the potential for plume formation and its effect on the surroundings, such as large windowed areas, and pedestrian or vehicular traffic arteries, particularly if the unit(s) will be operated during low ambient temperatures.
3. Provide sufficient unobstructed space around the unit(s) to ensure an adequate supply of fresh, ambient air to the air intake. Avoid situations that promote recirculation of unit discharge air, such as units located:
 - a. Adjacent to walls or structures that might deflect some of the discharge airstream back into the air intake.
 - b. Where building air intakes or exhausts, such as boiler stacks in the vicinity of the unit, might raise the intake wet-bulb temperature or starve the unit of air.
4. Provide adequate space around the unit for piping and proper servicing and maintenance, as shown in **Figures 1a, 1b, and 1c**.
5. If applicable the top of the fan discharge cylinder, velocity recovery stack, or discharge sound attenuation must be at least level with, and preferably higher than, any adjacent walls or buildings.
6. Orient the unit so the prevailing summer wind blows the discharge air away from the air intakes of the unit(s).
7. When the unit is installed with intake sound attenuation, the distances given in the **Tables 1-14** on pages **J92-J96** below should be measured from the face of the intake sound attenuation.
8. On larger unit installations, the problem of ensuring an adequate supply of fresh, ambient air to the tower intakes becomes increasingly difficult. See the "Multi-Cell Installation" section on **page J104**.
9. If the installation does not meet the recommended guidelines, the units will have a greater tendency to recirculate, and the design conditions should be altered to include an allowance for the recirculation. For instance, if the design conditions are 95°F/85°F/78°F (36.7°C/29.4°C/25.6°C) and it was estimated that the allowance for recirculation rate was 1 degree Fahrenheit (.56 degrees Celsius), then the new design conditions would be 95°F/85°F/79°F (36.7°C/29.4°C/26.1°C), and the units should be re-selected based on the new design conditions.

Layout Guidelines

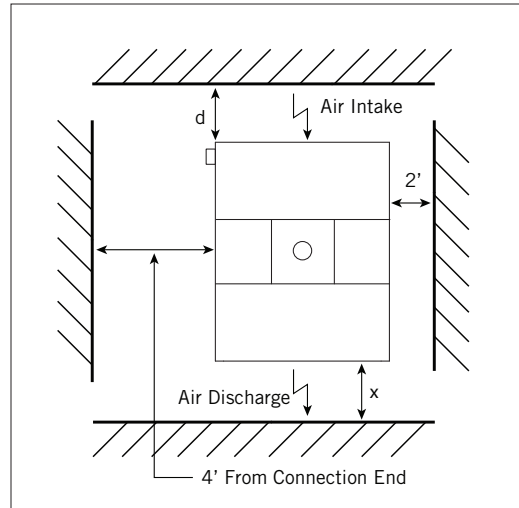


Figure 1c. Plan View of Recommended Unit Servicing and Maintenance Spacing for FXT Cooling Towers

The “Layout Guidelines” describe several typical site layouts for BAC’s cooling towers, closed circuit cooling towers, and evaporative condensers. If these guidelines do not cover a particular situation or if the layout criteria cannot be met, please refer the application to your BAC Representative for review. Please indicate prevailing wind direction, geographic orientation of the unit(s), and other factors such as large buildings and other obstructions that may influence layout decisions.

> Installations Adjacent to a Building or Wall(s)

- 1. Unit Orientation:** When a unit is located near a building wall, the preferred arrangement is to have the unit situated with the cased end or blank-off side (unlouvered side) facing the adjacent wall or building.
- 2. Air Intake Requirements:** Should it be necessary to install a unit with the air intake facing a wall, provide at least distance “d” between the air intake and the wall, as illustrated in **Figures 2a** and **2b**.

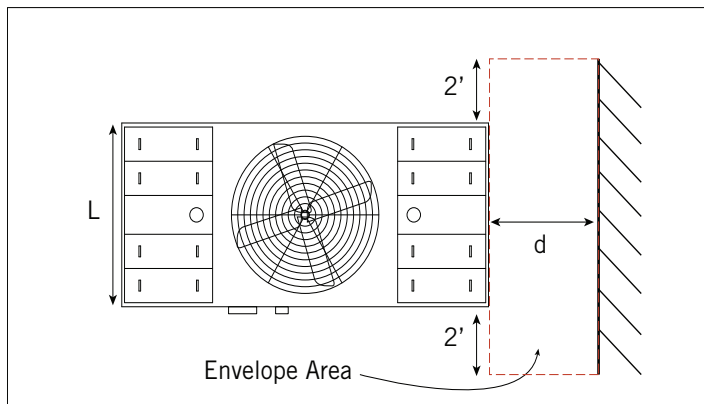


Figure 2a. Plan View of a Dual Air Intake Unit Adjacent to Wall

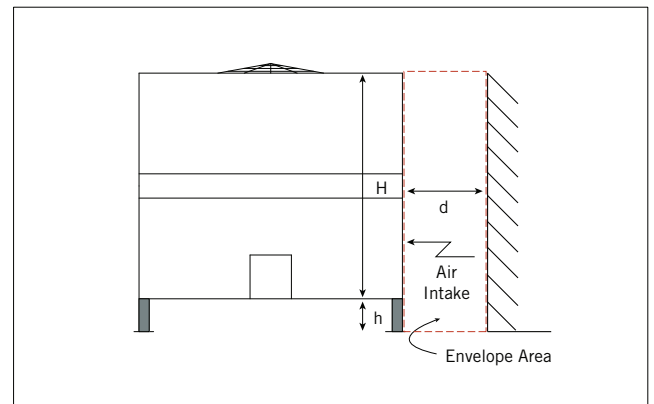


Figure 2b. Elevation View of a Dual Air Intake Unit Adjacent to Wall

Below is the method for determining the minimum acceptable dimension “d” for a unit located with the air intake facing a solid wall:

The maximum acceptable envelope air velocity is 300 FPM³, as illustrated in the following equation:

$$\text{Envelope Velocity} = \text{Airflow} / \text{Envelope Area} \leq 300 \text{ FPM}$$

The envelope area as illustrated on **Figures 2a** and **2b** on **page J90** is $[(L + 2 + 2) * d] + [2(H+h) * d]$, where:

- “H” – Height of the air intake face in feet
- “h” – Elevation of the unit from the roof/ground/pad in feet.
The maximum “h” value is 4'. For units installed at height greater than 4' use h = 4.
- “L” – Length of the air intake in feet
- “d” – Minimum acceptable distance between the wall and the air intake face in feet
- “x” – Minimum acceptable distance between wall and discharge face in feet (FXT only)²

$$\text{Therefore, } d = \frac{\text{Airflow}^1}{300 [L + 4 + 2 (H+h)]}$$

The minimum acceptable dimension “d” for the products is tabulated in **Tables 1 through 14** on **pages J92-J95**. The distance “d” was calculated using the largest horsepower model in the box size.



NOTE:

1. The louver face airflow for the FXV Closed Circuit Cooling Towers and CXVB Evaporative Condensers is 70% of the total unit airflow. The remaining 30% of the airflow enter the unit through the top of the coil section.
2. Calculate “x” with same equation for “d” using discharge face dimensions.
3. If a Series V unit cannot be designed to meet these criteria, a tapered discharge hood can be used to increase the maximum allowable downward air velocity to 400 FPM.

Example: Model S3E-1424-12S Adjacent to a Solid Wall

What is the minimum distance required between the air intake of the **S3E-1424-12S** when installed facing a wall?

$$\text{Unit Airflow} = 262,850 \text{ CFM} * 3 \text{ cells} = 788,550 \text{ CFM}$$

Note: Series 3000 units are dual air intake units, therefore the air intake airflow is half of the total unit airflow.

$$\text{Airflow} = \frac{\text{Unit Airflow}}{2} = \frac{788,550}{2}$$

$$\text{Airflow} = 394,275 \text{ CFM}$$

$$H = 19' 9" = 19.75', h = 0'$$

$$L = 42' 3" = 42.25'$$

Solving for “d”,

$$d = \frac{\text{Airflow}}{300 [L + 4 + 2(H+h)]}$$

$$d = \frac{394,275}{300 [42.25 + 4 + 2 (19.75 + 0)]}$$

$$d = 15.33'$$

This is rounded to the next 0.5' increment. Therefore, the air intake should be located no less than 15.5' from the solid wall.



Layout Guidelines

Example: Model VT1-415-R Adjacent to a Solid Wall

VT1-415-R with tapered discharge hood is installed adjacent to a solid wall. What is the minimum distance required between the air intake of the **VT1-415-R** when installed facing a wall?

Unit Airflow = 90,250 CFM

$H = 8' 4" = 8.33'$

$h = 0'$

$L = 11' 8" = 11.67'$

Note: With a tapered discharge hood, envelope velocity is increased to 400 FPM.

Solving for “d”,

$$d = \frac{\text{Airflow}}{400 [L + 4 + 2(H + h)]}$$

$$d = \frac{90,250 \text{ CFM}}{400 \text{ FPM} [11.67 + 4 + 2(8.33 + 0)]}$$

$$d = 6.98'$$

This is rounded to the next 0.5' increment. Therefore, the air intake should be located no less than 7.0' from the solid wall.

> Minimum Acceptable Air Intake Distance “d” (ft) to Solid Wall

Model Number	One Cell			Two Cell			Three Cell			Four Cell		
	h=0'	h=2'	h=4'	h=0'	h=2'	h=4'	h=0'	h=2'	h=4'	h=0'	h=2'	h=4'
S3E/XES3E-8518-05x	5.0	4.5	4.0	7.5	7.0	6.5	9.5	8.5	8.0	10.5	10.0	9.0
S3E/XES3E-8518-06x	5.5	5.0	4.5	8.5	8.0	7.5	11.0	10.0	9.5	12.0	11.5	11.0
S3E/XES3E-8518-07x	6.0	5.5	5.0	9.5	9.0	8.0	12.0	11.0	10.5	13.5	13.0	12.0
S3E/XES3E-1020-06x	5.5	5.0	4.5	8.5	8.0	7.5	10.5	10.0	9.5	12.0	11.5	10.5
S3E/XES3E-1020-07x	6.0	5.5	5.0	9.5	9.0	8.5	12.0	11.0	10.5	13.5	12.5	12.0
S3E/XES3E-1222-06x	6.0	5.5	5.0	9.0	8.5	8.0	11.0	10.5	9.5	12.0	11.5	11.0
S3E/XES3E-1222-07x	7.5	7.0	6.5	11.5	10.5	10.0	14.0	13.0	12.5	15.5	14.5	14.0
S3E/XES3E-1222-10x	8.0	7.5	7.0	12.5	12.0	11.0	15.5	15.0	14.0	18.0	17.0	16.5
S3E/XES3E-1222-12x	7.5	7.0	6.5	12.0	11.5	11.0	15.5	14.5	14.0	17.5	17.0	16.5
S3E/XES3E-1222-13x	7.5	7.0	6.5	12.0	11.5	11.0	15.5	14.5	14.0	17.5	17.0	16.5
S3E/XES3E-1222-14x	8.0	7.5	7.0	13.0	12.5	11.5	16.5	16.0	15.0	19.5	18.5	18.0
S3E/XES3E-1424-07x	8.0	7.5	7.0	12.0	11.0	10.5	14.0	13.5	12.5	15.5	15.0	14.5
S3E/XES3E-1424-12x	9.0	8.0	7.5	14.0	13.0	12.5	17.5	16.5	16.0	19.5	19.0	18.0
S3E/XES3E-1424-13x	8.5	8.0	7.5	14.0	13.0	12.5	17.0	16.5	16.0	19.5	19.0	18.0
S3E/XES3E-1424-14x	8.5	8.0	7.5	14.0	13.0	12.5	17.5	16.5	16.0	20.0	19.0	18.5

Table 1. Series 3000 Cooling Towers



NOTE: Refer to notes on Page J91 for calculation information.

Model Number	One Cell			Two Cell			Three Cell			Four Cell		
	h=0'	h=2'	h=4'	h=0'	h=2'	h=4'	h=0'	h=2'	h=4'	h=0'	h=2'	h=4'
S15E/XE15E-1285-06x	5.5	5	4.5	8.5	8	7	10.5	9.5	9	11.5	11	10.5
S15E/XE15E-1285-07x	6	5.5	5	9	8.5	8	11.5	10.5	10	13	12	11.5
S15E/XE15E-1285-09x	6	5	5	9.5	8.5	8	11.5	11	10	13.5	12.5	12
S15E/XE15E-1285-10x	6	5.5	5	9.5	9	8.5	12.5	11.5	11	14.5	13.5	13
S15E/XE15E-1212-07x	7.5	7	6	11	10	9.5	13	12.5	11.5	14.5	14	13
S15E/XE15E-1212-09x	7.5	7	6.5	11.5	11	10	14.5	13.5	13	16	15.5	14.5
S15E/XE15E-1212-10x	8	7.5	7	12.5	12	11	15.5	14.5	14	17.5	17	16
S15E/XE15E-1212-11x	8	7.5	7	12.5	11.5	11	15.5	14.5	14	17.5	17	16
S15E/XE15E-1212-12x	8	7	6.5	12.5	11.5	11	15.5	14.5	14	17.5	17	16
S15E/XE15E-1218-07x	9.5	8.5	8	13	12	11.5	15	14.5	13.5	16.5	15.5	15
S15E/XE15E-1218-09x	9.5	9	8.5	14	13.5	12.5	16.5	16	15	18	17.5	17
S15E/XE15E-1218-10x	10.5	9.5	9	15.5	14.5	14	18	17.5	16.5	20	19.5	18.5
S15E/XE15E-1218-11x	10.5	9.5	9	15.5	14.5	14	18.5	17.5	17	20.5	19.5	19
S15E/XE15E-1218-12x	10	9.5	9	15	14.5	13.5	18.5	17.5	17	20.5	19.5	19

Table 2. Series 1500 Cooling Towers

Model Number	No Discharge Hood			4' Discharge Hood		
	h=0'	h=2'	h= 4'	h=0'	h=2'	h= 4'
VT0-12-E to VT0-176-O	5	6	3	3.5	3	3
VT1-N209-P to VT1-N255-P	6.5	6	5	5	4.5	4
VT1-N301-Q to VT1-N395-R	8	7.5	6.5	6	5.5	5
VT1-N418-P to VT1-N510-P	9	8.5	7.5	7	6.5	6
VT1-M316-O to VT1-M420-R	8.5	7.5	6.5	6.5	5.5	5
VT1-M431-O to VT1-M610-R	10.5	9.5	8.5	8	7	6.5
VT1-M632-O to VT1-M840-R	12	11	10	9	8.5	7.5
VT1-M948-O to VT1-M1260-R	14	13.5	12.5	11	10	9.5
VT1-275-P to VT1-415-R	9	8.5	7.5	7	6.5	6
VT1-416-O to VT1-600-P	11.5	10.5	9	8.5	8	7
VT1-550-P to VT1-830-R	13.5	12.5	11.5	10	9.5	8.5
VT1-825-P to VT1-1335-S	17	16	15	13	12	11.5

Table 3. VT0 and VT1 Cooling Towers

Model Number	No Discharge Hood			4' Discharge Hood		
	h=0'	h=2'	h=4'	h=0'	h=2'	h=4'
VTL-016-E to VTL-039-H	3	3	3	3	3	3
VTL-045-H to VTL-079-K	3	3	3	3	3	3
VTL-082-K to VTL-095-K	3	3	3	3	3	3
VTL-103-K to VTL-137-M	4.5	3.5	3	3	3	3
VTL-152-M to VTL-227-O	6	5	4.5	4.5	4	3
VTL-245-P to VTL-272-P	7	6	5.5	5	4.5	4

Table 4. VTL Cooling Towers



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> Minimum Acceptable Air Intake Distance “d” (ft) to Solid Wall



NOTES:

1. "d" value was calculated using the largest horsepower motor available.
2. Max "h" value is 4'. For units installed at height greater than 4' use "d" value for h = 4.

Model Number	One Cell						
	h=0'	h=2'	h=4'	Model Number	h=0'	h=2'	h=4'
FXV-0806A, 0806B	4	3.5	3	FXV-0818B	8	7.5	7
FXV-0809A	5	4	3.5	FXV-1212B, HXV-1212N-1B	7.5	6.5	6
FXV-0809B	5	4.5	4	FXV-1212C, HXV-1212N-1C	8	7	6.5
FXV-0812A	6	5	4.5	FXV-1218B, HXV-1218N-1B	9.5	8.5	8
FXV-0812B	6.5	5.5	5	FXV-1218C, HXV-1218N-1C	10	9	8.5
FXV-0818A	7	6.5	6				

Table 5. FXV Closed Circuit Cooling Towers and HXV Hybrid Coolers

Model Number	One Cell			Two Cell		
	h=0'	h=2'	h=4'	h=0'	h=2'	h=4'
CXVB-X-0806-X	4	3.5	3	—	—	—
CXVB-X-0809-X	5	4.5	4	—	—	—
CXVB-X-0812-X	6	5.5	5	—	—	—
CXVB-X-0818-X	8	7	6.5	—	—	—
CXVB-X-1212-X	7.5	7	6.5	11.5	10.5	10
CXVB-X-1218-X	9.5	9	8.5	13.5	13	12

Table 7. CXVB Evaporative Condensers

Model Number	h=0'	h=2'	h=4'
TRF-1010N-C806x17E	2.7	2.4	2.2
TRF-1014N-C806x26E	3.6	3.3	3.0
TRF-1018N-C806x34E	4.4	4.0	3.7
TRF-1022N-C806x43E	5.1	4.7	4.3
TRF-1026N-C806x51E	5.6	5.2	4.8
TRF-1030N-C806x60E	6.0	5.6	5.3
TRF-1034N-C806x68E	6.4	6.0	5.7
TRF-1038N-C806x77E	6.8	6.4	6.0

Table 6. TrilliumSeries™ Adiabatic Cooler

Model Number	h=0'		h=2'		h=4'	
	x	d	x	d	x	d
FXT-58, 68	3	3	3	3	3	3
FXT-74, 87, 95	4	4	3.5	3.5	3	3
FXT-115, 130, 136	5	5	4.5	4.5	4	4
FXT-160, 175, 192	6.5	6.5	5.5	5.5	5	5
FXT-216, 240, 257	6.5	6.5	6	6	5.5	5.5

Table 8. FXT Cooling Towers

FXV3 Model Number	CXVT Model Number	One Cell			Two Cell		
		h=0'	h=2'	h=4'	h=0'	h=2'	h=4'
FXV3-1224-X-X	CXVT-x-1224-x and XECXVTx-1224-x	6	5.5	5	9.5	9	8.5
FXV3-1426-X-X	CXVT-x-1426-x and XECXVTx-1426-x	7	6.5	6	11	10.5	10
—	CXVT-x-2424-x and XECXVTx-2424-x	—	—	—	9.5	9	8.5
—	CXVT-x-2826-x and XECXVTx-2826-x	—	—	—	11	10.5	10

Table 9. FXV3 and CXVT Units

Model Number		No Discharge Hood			4' Discharge Hood		
		h=0'	h=2'	h=4'	h=0'	h=2'	h=4'
VF1-009-XXX	VC1-10 to 25	3	3	3	3	3	3
VF1-018-XXX	VC1-30 to 65	3	3	3	3	3	3
VF1-027-XXX	VC1-72 to 90	3	3	3	3	3	3
VF1-036-XXX	VC1-100 to 135	4	3.5	3	3	3	3
VF1-048-XXX	VC1-150 to 205	5	4.5	4	3.5	3	3
VF1-072-XXX	VC1-N208 to N230	6.5	5.5	5	5	4	3.5
VF1-096-XXX	VC1-N243 to N315	7	6	5.5	5	4.5	4
VF1-144N-XXX	VC1-N338 to N470	7	6.5	6	5	4.5	4
VF1-192-XXX	—	10	9	8	7	6.5	6
VF1-288N-XXX	—	9.5	8.5	8	7	6.5	6
VF1-1012N-XXXXX-XX	—	6.5	6	5.5	5.5	5	5
VF1-1018N-XXXXX-XX	—	9	8	7.5	7.5	7	6.5
VF1-1024N-XXXXX-XX	—	10	9.5	9	9	8.5	8
VF1-1036N-XXXXX-XX	—	13	12	11.5	11.5	11	10.5
VF1-144-XXX	VC1-386 to 516	10	9	8	7.5	6.5	6
VF1-216-XXX	VC1-540 to 804	13	11.5	10.5	9.5	8.5	8
VF1-288-XXX	VC1-772 to 1032	13.5	12.5	11.5	10	9.5	8.5
VF1-432-XXX	VC1-1158 to 1608	17.5	16	15	13	12	11.5
—	VC1-C216 to C320	6	5.5	5	4.5	4	3.5
—	VC1-C339 to C469	7	6.5	6	5.5	5	4.5

Table 10. VF1 and VC1 Units

Model Number	No Discharge Hood		
	h=0'	h=2'	h=4'
VCA-122A to 191A	3.5	3	3
VCA-174A to 259A	5.5	5	4.5
VCA-261A to 322A	5	4.5	4
VCA-323A to 446A	6	5.5	5
VCA-300A to 512A	7	6.5	6
VCA-460A to 779A	9	8.5	7.5
VCA-662A to 1024A	10.5	10	9
VCA-S700A to S884A	10	9.5	8.5
VCA-920A to 1558A	12.5	12	11
VCA-302A to 661A	9	8	7.5
VCA-526A to 1010A	11.5	10.5	9.5
VCA-S870A to S1204A	13	12	11
VCA-605A to 1321A	13.5	12.5	11.5
VCA-930A to 2019A	15.5	14.5	14

Table 11. VCA Evaporative Condensers

Model Number		No Discharge Hood			4' Discharge Hood		
		h=0'	h=2'	h=4'	h=0'	h=2'	h=4'
VFL-012-XXX	VCL-016 to 035	3	3	3	3	3	3
VFL-024-XXX	VCL-038 to 079	3	3	3	3	3	3
VFL-036-XXX	VCL-087 to 120	4.5	3.5	3	3	3	3
VFL-048-XXX	VCL-134 to 155	4.5	4	3.5	3.5	3	3
VFL-072-XXX	VCL-167 to 234	6	5.5	5	4.5	4	3.5
VFL-096-XXX	VCL-257 to 299	7	6.5	5.5	5.5	5	4.5

Table 12. VFL and VCL Units



Layout Guidelines

Model Number	# of Modules	h=0'
NXF-0403N-CS2TT-H1	1	3 ^[1]
NXF-0403N-CS2TT-H2	2	3
NXF-0403N-CS2TT-H3	3	4
NXF-0403N-CS2TT-H4	4	4.75
NXF-0403N-CS2TT-H5	5	5.25
NXF-0403N-CS2TT-H6	6	5.5
NXF-0603N-CS2TT-J1	1	3 ^[1]
NXF-0603N-CS2TT-J2	2	3 ^[1]
NXF-0603N-CS2TT-J3	3	3
NXF-0603N-CS2TT-J4	4	3.5
NXF-0603N-CS2TT-J5	5	4
NXF-0603N-CS2TT-J6	6	4.25

Table 13. Nexus® Modular Hybrid Cooler

Model Number	No Discharge Hood		
	h=0'	h=2'	h=4'
VRC-0213A to 0364A-1012N-XA	7	6.5	6
VRC-0327A to 0553A-1018N-XA	9	8	7.5
VRC-0470A to 0727A-1024N-XA	10.5	5	9
VRC-0653A to 1106A-1036N-XA	12.5	11.5	11
VRC-0214A to 0469A-1212N-XA	9	8	7.5
VRC-0374A to 0717A-1218N-XA	11	10.5	9.5
VRC-0429A to 0939A-1224N-XA	13	12	10.5
VRC-0661A to 1434A-1236N-XA	15.5	14.5	13.5
VRC-0241A to 0383A-1012N-XB	8	7	6
VRC-0357A to 0565A-1018N-XB	8	7	6.5
VRC-0482A to 0766A-1024N-XB	11.5	10.5	9.5
VRC-0713A to 1131A-1036N-XB	11	10	9.5
VRC-0281A to 0448A-1212N-XB	9	8	7.5
VRC-0417A to 0662A-1218N-XB	8.5	8	7
VRC-0562A to 0895A-1224N-XB	13	12	11
VRC-0835A to 1324A-1236N-XB	11.5	11	10.5

Table 14. Vertex™ Evaporative Condenser



NOTES FOR THE NEXUS MODULAR HYBRID COOLER:

1. Minimum dimension adjusted to allow for access to the EC Fan System via the swing-out access door.
2. To allow for the future removal of the drift eliminators and water collection, extra space may be required on the basin side of the unit. For NXF-0403x units this required distance is 4'. For NXF-0603x units this required distance is 6'.
3. All dimensions are measured from base of unit.
4. For accessing the iPilot™ Control System on the end of a unit (Face A or B), 38" of free space is required.
5. Calculations are based on a maximum air velocity of 300 fpm when considering a single, solid wall. These calculations also assume a maximum air envelope width of 1.5' wider than the unit on each side.



NOTES FOR THE VERTEX EVAPORATIVE CONDENSER:

1. "d" value was calculated using the largest horsepower motor available.
2. Max "h" value is 4'. For units installed at height greater than 4' use "d" value for h = 4.

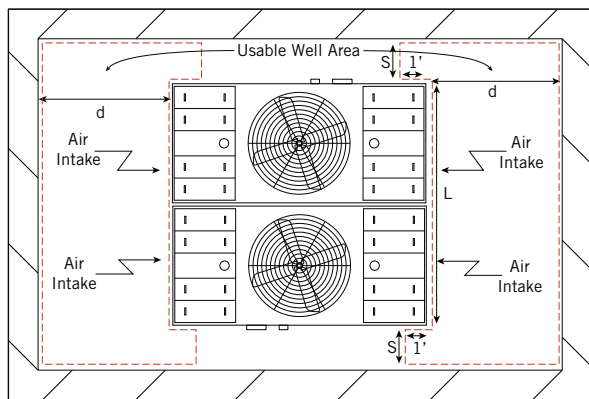


Figure 5. Plan View of Dual Air Intake Unit in a Well Enclosure

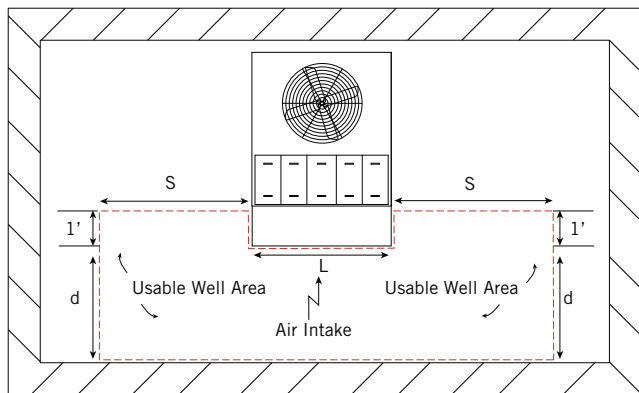


Figure 6. Plan View of Single Air Intake Unit in a Well Enclosure

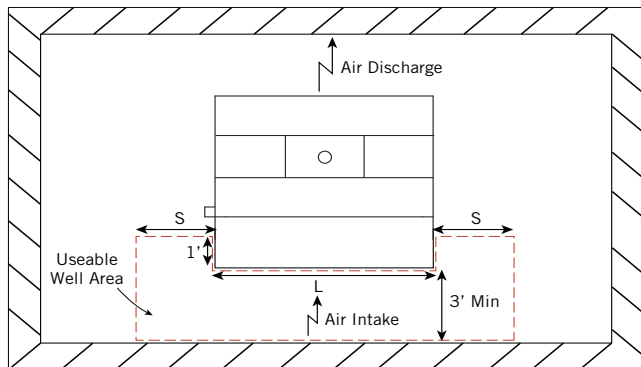


Figure 7. Plan View of Single Air Intake And Horizontal Discharge Units in a Well Enclosure

> Well Layout

The following method is used to determine the minimum acceptable dimension “d” for units installed in a well layout.

The maximum allowable downward air velocity for a well installation is 400 FPM. The downward velocity is determined using the following equation:

$$\text{Downward Air Velocity} = \text{Airflow} / \text{Useable Well Area} \leq 400 \text{ FPM}$$

The useable well area at each air intake face is defined as illustrated in **Figures 5, 6, and 7**.

Usable Well Area = $d(L + 2s) + 2(s \times 1')$, where:

“d” – minimum acceptable distance between the air intake of the unit and the wall of the well in feet

“L” – length of the air intake of the unit in feet

“s” – Distance usable well area extends beyond unit length (L). Maximum value for “s” is 4'. If greater than 4' clearance beyond the sides of the unit, use $s = 4$

$$\text{Therefore, } d = \frac{\left(\frac{\text{Airflow}^1}{400} \right) - 2s}{L + 2s}$$

The minimum acceptable distance “d” for well installations is tabulated in **Tables 15-28** on **pages J99-J102**.



NOTE:

1. The louver face airflow for the FXV Closed Circuit Cooling Towers and CXVB Evaporative Condensers is 70% of the total unit airflow. The remaining 30% of the airflow enters the unit through the top of the coil section.



Layout Guidelines

Example: Model FXV-0809B-28D-M in a Well

What is the minimum distance between the air intake of the FXV-0809-28D-M and the enclosure wall of the well?

Unit Airflow = 56,670 CFM

Note: Air intake airflow is 70% of total unit airflow for FXV Closed Circuit Cooling Towers

Airflow = Unit Airflow * 0.70 = 56,670 * 0.70

Airflow = 39,669 CFM

L = 9'

s = 4'

Solving for "d",

$$d = \frac{\left(\frac{\text{Airflow}}{400} \right) - 2s}{L + 2s}$$

$$d = \frac{\left(\frac{39,669}{400} \right) - (2*4)}{9 + (2*4)}$$

d = 5.36'

This is rounded up to the next 0.5' increment. Therefore the air intake should be no less than 5.5' from the enclosure walls.

Example: Model VF1-144-31Q in a Well

If the VF1-144-31Q has a 4' tapered discharge hood, what is the minimum distance between the air intake of the VF1-144-31Q and the enclosure wall in a well?

Unit Airflow = 86,500 CFM

L = 11' 8" = 11.67'

s = 4'

400 FPM = maximum allowable air downward velocity for a VF1 with a tapered discharge hood

Solving for "d",

$$d = \frac{\left(\frac{\text{Airflow}}{400} \right) - 2s}{L + 2s}$$

$$d = \frac{\left(\frac{86,500}{400} \right) - (2*4)}{11.67' + (2*4)}$$

d = 10.59'

This is rounded up to the next 0.5' increment. Therefore the air intake should be no less than 11' from the enclosure walls.

> Minimum Acceptable Air Intake Distance “d” (ft) in a Well



NOTE:

1. "d" value was calculated using the largest horsepower motor available and 4' clearance on both sides of the units intake face.

Model Number	One Cell	Two Cell	Three Cell	Four Cell
S3E/XES3E-8518-05x	6.0	8.5	9.5	10.0
S3E/XES3E-8518-06x	7.5	10.5	11.5	12.5
S3E/XES3E-8518-07x	9.0	12.0	13.5	14.5
S3E/XES3E-1020-06x	7.5	10.0	11.0	12.0
S3E/XES3E-1020-07x	9.0	12.0	13.0	14.0
S3E/XES3E-1222-06x	8.0	10.0	11.0	11.5
S3E/XES3E-1222-07x	10.5	13.5	14.5	15.5
S3E/XES3E-1222-10x	13.5	17.0	19.0	19.5
S3E/XES3E-1222-12x	14.5	18.0	20.0	21.0
S3E/XES3E-1222-13x	14.5	18.5	20.5	21.5
S3E/XES3E-1222-14x	16.5	21.0	23.0	24.0
S3E/XES3E-1424-07x	10.5	13.5	14.5	15.0
S3E/XES3E-1424-12x	16.0	19.5	21.0	22.0
S3E/XES3E-1424-13x	16.5	20.0	22.0	22.5
S3E/XES3E-1424-14x	17.0	21.0	22.5	23.5

Table 15. Series 3000 Cooling Towers

Model Number	One Cell	Two Cell	Three Cell	Model Number	One Cell	Two Cell	Three Cell
S15E/XE15E-1285-06x	7.0	9.5	10.5	S15E/XE15E-1212-11x	13.5	17.0	18.5
S15E/XE15E-1285-07x	8.0	11.0	12.0	S15E/XE15E-1212-12x	13.5	17.5	19.0
S15E/XE15E-1285-09x	9.0	12.5	14.0	S15E/XE15E-1218-07x	11.0	13.5	14.0
S15E/XE15E-1285-10x	10.5	14.0	15.5	S15E/XE15E-1218-09x	13.0	15.5	17.0
S15E/XE15E-1212-07x	9.5	12.0	13.0	S15E/XE15E-1218-10x	15.0	18.0	19.0
S15E/XE15E-1212-09x	11.5	14.5	15.5	S15E/XE15E-1218-11x	15.5	18.5	19.5
S15E/XE15E-1212-10x	13.0	16.0	18.0	S15E/XE15E-1218-12x	16.0	19.0	20.5

Table 16. Series 1500 Cooling Towers



Layout Guidelines

> Minimum Acceptable Air Intake Distance “d” (ft) in a Well

Model Number	One Cell
FXT-58, 68	3.5
FXT-74, 87, 95	5
FXT-115, 130, 136	6
FXT-160, 175, 192	7
FXT-216, 240, 257	8.5

Table 17. FXT Cooling Towers

Model Number	One Cell
VT0-12-E to VT0-176-O	4.5
VT1-N209-P to VT1-N255-P	6.5
VT1-N301-Q to VT1-N395-R	8
VT1-N418-P to VT1-N510-P	8.5
VT1-M316-O to VT1-M420-R	10
VT1-M431-O to VT1-M610-R	11.5
VT1-M632-O to VT1-M840-R	12.5
VT1-M948-O to VT1-M1260-R	14
VT1-275-P to VT1-415-R	11
VT1-416-O to VT1-600-P	12.5
VT1-550-P to VT1-830-R	14
VT1-825-P to VT1-1335-S	16.5

Table 19. VT0 and VT1 Cooling Towers with or without a Tapered Discharge Hood

Model Number	One Cell
VTL-016-E to VTL-039-H	3
VTL-045-H to VTL-079-K	3
VTL-082-K to VTL-095-K	4
VTL-103-K to VTL-137-M	5.5
VTL-152-M to VTL-227-O	7
VTL-245-P to VTL-272-P	8.5

Table 18. VTL Cooling Towers with or without a Tapered Discharge Hood

Model Number	One Cell
FXV-0806A	3.5
FXV-0806B, FXV-0809A	5
FXV-0809B	5.5
FXV-0812A	6
FXV-0812B, FXV-0818A	7.5
FXV-0818B, FXV-1212B, HXV-1212N-1B	9
FXV-1212C, HXV-1212N-1C	10
FXV-1218B, HXV-1218N-1B	10
FXV-1218C, HXV-1218N-1C	11.5

Table 20. FXV Closed Circuit Cooling Tower and HXV Hybrid Cooler

FXV3 Model Number	CXVT Model Number	One Cell	Two Cell
FXV3-1224-X-X	CXVT-x-1224-x and XECXVTx-1224-x	11.5	14.5
FXV3-1426-X-X	CXVT-x-1426-x and XECXVTx-1426-x	13.5	16.5
—	CXVT-x-2424-x and XECXVTx-2424-x	—	14.5
—	CXVT-x-2826-x and XECXVTx-2826-x	—	16.5

Table 21. FXV3 and CXVT Units

Model Number	One Cell	Two Cell
CXVB-X-0806-X	4.5	—
CXVB-X-0809-X	5.5	—
CXVB-X-0812-X	7	—
CXVB-X-0818-X	8	—
CXVB-X-1212-X	9.5	14
CXVB-X-1218-X	11	15

Table 22. CXVB Evaporative Condensers

Model Number	One Cell
VCA-122A to 191A	3.5
VCA-174A to 259A	5.5
VCA-261A to 322A	6.5
VCA-323A to 446A	6.5
VCA-300A to 512A	9
VCA-460A to 779A	10.5
VCA-662A to 1024A	11
VCA-S700A to S884A	11
VCA-920A to 1558A	12.5
VCA-302A to 661A	11
VCA-526A to 1010A	13
VCA-S870A to S1204A	14
VCA-605A to 1321A	14
VCA-930A to 2019A	15.5

Table 23. VCA Evaporative Condensers

Model Number	One Cell
VRC-0213A to 0364A-1012N-XA	9
VRC-0327A to 0553A-1018N-XA	10.5
VRC-0470A to 0727A-1024N-XA	11
VRC-0653A to 1106A-1036N-XA	12.5
VRC-0214A to 0469A-1212N-XA	11.5
VRC-0374A to 0717A-1218N-XA	13
VRC-0429A to 0939A-1224N-XA	14.5
VRC-0661A to 1434A-1236N-XA	15.5
VRC-0241A to 0383A-1012N-XB	10
VRC-0357A to 0565A-1018N-XB	9
VRC-0482A to 0766A-1024N-XB	12.5
VRC-0713A to 1131A-1036N-XB	11
VRC-0281A to 0448A-1212N-XB	11
VRC-0417A to 0662A-1218N-XB	9.5
VRC-0562A to 0895A-1224N-XB	14
VRC-0835A to 1324A-1236N-XB	11.5

Table 25. Vertex™ Evaporative Condensers

Model Number		One Cell
VFL-012-XXX	VCL-016 to 035	3
VFL-024-XXX	VCL-038 to 079	3
VFL-036-XXX	VCL-087 to 120	5.5
VFL-048-XXX	VCL-134 to 155	6
VFL-072-XXX	VCL-167 to 234	8
VFL-096-XXX	VCL-257 to 299	9

Table 24. VFL and VCL Units with or without a Tapered Discharge Hood

Model Number		One Cell
VF1-009-XXX	VC1-10 to 25	3
VF1-018-XXX	VC1-30 to 65	3
VF1-027-XXX	VC1-72 to 90	3
VF1-036-XXX	VC1-100 to 135	3
VF1-048-XXX	VC1-150 to 205	4.5
VF1-072-XXX	VC1-N208 to N230	6.5
VF1-096-XXX	VC1-N243 to N315	8
VF1-144N-XXX	VC1-N338 to N470	7.5
VF1-192-XXX	—	10
VF1-288N-XXX	—	9
VF1-1012N-XXXXX-XX	—	10.5
VF1-1018N-XXXXX-XX	—	12.5
VF1-1024N-XXXXX-XX	—	13
VF1-1036N-XXXXX-XX	—	15
VF1-144-XXX	VC1-386 to 516	11.5
VF1-216-XXX	VC1-540 to 804	14
VF1-288-XXX	VC1-772 to 1032	14.5
VF1-432-XXX	VC1-1158 to 1608	16.5
—	VC1-C216 to C320	6.5
—	VC1-C339 to C469	7

Table 26. VF1 and VC1 Units with or without a Tapered Discharge Hood



Model Number	# of Modules	d Value
NXF-0403N-CS2TT-H1	1	3.5
NXF-0403N-CS2TT-H2	2	4.75
NXF-0403N-CS2TT-H3	3	5.5
NXF-0403N-CS2TT-H4	4	5.75
NXF-0403N-CS2TT-H5	5	6
NXF-0403N-CS2TT-H6	6	6
NXF-0603N-CS2TT-J1	1	3 ^[1]
NXF-0603N-CS2TT-J2	2	3.75
NXF-0603N-CS2TT-J3	3	4
NXF-0603N-CS2TT-J4	4	4.5
NXF-0603N-CS2TT-J5	5	4.5
NXF-0603N-CS2TT-J6	6	4.75

Table 27. Nexus® Modular Hybrid Cooler

Model Number	d Value
TRF-1010N-C80Gx17E	3.2
TRF-1014N-C80Gx26E	4.1
TRF-1018N-C80Gx34E	4.8
TRF-1022N-C80Gx43E	5.4
TRF-1026N-C80Gx51E	5.7
TRF-1030N-C80Gx60E	6.0
TRF-1034N-C80Gx68E	6.3
TRF-1038N-C80Gx77E	6.5

Table 28. TrilliumSeries™ Adiabatic Cooler

**NOTES FOR THE NEXUS MODULAR HYBRID COOLER:**

1. Minimum dimension adjusted to allow for access to the EC Fan System via the swing-out access door.
2. To allow for the future removal of the drift eliminators and water collection, extra space may be required on the basin side of the unit. For NXF-0403x units this required distance is 4'. For NXF-0603x units this required distance is 6'.
3. All dimensions are measured from base of unit.
4. For accessing the iPilot™ Control System on the end of a unit (Face A or B), 38" of free space is required.
5. Calculations are based on a maximum air velocity of 400 fpm when considering a well installation. These calculations also assume a maximum air envelope width of 1.5' wider than the unit on each side.

> Louvered or Slotted Wall Installations

Check to see if the layout meets the requirements for a well installation. If the criteria for the well installation are met, the layout is satisfactory. If the layout does not satisfy the criteria for the well installation, analyze the layout as follows:

1. Air intake requirements:

- Units should be arranged within the enclosure such that the air intake directly faces the louver or slot locations as shown in **Figures 8 and 9**, with a minimum distance of three feet.
- If the available space does not permit the unit to be arranged with the air intakes facing the louvered or slotted walls and the enclosure cannot be modified to permit such an arrangement, consider the alternative illustrated in **Figures 10 and 11** on the following page. This arrangement should be restricted to one-cell or two-cell installations. The usable area of the louvers is only the length extending beyond the width of the unit.

2. Louver requirements:

- Louvers must provide at least 50% net free area to ensure that the unit airflow is not reduced due to friction or dynamic losses and that sufficient air is drawn through the openings and not downward from above.
- The required total louver or slot area is based on drawing the airflow through the net free area of the louvers at a velocity of 600 FPM or less.
- Locate the louver area in the walls of the enclosure such that air flows uniformly to the air intakes.
- If the unit is elevated to ensure the discharge is at the same level or above the top of the enclosure, it is acceptable to extend the louvered or slot area below the base of the units up to 2' if needed to achieve the minimum gross louver area. To calculate air velocity through the louver, the usable louvered or slot area may extend beyond the ends of the unit by a value $\frac{1}{2}$ the unit length (L), with 6' maximum on either side.

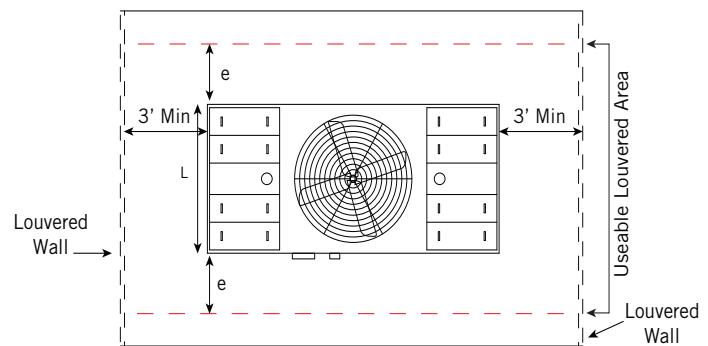


Figure 8. Plan View of Dual Air Intake Unit in Enclosure with Louvered Walls

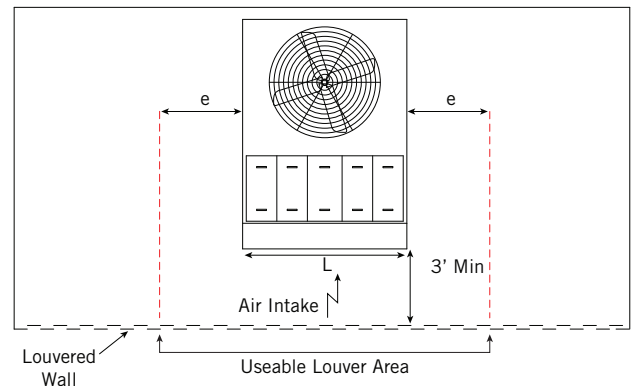


Figure 9. Plan View of Single Air Intake Unit in Enclosure with Louvered Walls

Layout Guidelines

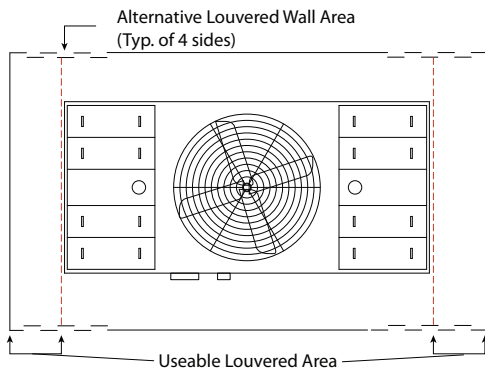


Figure 10. Plan View of Dual Air Intake Unit with Alternate Louver Arrangement

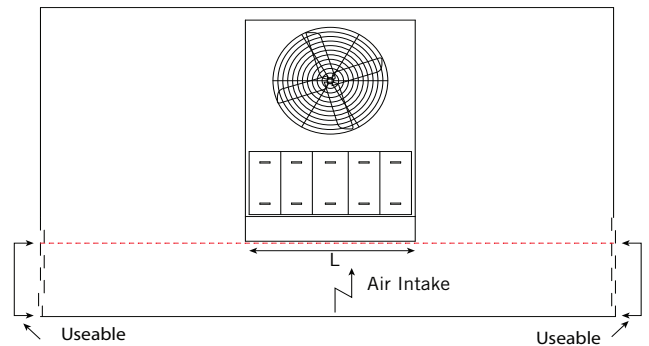


Figure 11. Plan View of Single Air Intake Unit with Alternate Louver Arrangement

Calculate the louver velocity as follows:

$$\text{Louver Velocity} = \frac{\text{Airflow}}{\% \text{ Louver Free Area} * \text{Usable Louver Area}} \leq 600 \text{ FPM}$$

"e" - Distance usable louvered area may extend beyond unit length (L) as illustrated in **Figures 8 and 9**. The value for "e" is 1/2 the unit length (L), not to exceed 6'.

Example: S3E-1222-06M-2 in a Louvered Enclosure

The enclosure is 27.5' long by 38' wide by 10' tall. The enclosure walls are equal in elevation to the unit discharge height. The louvers are 70% free area and 3' 0" from the air intake of the tower. The louvers extend the full width of the enclosure (38') on both air intake ends and they extend 9' vertically of the 10' enclosure height.

$$\text{Unit Airflow} = 120,200 \text{ CFM} \times 2 \text{ cells} = 240,400 \text{ CFM}$$

Note: Series 3000 units are dual air intake units, therefore the air intake airflow is half of the total unit airflow.

$$\text{Airflow} = \text{Total Unit Airflow} / 2 = 240,400 / 2 = 120,200 \text{ CFM}$$

$$L = 23' 10" = 23.83', L/2 = 23.83' / 2 = 11.9'$$

$$L/2 > 6', \text{ therefore } e = 6'$$

$$\text{Maximum Usable Louver Length} = L + 2e = 23.83' + (2 * 6) = 35.83' \text{ (of total 38' louver length)}$$

$$\text{Area} = 35.83 * 9 = 322.47 \text{ ft}^2$$

$$\begin{aligned} \text{Louver Velocity} &= \frac{\text{Airflow}}{(\% \text{ Louver Free Area}) * (\text{Usable Louver Area})} \\ &= \frac{120,200}{0.70 * 322.47} \\ &= 527 \text{ FPM} \end{aligned}$$

Therefore, louver sizing is sufficient because 527 FPM < 600 FPM maximum allowable louver velocity.

> Indoor Installation Layout Guidelines: Applicable for Series V Centrifugal Fan Products Only (VT0, VT1, VTL, VF1, VC1, VCL, and VFL)

1. Air intake requirements:

- Louvers must have at least 50% net free area.
- Install the cooling tower with the limitations shown in **Figure 12** for uniform air distribution.
- Determine the total louver or slot area required based on drawing the total unit airflow through the net free area of the louvers at a velocity of 800 FPM or less.
- The louver or slot area should be located in the walls of the enclosure so that air flows uniformly to all air intakes.
- It is acceptable to extend the louvered or slot area below the base of the unit if needed to achieve the minimum gross free area. The usable louvered or slot area may also be extended beyond the ends of the tower by a maximum 4'.
- As a general rule, axial fan units cannot be located indoors.

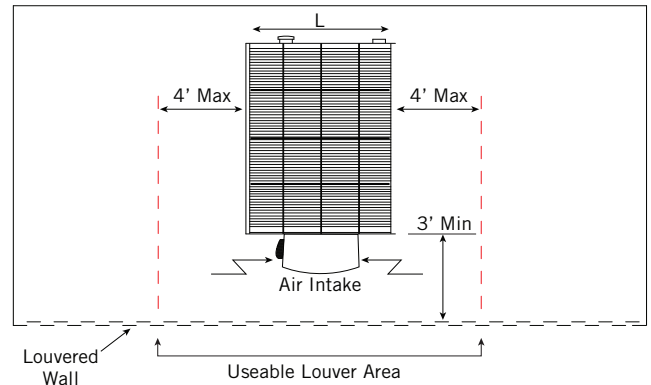


Figure 12. Plan View of Single Air Intake Unit in Enclosure with Louvered Walls and Closed Top Installation

2. Ductwork requirements:

- Air velocities in the intake duct should be kept below 800 FPM to hold static pressure losses to a minimum and ensure a uniform supply of air to all fans. In general the maximum allowable External Static Pressure (ESP) on Series V centrifugal fan units is 1/2". Consult the factory for any ESP greater than 1/2".
- Air velocities in the discharge duct(s) should not exceed 1,000 FPM to reduce friction losses in the duct, and more importantly, to ensure uniform air distribution through the unit.
- Turns in intake or discharge ducts should be avoided. Where turns must be used, velocities should be minimized in the vicinity of the turn. Turns in discharge ducting should be designed in accordance with the "2/3's rule" shown in **Figure 13a** and **13b**.
- Where individual fan sections are to be cycled for capacity control, each fan section must be ducted as a separate system on both intake and discharge to avoid recirculation within the ductwork. All ductwork systems should be symmetrical to ensure that each fan section operates against the same ESP.
- Access doors must be provided in both the intake and discharge ducts.
- When multi-cell units are located indoors with the room as the plenum, the installation must be operated as a single unit to avoid pulling air through an idle cell.

Layout Guidelines

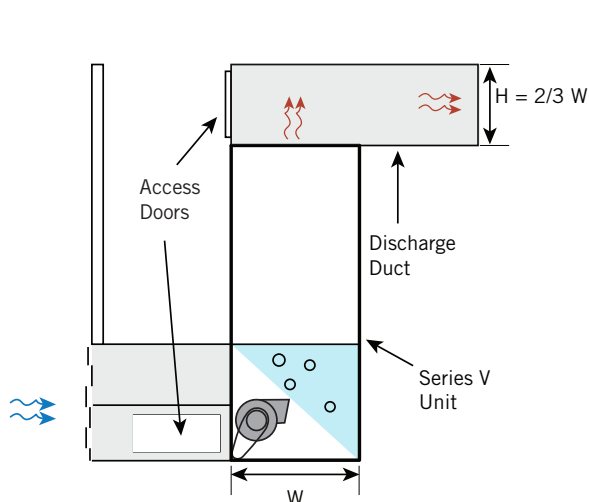


Figure 13a. Elevation Side View of Ducted Unit Enclosure

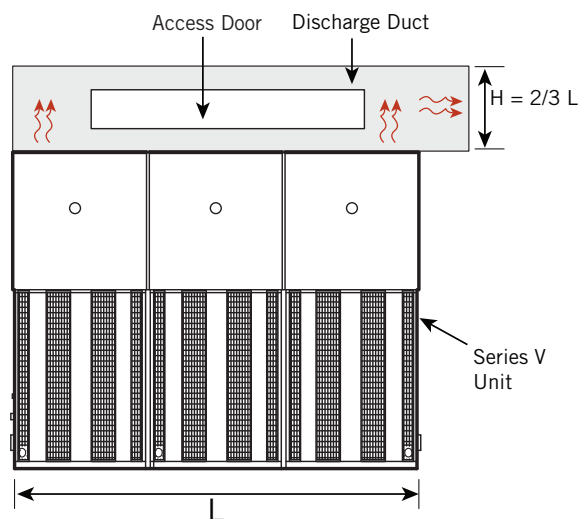


Figure 13b. Elevation Front View of Ducted Unit

> Multi-Cell Installation

Multiple cells create a “wall” of moist discharge air which could easily be swept into the air intakes due to prevailing wind. To minimize the potential of recirculation of the discharge air, the units should be situated with adequate spacing between air intakes.

When multiple cells are arranged with the air intakes facing each other, the distance between air intakes should follow the equation below:

$M = (2 * d) + (\text{number of cells per module})$, where “d” is obtained from the appropriate model for "Installations Adjacent to a Building or Wall(s)" on **page J90-J92**.

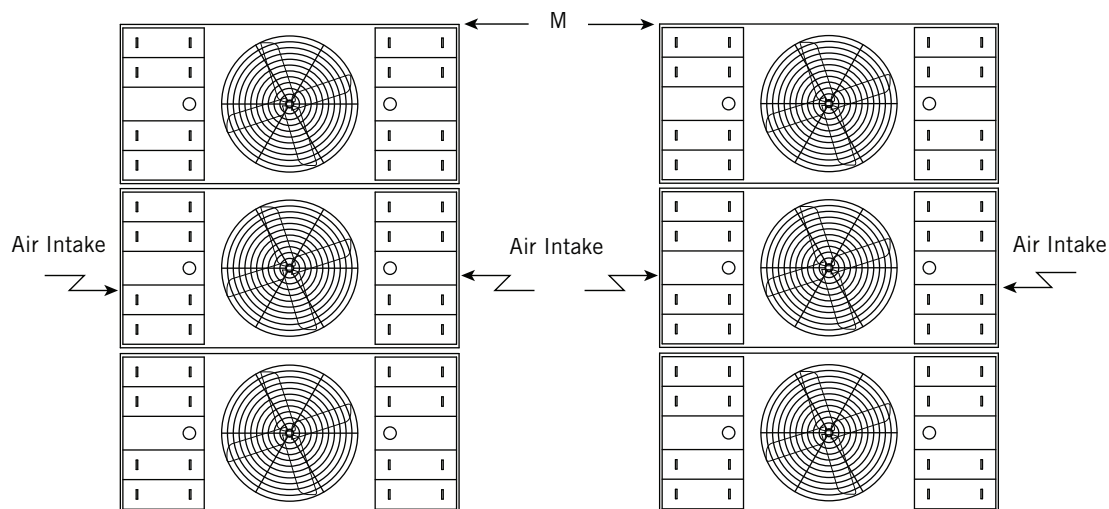


Figure 14. Plan View of Multi-Cell Units with Air Intakes Facing Each Other

Example: Model S3E-1222-14R (see Figure 14)

There are two banks of three cell unit modules on a roof. There are no enclosures surrounding the unit installation. The two banks of units have air intakes facing each other. What is the minimum distance “M” between banks of units?

From **Table 1** on **page J92**, $d = 15'$

$$\begin{aligned} M &= (2 * d) + (\text{number of units per module}) \\ &= (2 * 15) + 3 \\ &= 33 \text{ feet} \end{aligned}$$

The calculated “M” dimension of 33 feet will minimize the potential for recirculation of the discharge air.

Group units in two cell or three cell modules, spaced at least one unit length between adjacent end walls to allow fresh air to circulate around each group, as shown in **Figure 15**.

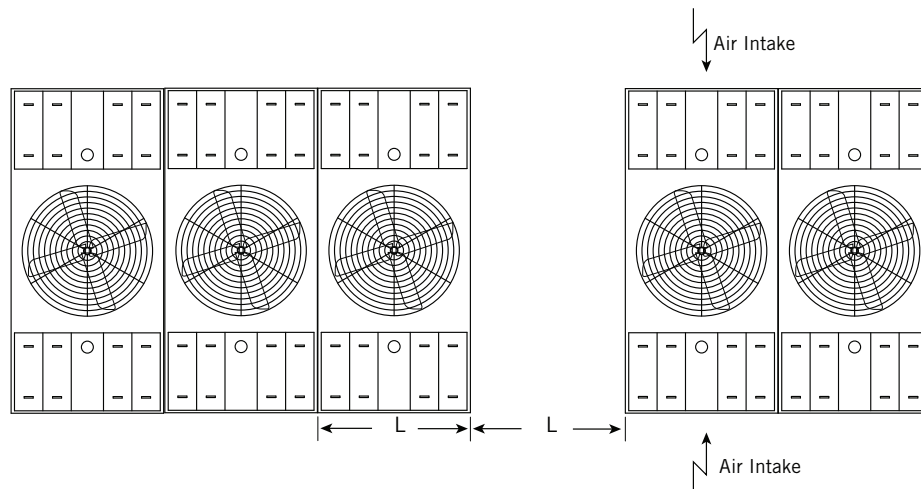


Figure 15. Plan View of Recommended Multi-cell Installation

In the extreme case, when multiple cells are arranged with the air intakes facing each other in a well, the dimensions between the cells should follow the following requirements.

1. **Enclosure:** The bottom 3 feet of the well should be louvered a minimum of 50% net free area to allow air flow under the units as shown in **Figure 17**.
2. **Support:** The units should be raised off the roof deck to allow fresh air to flow under to the air intakes between the bank of cells.
3. **The distance between the cells should be determined using the following method:**
 - a. Determine the maximum airflow drawn from the louvered area using the following equation:
CFM drawn through the louvers = Louver Velocity * % Louver Free Area * Usable Louver Area
CFM drawn through the louvers = 600 FPM * % Louver Free Area * Usable Louver Area
 - b. Determine the CFM drawn from the top of the enclosure using the following equation:
CFM drawn from the top of the enclosure = 400 FPM * Usable Well Area

Layout Guidelines

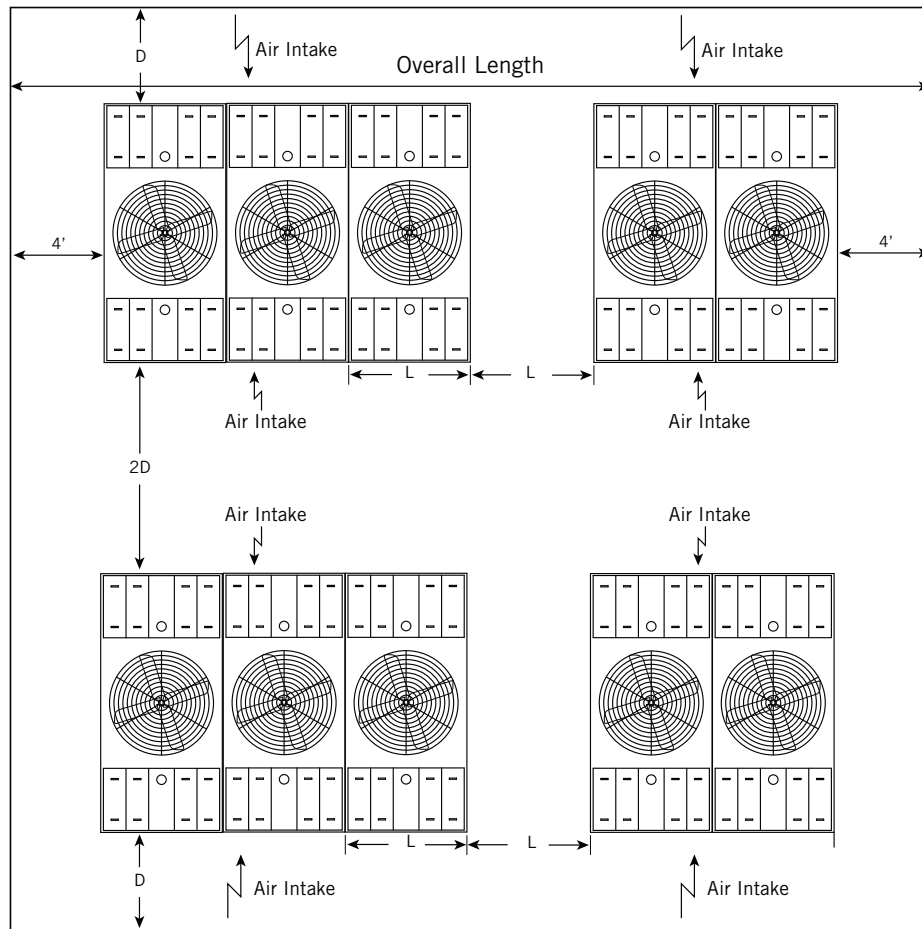


Figure 16. Plan View of Multi-cell Installation

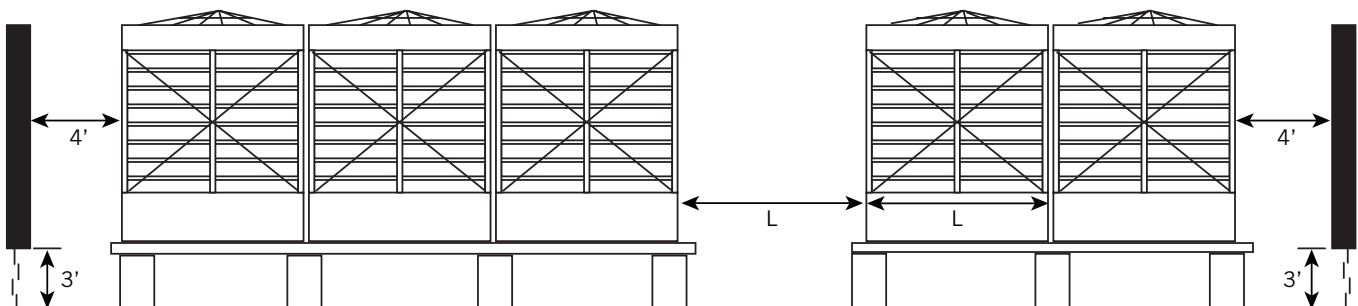


Figure 17. Elevation View of Recommended Enclosure

Example: (10) S3E-1222-14S (See Figure 16)

Bottom 3' of enclosure is louvered with 50% net free area. What is the minimum distance "D" between the banks of cells.

$$\text{Unit Airflow} = 244,030 \text{ CFM} * 10 \text{ cells} = 2,440,300 \text{ CFM}$$

$$L = 11' 10" = 11.83'$$

$$\begin{aligned}\text{Usable Length} &= (\text{Number of cells} * L) + (\text{Number of Openings} * L) + 4' + 4' \\ &= (5 * 11.83) + (1 * 11.83) + 4 + 4 \\ &= 78.98' \text{ feet}\end{aligned}$$

$$\text{Usable Width} = 4D$$

$$\text{CFM Drawn Through Louvers} = \text{Louver Velocity} * \% \text{ Louver Free Area} * \text{Usable Louver Area}$$

$$\begin{aligned}&= \text{Louver Velocity} * \% \text{ Louver Free Area} * \text{Perimeter of the Enclosure} * \text{Height of Louvered Wall} \\ &= \text{Louver Velocity} * \% \text{ Louver Free Area} * [2(\text{Usable Length} + \text{Usable Width}) * \text{Louver Height}] \\ &= 600 * 0.5 * [2(78.98 + 4D) * 3] \\ &= 142,164 + 7,200D\end{aligned}$$

$$\text{CFM Drawn from Top of the Enclosure} = \text{Downward Velocity} * \text{Usable Area}$$

$$\begin{aligned}&= \text{Downward Velocity} * (\text{Usable Length} * \text{Usable Width}) \\ &= 400 * 78.98 * 4D \\ &= 400 * 4D * 80 \\ &= 126,368D\end{aligned}$$

$$\text{Total CFM} = \text{CFM Drawn through louvers} + \text{CFM Drawn from Top of the Enclosure}$$

$$2,449,300 = 142,164 + 7,200D + 126,368D$$

$$133,568D = 2,298,136$$

$$D = 17.21'$$

The "Layout Guidelines" describe several typical site situations involving evaporative cooling products. If these guidelines do not cover a particular situation or if the layout criteria cannot be met, please refer the application to the your local BAC Representative for review. Please indicate prevailing wind direction, geographic orientation of the unit(s), and other factors such as large buildings and other obstructions that may influence layout decisions.