PT2, PFi, & PCC Layout Guidelines

Included are the layout guidelines for PT2 Cooling Towers, PFi Closed Circuit Cooling Towers, and PCC Evaporative Condensers 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, must also 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 increase — 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 the 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.

?

DID YOU KNOW?
As the size of an installation increases, the total amount of heat being rejected into the atmosphere and the volume of discharge air increase — to the point where the units can virtually create their own environment. Following these layout guidelines can minimize air recirculation and ensure optimal performance.

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 building(s) served by the unit, 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 intakes. Avoid situations which 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 intakes.

   b. Where building air intakes or exhausts, such as boiler stacks in the vicinity of the unit, might raise the entering 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 **Figure 1**. Maintain 3' minimum around unit for maintenance access and 4' minimum from connection end.

5. The fan discharge cylinder must be at least level with or higher than any adjacent walls or buildings.

6. On larger unit installations, involving multiple cells on one site, the total heat rejection and volume of discharge air may be so great that the units virtually create their own environment. In such situations, the problem of ensuring an adequate supply of fresh, ambient air to the tower intakes becomes increasingly difficult. Therefore, please contact the local BAC Representative for further direction.

7. 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 and it was estimated that the allowance for recirculation rate was 1°F, then the new design conditions would be 95°F/85°F/79°F and the units should be reselected based on the new design conditions.
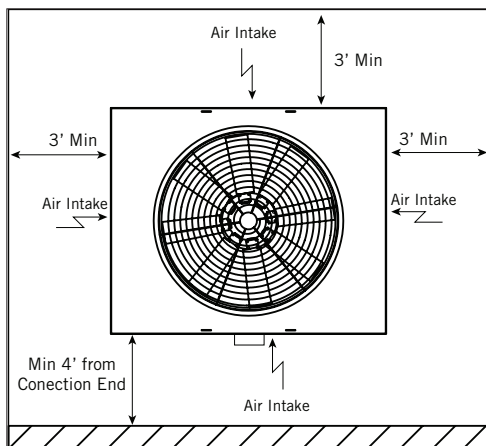

Figure 1. Plan View of Recommended Unit Servicing and Maintenance Spacing

PT2, PFi, & PCC Layout Guidelines

If these guidelines do not cover a particular situation or if the layout criteria cannot be met, please contact 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.

❯ Installations Adjacent to a Building or Wall(s)

Should it be necessary to install a unit adjacent to a building or wall(s), provide at least distance "X" or "Y" between the air intake and the wall, as illustrated in **Figures 2** and **Figure 3**.
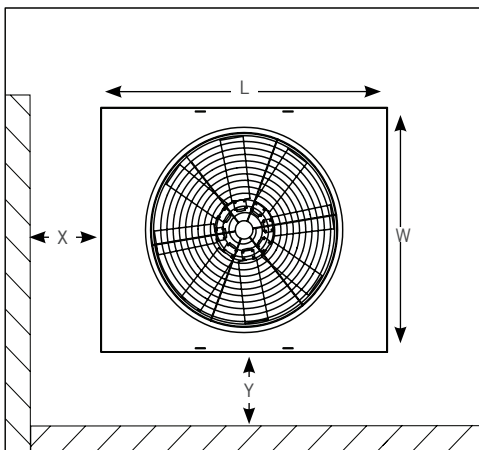

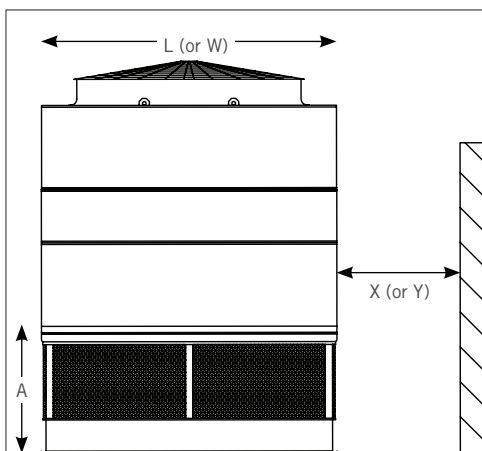**Figure 2.** Plan View of PT2, PFi, or PCC Unit Adjacent to One or More Walls

Figure 3. Section View of a PT2, PFi, or PCC Unit Adjacent to Wall

Below is the method for determining the minimum acceptable dimensions "X" and "Y" for a PT2, PFi, or PCC located adjacent to one or more solid wall(s). The recommended envelope air velocity for a PT2 Cooling Tower, PFi Closed Circuit Cooling Tower, and PCC Evaporative Condenser is 300 FPM. We must solve the following equations for the desired distance, "X" or "Y":

Envelope Air Velocity = (% Airflow per Intake) / (Envelope Area)

% Airflow per Inlet = [L (or W) / Total Air Intake Perimeter]

Total Air Intake Perimeter = 2L + 2W

Envelope Area = [(L * Y) + 2(A * Y)] or [(W * X) + 2(A * X)] , where:

"A" = height of the air intake section in feet

"L" = length of the unit in feet

"W" = width of the unit in feet

"X" = minimum acceptable distance between the wall and the air intake face "W", in feet

"Y" = minimum acceptable distance between the wall and the air intake face "L", in feet

The minimum acceptable dimensions "X" and "Y" in this orientation have already been tabulated for 1 thru 4 cell units in **Table 1** for the PT2 Cooling Tower**,** tabulated for 1, 2, and 4 cell units in **Table 2** for the PFi Closed Circuit Cooling Tower, and tabulated in **Table 3** for the PCC Evaporative Condenser.
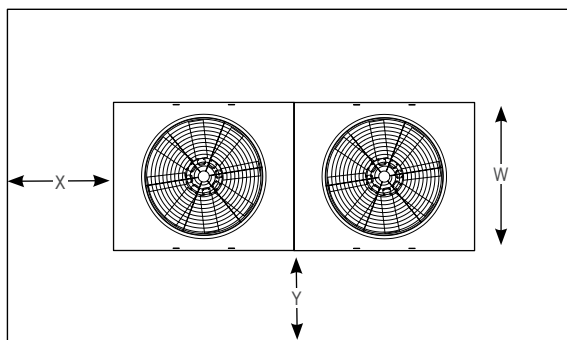
Figure 4. Plan View of a Two Cell PT2-XXXXA-**2 Arrangement
Plan View of PCC-x-0718x, PCC-x-1024x, PCC-x-1224x, PCC-x-1236x, and PCC-x-1240x
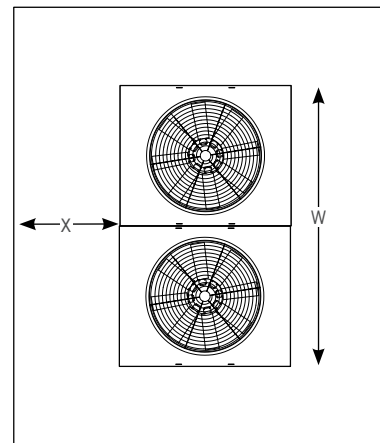Plan View of PFi-0718x, PFi-1024x, PFi-1224x, and PFi-1236x

Figure 5. Plan View of a Two Cell PT2-1218A-**T Arrangement
Plan View of a Two Cell PCC-x-2012x, PCC-x-2412x, PCC-x-2418x, and PCC-x-2420x
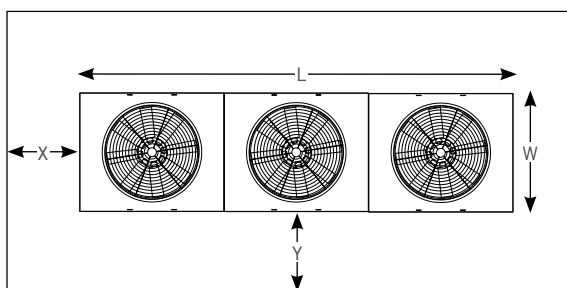Plan View of a Two Cell PFi-2012Ax, PFi-2412Ax, and PFi-2418x

Figure 6. Plan View of a Three Cell PT2 Arrangement

Figure 7. Plan View of a Four Cell PT2 Quad Arrangement
Plan View of a Four Cell PCC-x-2424x, PCC-x-2436x, and PCC-x-2440x

NOTE: PT2-1218A, have two fan mechanicals as standard with an option for one fan mechanical. PFi-1236-x, PFi-1236-x, PFi-2418-x, PCC-x-1218x, PCC-x-1220x, PCC-x-1236x, PCC-x-1240x, PCC-x-2418x, PCC-x-2420x, PCC-x-2420x, PCC-x-2436x, and PCC-x-2440x models have one fan mechanical as standard with an option for two fan mechanicals.

PT2, PFi, & PCC Layout Guidelines

Model Number	Distance from Wall to Air Intake							
	One Cell Width (X)	One Cell Length (Y)	Two Cell Width (X)	Two Cell Length (Y)	Three Cell Width (X)	Three Cell Length (Y)	Four Cell Width (X)	Four Cell Length (Y)
PT2-0412A	3[1]	3[1]	—	—	—	—	—	—
PT2-0709A	3[1]	3[1]	3[1]	4	3[1]	5	—	—
PT2-0809A	3[1]	3[1]	3[1]	4.5	3.5	5.5	—	—
PT2-0812A	3.5	4	3.5	5.5	3.5	6.5	—	—
PT2-1009A	4	4	4.5	6	5	7.5	8	8
PT2-1012A	4	4	5	6	4.5	7	8	8.5
PT2-1212A	4	4.5	5	6.5	5	8	9	9
PT2-1218A	4.5	5.5	PT2-1218A-**2 – 5.5 PT2-1218A-**T – 8	PT2-1218A-**2 – 8.5 PT2-1218A-**T – 7	5.5	10	11	12.5

Table 1. Minimum Acceptable Air Intake Distance "X" and "Y" (feet) to Solid Wall for PT2 Cooling Towers

Model Number	Distance from Wall to Air Intake		Model Number	Distance from Wall to Air Intake		Model Number	Distance from Wall to Air Intake	
	Width (X)	Length (Y)		Width (X)	Length (Y)		Width (X)	Length (Y)
PFi-0406N	3[1]	3[1]	PFi-1212N	4.5	4.5	PFi-1236N	5.5	8.5
PFi-0412N	3[1]	3[1]	PFi-1218N	5	5.5	PFi-2412N	7	5.5
PFi-0709N	3[1]	3[1]	PFi-1024N	4.5	6.5	PFi-2418N	8	7.5
PFi-0718N	3[1]	4.5	PFi-2012N	6.5	5			
PFi-1012N	4	4	PFi-1224N	5.5	7			

Table 2. Minimum Acceptable Air Intake Distance "X" and "Y" (feet) to Solid Wall for PFi Closed Circuit Cooling Towers

NOTES:

1. Minimum distance for maintenance access is 3'.
2. For a plan view of a one cell PT2 arrangement and a plan view of a PFi-0406A, PFi-0412A, PFi-0709A, PFi-1212A, and PFi-1218A refer to **Figure 2** on **Page J110**. For plan views of all other configurations, see **Page J111**.

Model Number	Distance from Wall to Air Intake		Model Number	Distance from Wall to Air Intake		Model Number	Distance from Wall to Air Intake	
	Width (X)	Length (Y)		Width (X)	Length (Y)		Width (X)	Length (Y)
PCC-x-0406x	3[1]	3[1]	PCC-x-1220x	4	6	PCC-x-2412x	6	4.5
PCC-x-0412x	3[1]	3[1]	PCC-x-1024x	4.5	6.5	PCC-x-2418x	7	6.5
PCC-x-0709x	3[1]	3[1]	PCC-x-2012x	6.5	5.5	PCC-x-2420x	8	5
PCC-x-0718x	3[1]	4.5	PCC-x-1224x	4.5	6	PCC-x-2424x	7.5	7.5
PCC-x-1012x	4	4.5	PCC-x-1236x	4.5	7	PCC-x-2436x	9.5	10.5
PCC-x-1212x	3.5	3.5	PCC-x-1240x	5	8	PCC-x-2440x	10	11
PCC-x-1218x	4	5						

Table 3. Minimum Acceptable Air Intake Distance "X" and "Y" (feet) to Solid Wall for PCC Evaporative Condensers

NOTES:

1. Minimum distance for maintenance access is 3'.

2. For a plan view of a PCC-x-0406x, PCC-x-0412x, PCC-x-0709-x, PCC-x-1212x, PCC-x-1218x, and PCC-x-1220x refer to **Figure 2** on **Page J110**. For plan views of all other configurations, see **Page J111**.

PT2, PFi, & PCC Layout Guidelines

Example 1: Model PT2-1212A-3P1 with Air Intake Face "L" Adjacent to a Solid Wall

Find minimum acceptable distance "Y".

Referencing the PT2 Engineering Data:

Unit CFM = 104,080 CFM

A = 4'-10 3/8" (4.9')   L = 11'-11 3/4" (12')   W = 11'-10" (11.9')

Total Air Intake Perimeter = 2L + 2W = 47.8'

300 FPM = suggested envelope air velocity for a unit

Envelope Velocity = (Airflow per Intake) / (Envelope Area)

$$\% \text{ Airflow to Inlet} = \frac{L}{\text{Total Air Intake Perimeter}} = \frac{12'}{47.8'} = 25\%$$

$$300 \text{ FPM} = \frac{104{,}080 \text{ CFM} * 25\%}{(12' * Y) + 2(4.9' * Y)}$$

Solve for "Y" to find the distance from the "W" Side of the unit to the wall:

$$Y * (21.8) = \frac{26{,}020 \text{ CFM}}{(300 \text{ FPM})} \qquad Y = \frac{[(26{,}020 \text{ CFM}) / (300 \text{ FPM})]}{21.8'} \qquad Y = 3.98'$$

This is rounded up to the next 0.5' increment. Therefore, the air intake should be located no less than 4 feet from the solid wall.

Example 2: Model PT2-0412A-2J1 with Air Intake Face "W" Adjacent to a Solid Wall

Find minimum acceptable distance "X".

Referencing the PT2 Engineering Data:

Unit CFM = 33,520 CFM

A = 3.2'

L = 11'-11 3/4" (12')

W = 4'

Total Air Intake Perimeter = 2L + 2W = 32'

300 FPM = suggested envelope air velocity for a unit

Envelope Velocity = (Airflow per Intake) / (Envelope Area)

$$\% \text{ Airflow to Intake} = \frac{W}{\text{Total Air Intake Perimeter}} = \frac{4'}{32'} = 12.5\%$$

$$300 \text{ FPM} = \frac{34{,}790 \text{ CFM} * 12.5\%}{(4' * X) + 2(3.2' * X)}$$

Solving for "X,"

$$X * (10.4) = \frac{4{,}350 \text{ CFM}}{300 \text{ FPM}}$$

$$X = \frac{[(4{,}350 \text{ CFM}) / (300 \text{ FPM})]}{10.4'}$$

X = 1.39'

This is rounded up to the next 0.5' increment, so the intake would be located 1.5' from the solid wall. However, since the minimum distance from a wall is 3' for maintenance access, the air intake should be located no less than 3' from the solid wall.

PT2, PFi, & PCC Layout Guidelines

❯ Well Installation

Use the method outlined in Installations Adjacent to a Building or Wall(s) on **page J110** to determine the minimum acceptable dimensions "X" and "Y" for PT2 Cooling Towers, PFi Closed Circuit Cooling Towers, or PCC Evaporative Condensers installed in a well layout.

Next, determine the downward air velocity for the well installation. The maximum allowable downward air velocity for a well installation is 400 FPM for PT2 Cooling Towers, PFi Closed Circuit Cooling Towers, or PCC Evaporative Condensers. The downward air velocity is determined using the following equation:

Figure 8. Plan View of a PT2, PFi, or PCC Unit in a Well Enclosure

Downward Air Velocity = (Unit CFM) / (Usable Well Area)

The usable well area is defined as illustrated in **Figure 8**.

Usable Well Area = Well Area − Unit Area

Where:

Well Area = b * c

Unit Area = L * W

"L" = length of the unit in feet.

"W" = width of the unit in feet.

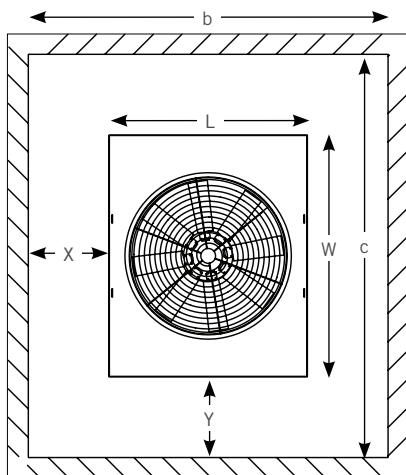"b" = length of the well in feet.

"c" = width of the well in feet.

Example: **Model PT2-1212A-3M1 in a 20' x 20' Well**

Referencing the PT2 Engineering Data:

Unit CFM = 84,520 CFM

L = 11'-11 3/4" (12')

W = 11'-10" (11.9')

b = 20'

c = 20'

400 FPM = maximum acceptable envelope air velocity for a PT2 Cooling Tower in a well installation.

Usable Well Area = Well Area − Unit Area

Usable Well Area = (b * c) − (L * W)

Usable Well Area = (20' * 20') − (12' * 11.9') = 257.2'

Downward Air Velocity = (Unit CFM) / (Usable Well Area)

Downward Air Velocity = 84,520 CFM / 257.2' = 328.6 FPM

328.6 FPM < 400 FPM. Therefore, the installation results in an acceptable downward air velocity.

❯ 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:
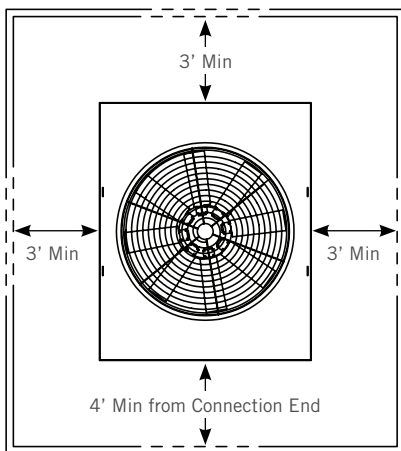
1. Air intake requirements:
    a. Units should be arranged within the enclosure such that they maintain a minimum distance of three feet (3') between the unit air intakes and the louvered or slotted wall for uniform air distribution and 4' from the connection end.
2. Louver Requirements:
    a. Louvers 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.
    b. The required total louver or slot area is based on drawing the total unit airflow through the net free area of the louvers at a velocity of 600 FPM or less.
    c. Locate the louver area in the walls of the enclosure such that air flows uniformly to the air intakes.

Louver area and unit airflow are related to louver velocity as follows:

$$\text{Louver Velocity} = \frac{(\text{Unit Airflow} * \% \text{ Airflow})}{[(\% \text{ Louver Free Area}) * (\text{Louver Area})]}$$

Figure 9. Plan View of a PCC, PFi, or PT2 Unit in an Enclosure with Louvered Walls

Labels in figure: 3' Min (top), 3' Min (left), 3' Min (right), 4' Min from Connection End (bottom)

PT2, PFi, & PCC Layout Guidelines

Example: **PT2-0709A-2L in a Louvered Enclosure**

The enclosure walls are equal in elevation to the unit discharge height. The louvers are 70% free area and 3' from the air intake of the tower. Find the required louver area to produce a minimum Louver Velocity of 600 FPM.

Referencing the PT2 Engineering Data:

Unit CFM = 46,500 CFM

A = 3.9'   L = 9'   W = 7.4'

Total Air Intake Perimeter = 2L + 2W = 32.8'

Maximum Allowable Louver Velocity = 600 FPM

For "W" Side (7.4'):

% Airflow = W / Total Air Intake Perimeter

7.4' / 32.8' = 23%

$$\text{Louver Velocity} = \frac{(\text{Unit Airflow} * \%\text{ Airflow})}{[(\%\text{ Louver Free Area}) * (\text{Louver Area})]}$$

$$600 = \frac{(46,000\text{ CFM} * 23\%)}{(70\%) * \text{Louver Area}} \qquad \text{Louver Area} = \frac{(10,580\text{ CFM} / 0.7)}{600}$$

Louver Area =   25.19 square feet

For "L" Side (9'):

% Airflow = L / Total Air Intake Perimeter

9' / 32.8' = 27%

$$\text{Louver Velocity} = \frac{(\text{Unit Airflow} * \%\text{ Airflow})}{[(\%\text{ Louver Free Area}) * (\text{Louver Area})]}$$

$$600 = \frac{(46,000\text{ CFM} * 27\%)}{(70\%) * \text{Louver Area}} \qquad \text{Louver Area} = \frac{(12,555\text{ CFM} / 0.7)}{600}$$

Louver Area =   30 square feet

The louver areas on the "W" sides of the unit must equal or exceed 25.5 square feet, and the louver areas on the "L" sides of the unit must equal or exceed 30 square feet.

› Multi-Row Installations

Multiple cells arranged end-to-end 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 * X) + (number of cells per module) or M = (2 * Y) + (number of cells per module), where "X" and "Y" are obtained from the appropriate model in **Table 1, Table 2** or **Table 3**.
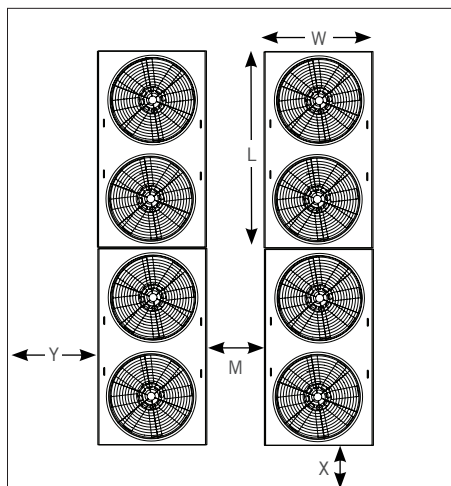

Figure 10. Plan View of Multi-Cell PCC, PFi, or PT2 Units with Air Intakes Facing

Example: Qty (2) of Model PT2-1218A-1M2

There are two modules of two cells of each on a roof. There are no enclosures surrounding the unit installation. The two banks of units have air intakes "L" facing each other. The minimum distance "M" between rows of units is determined as follows:

From **Table 1**, face "L" corresponds to distance "Y" and Y = 8.5',

$$M = (2 * Y) + \text{(number of units per module)}$$
$$= (2 * 8.5') + (2)$$
$$= 19 \text{ feet}$$

The calculated "M" dimension of 19 feet will minimize the potential for recirculation of the discharge air.

Multi-cell banks (i.e. more than one row or quad) should be elevated a minimum of 2 feet to allow air equalization under the cells, and minimize recirculation.

If these guidelines do not cover a particular situation or if the layout criteria cannot be met, please contact 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.