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VRV® Outdoor Unit Layout Guide

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VRV® Outdoor Unit Layout Guide

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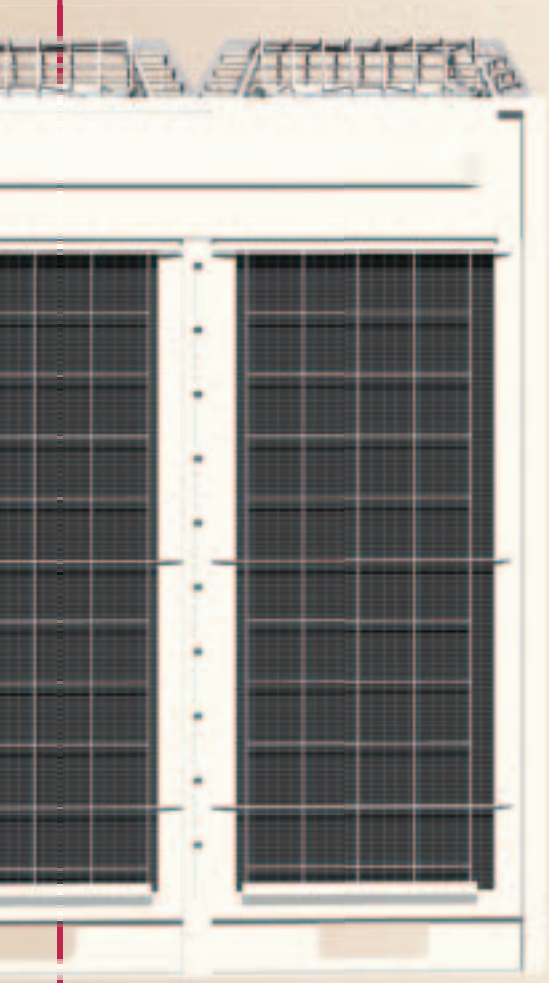
Contents

Introduction

For air conditioning system designers, it is always difficult to find space to install outdoor units without sacrificing performance. Outdoor unit installation in severe conditions tends to cause discharged air short circuits, resulting in wasted energy and shortened machine life. In order for VRV outdoor unit systems to operate properly, it is necessary to ensure proper fresh air supply and proper exhaust of discharged air. This guide shows optimum layouts for outdoor units in various situations. We hope this brochure will be helpful to designers and engineers in their daily work.

What is an air short circuit?

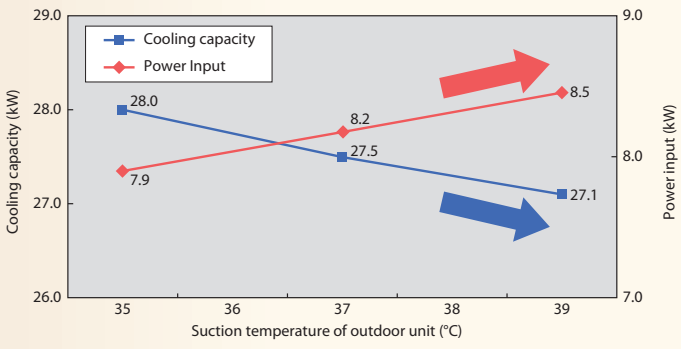


Air short circuit

It refers a phenomenon when discharged air (exhaust heat) from the outdoor unit is drawn back into the suction vent.

If an air short circuit occurs

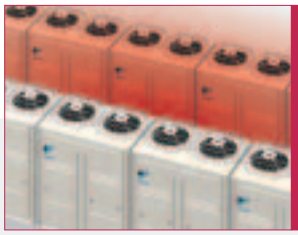
1. Efficiency of cooling operations will decrease.
2. Shortage in capacity.
3. High pressure cut-off will occur (operation stops).
4. The lifespan of the outdoor unit will be shortened.



RXYQ10P(A) Series (10HP VRVIII outdoor unit)

Row installation

Align outdoor units so the suction side of the both front and back rows are facing outward in order to ensure a fresh air supply.



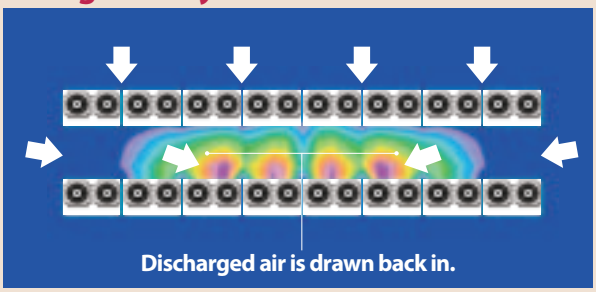
Original Layout

Discharged air is drawn into the front row suction vents.

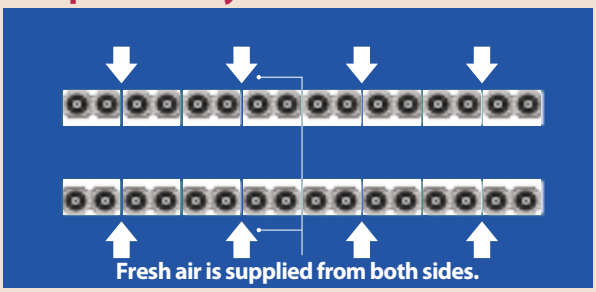
Air temperature and airflow simulation results

TOP VIEW

■ Original Layout



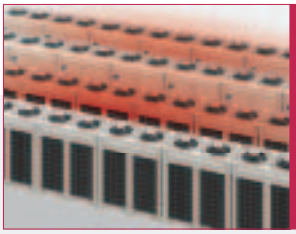
■ Improved Layout



low Temperature — high Temperature

Collective installation (When Installation Space Allows)

Installing units too close together will cause heat to build up in one area. To avoid this, install the units by dividing them into multiple groups.



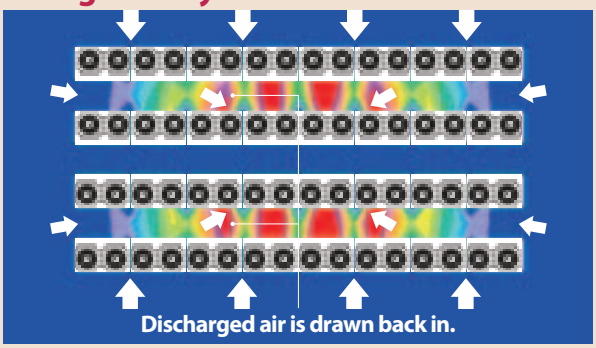
Original Layout

Fresh air is not supplied to the centre, and emanated heat is drawn back in.

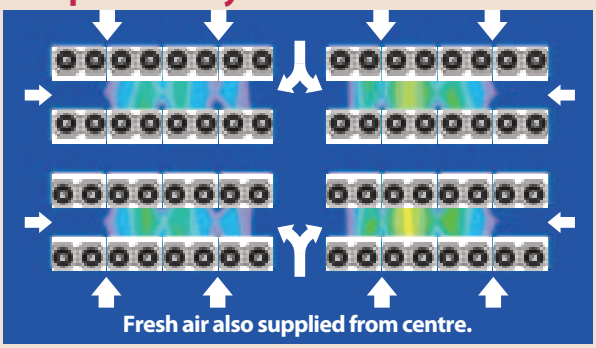
Air temperature and airflow simulation results

TOP VIEW

■ **Original Layout**



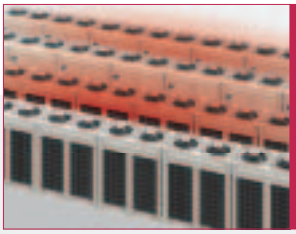
■ **Improved Layout**



low Temperature — high Temperature

Collective installation (When Installation Space is Limited)

Elevate the units and make sure that fresh air is supplied from underneath.



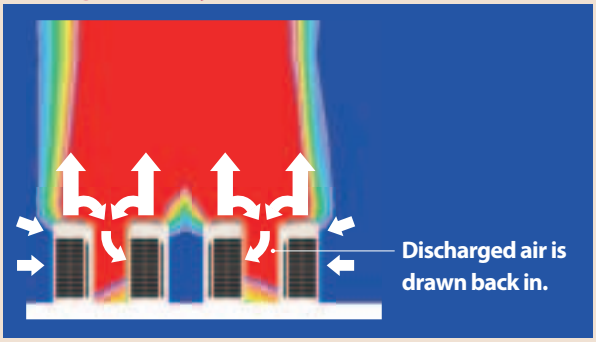
Original Layout

Fresh air is not supplied to the centre, and emanated heat is drawn back in.

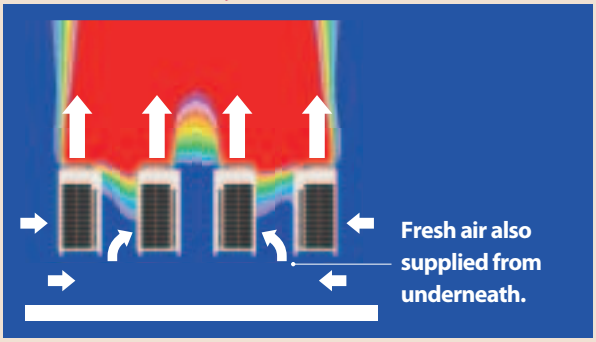
Air temperature and airflow simulation results

SIDE VIEW

■ Original Layout



■ Improved Layout

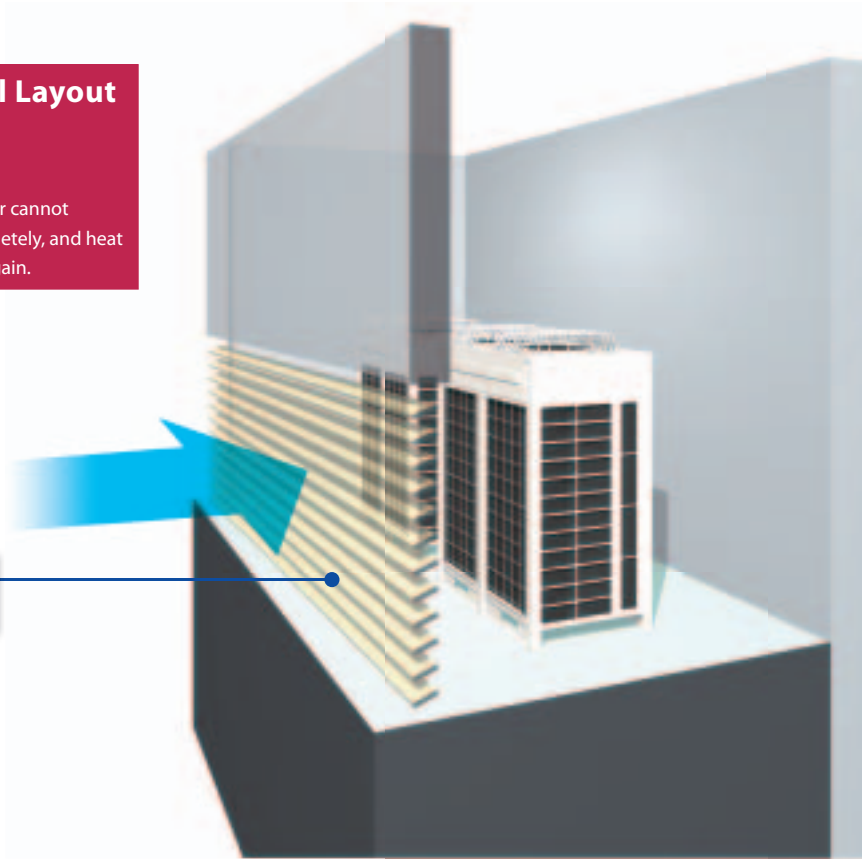


The importance of louvres

A louvred wall improves fresh air supply.

Original Layout

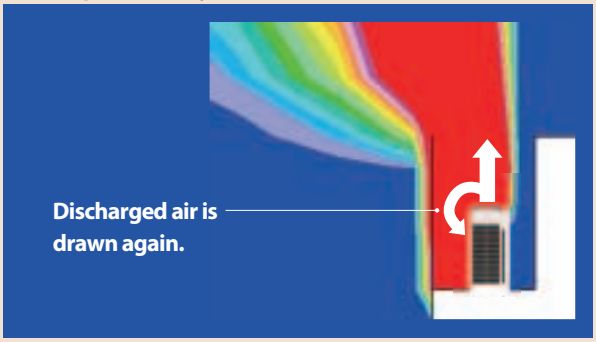
Discharged air cannot escape completely, and heat is drawn in again.



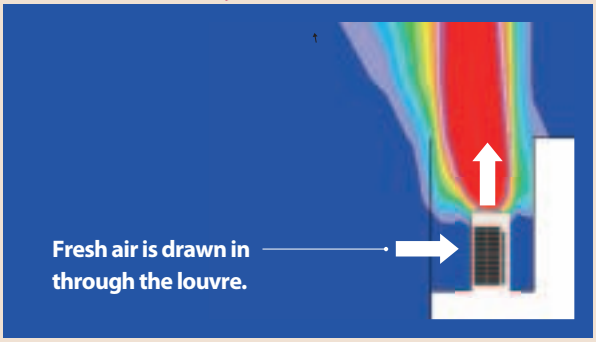
Air temperature and airflow simulation results

SIDE VIEW

■ Original Layout

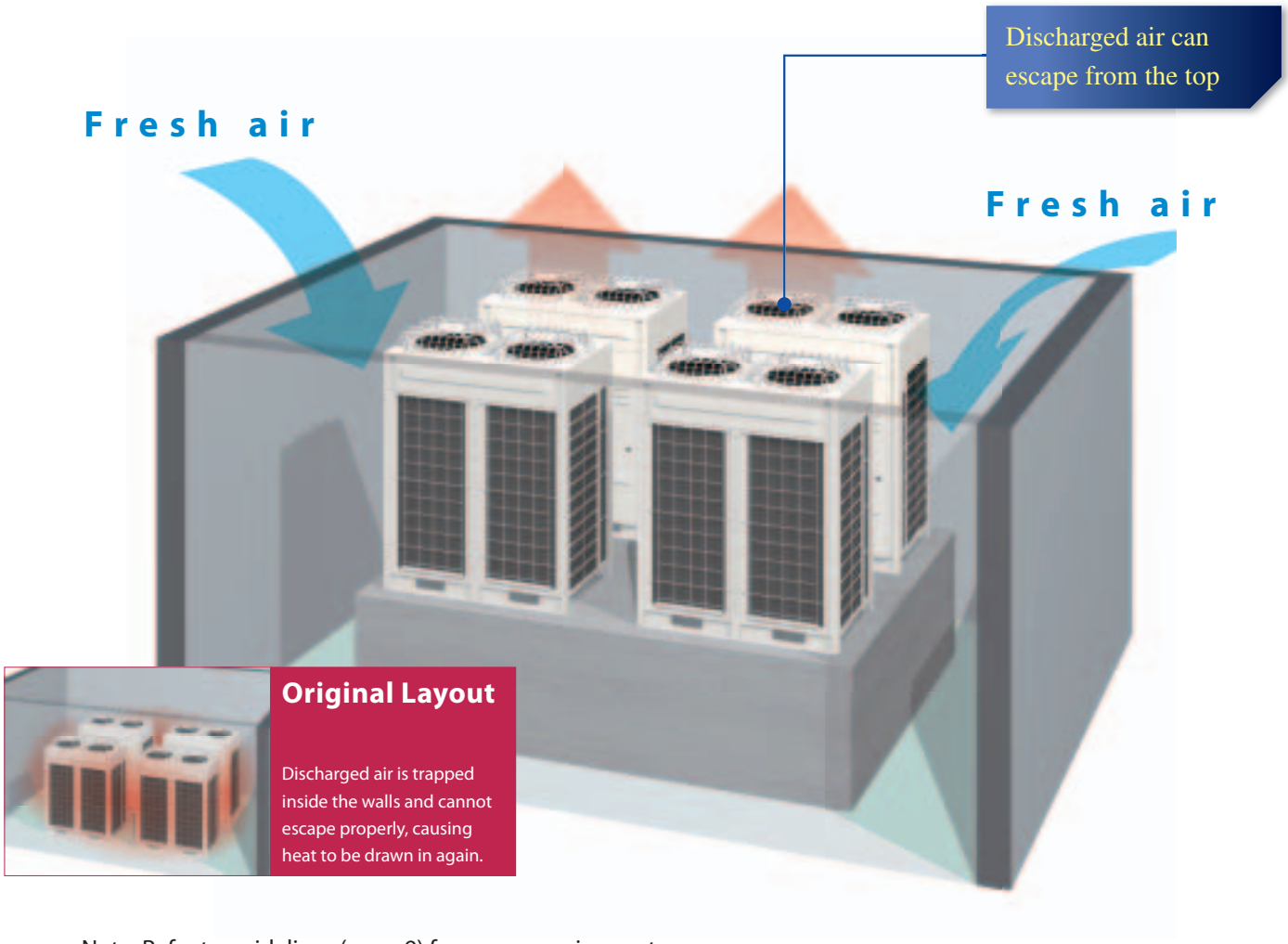


■ Improved Layout



Units surrounded by walls

Elevate the units to make discharge vents and top of the wall at the same level.

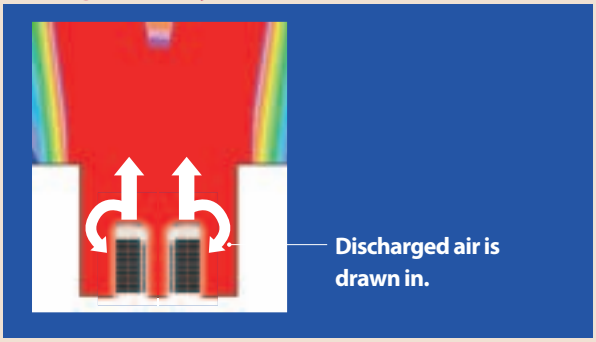


Note: Refer to guidelines (page 9) for space requirements.

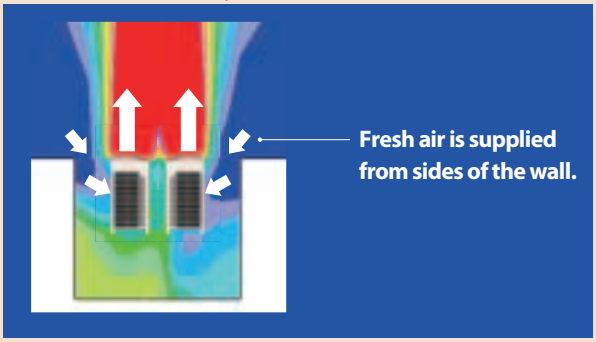
Air temperature and airflow simulation results

SIDE VIEW

Original Layout



Improved Layout



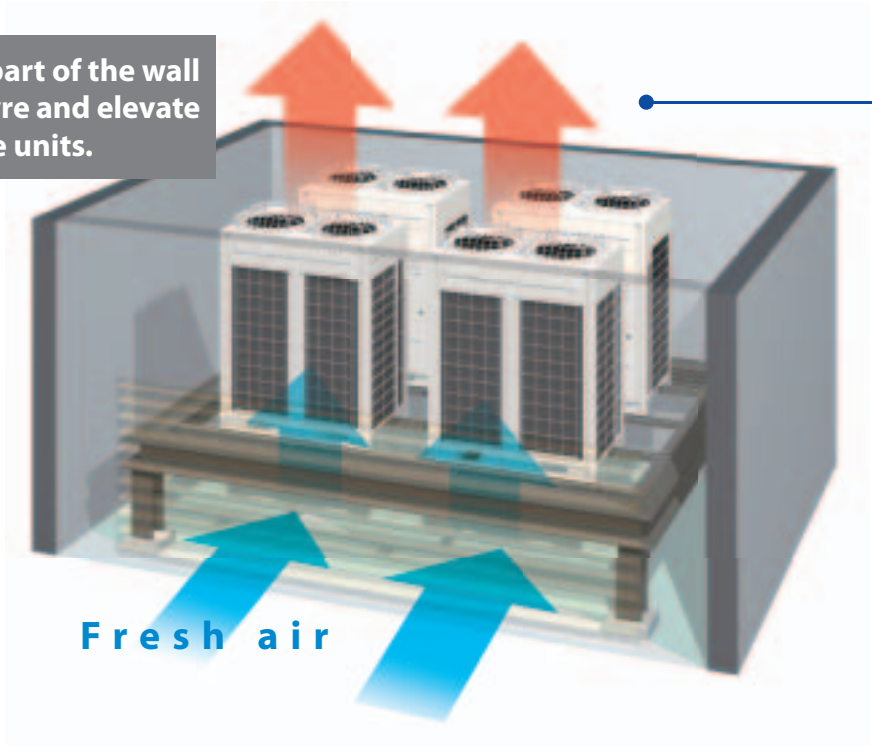
low Temperature — high Temperature

In case of more severe conditions

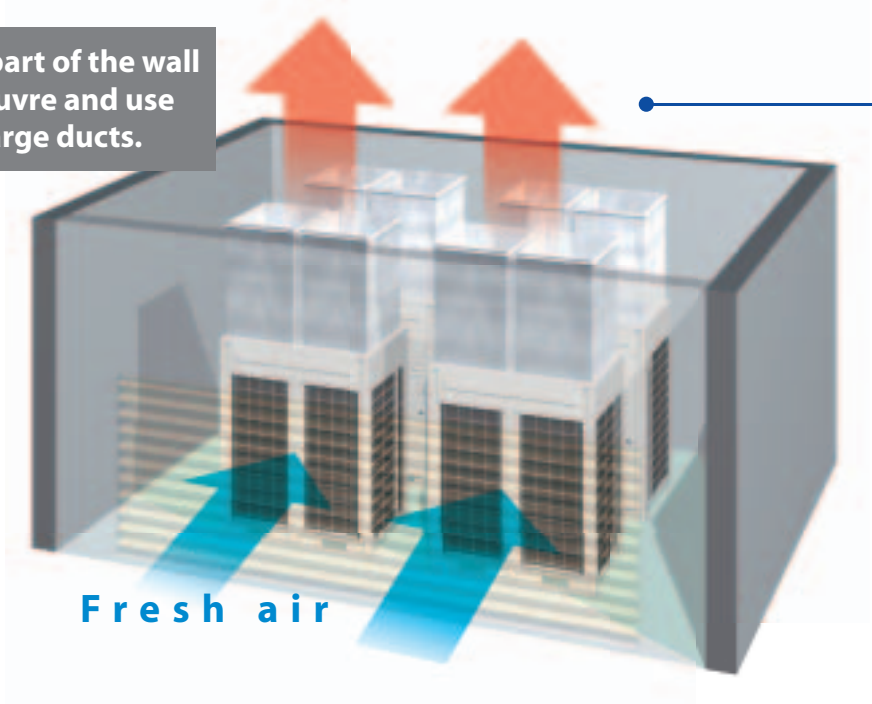
After making one part of the wall into a louvre, place the exhaust vent in a position higher than the wall, and make sure that intake air and exhaust air do not mix.

- Turn one part of the wall into a louvre.
- Place the discharge level higher than the wall, either by elevating the units or installing discharge ducts.

Turn one part of the wall into a louvre and elevate the units.



Turn one part of the wall into a louvre and use discharge ducts.



Guideline for the installation of VRV outdoor units, surrounded by walls

1.Technical background

When installing VRV outdoor units collectively on the rooftop, the suction temperature increases due to the heat emanated from other outdoor units (air short circuit). As a result, in cooling system, the COP is lowered because of decreased equipment capacity and increased power consumption. In some cases, outdoor units stop operations due to abnormally high pressure. When installing these units, choose the most suitable layout for on-site space conditions from the installation options below, while taking walkway space and ventilation into consideration.

* For other installation patterns, determine the appropriate installation method based on the space conditions, referring to the installation examples below.

For the space in front of the units, please ensure there is enough space for refrigerant piping work. The required installation space shown in the illustrations is based on the cooling operation at 35°C of outside temperature. When the design outside temperature exceeds 35°C, make the inlet space larger than spaces shown in the illustrations.

2. Installation examples (up to 24 units)

Here shows basic collective installation examples of 16 HP units when 1600mm-high walls surround outdoor units, which is as high as outdoor units. Please be sure that the distances from each wall and between outdoor units are larger than the figures shown in illustration diagrams.

Precautions on Installation

Determination of the Installation Location

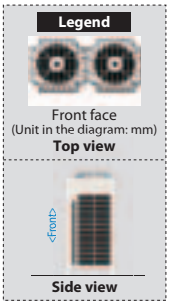
SELECTION OF LOCATION

This unit, both indoor and outdoor, is suitable for installation in a commercial and light industrial environment.

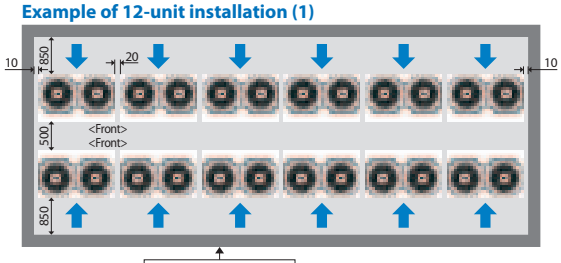
If installed as a household appliance it could cause electromagnetic interference.

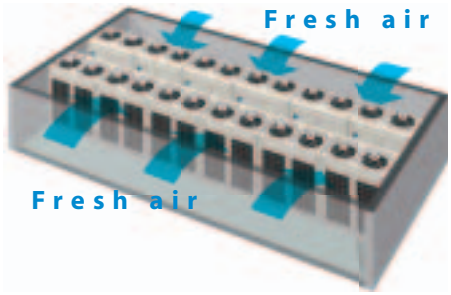
The VRV outdoor units should be installed in a location that meets the following requirements:

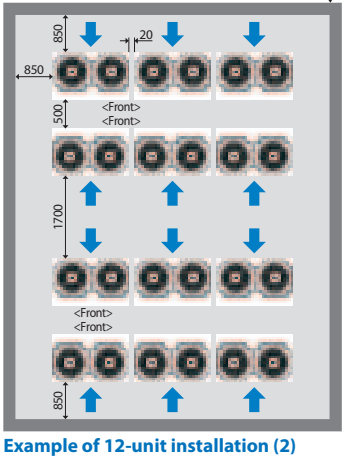
1. The foundation is strong enough to support the weight of the unit and the floor is flat to prevent vibration and noise generation.
2. The space around the unit is adequate for servicing and the minimum space for air inlet and air outlet is available.
   (Refer to below figure and choose one of both possibilities.)
3. There is no danger of fire due to leakage of inflammable gas.
4. Ensure that water cannot cause any damage to the location in case it drips out the unit (e.g. in case of a blocked drain pipe).
5. The piping length between the outdoor unit and the indoor unit may not exceed the allowable piping length. (See "Example of connection".)
6. Select the location of the unit in such a way that neither the discharged air nor the sound generated by the unit disturb anyone.
7. Make sure that the air inlet and outlet of the unit are not positioned towards the main wind direction.
   Frontal wind will disturb the operation of the unit. If necessary, use a windscreen to block the wind.



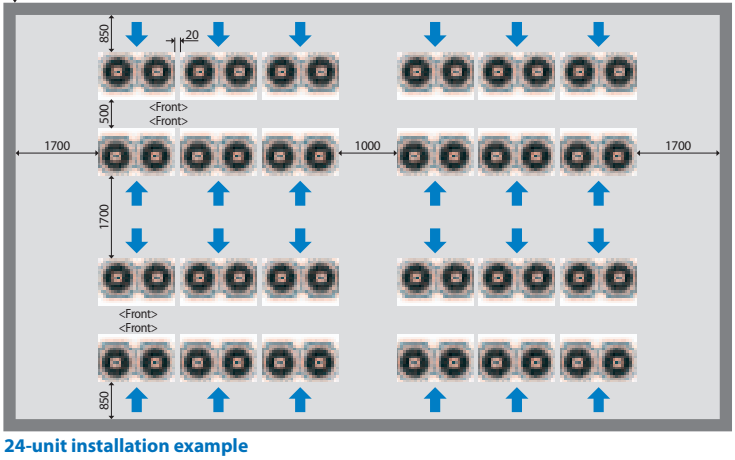
Example of 12-unit installation (1)







Example of 12-unit installation (2)

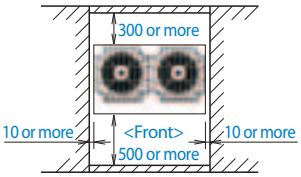


24-unit installation example

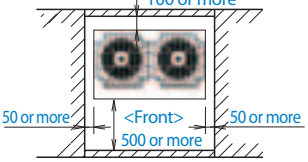
Service Space

For single unit installation

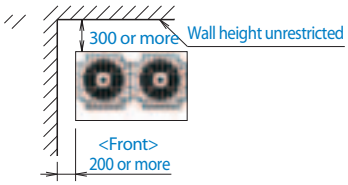
Pattern 1



Pattern 2

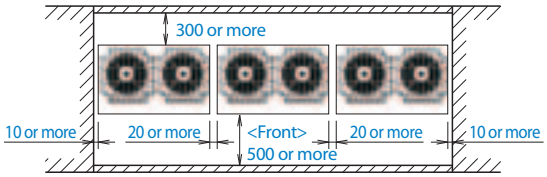


Pattern 3

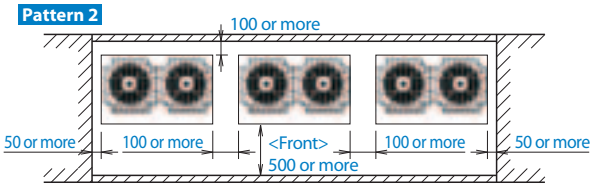


For installation in rows

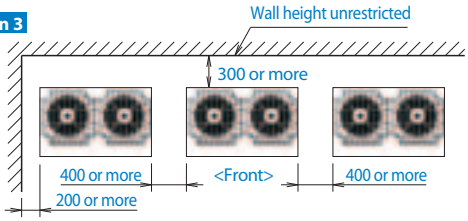
Pattern 1



Pattern 2

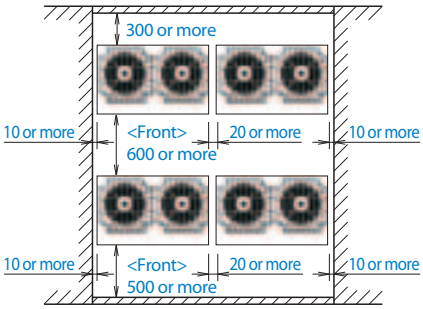


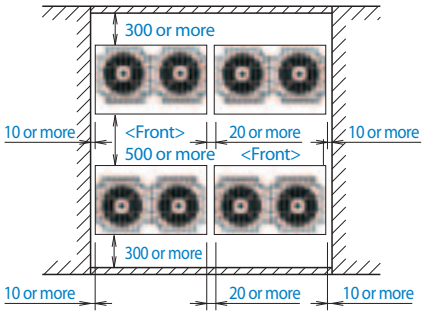
Pattern 3



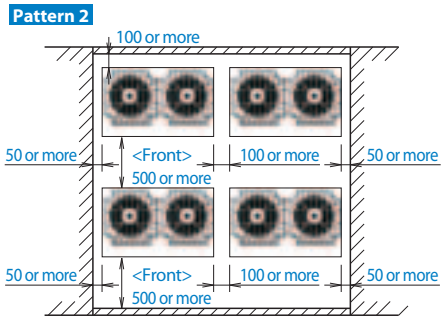
For centralized group layout

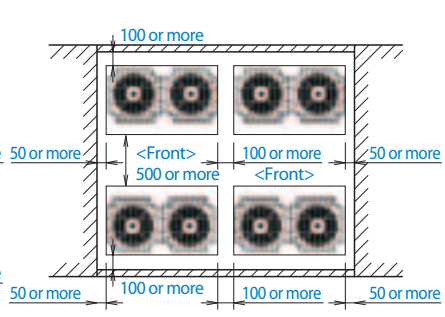
Pattern 1

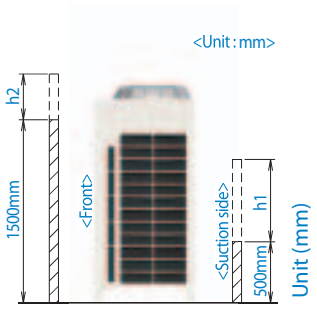




Pattern 2







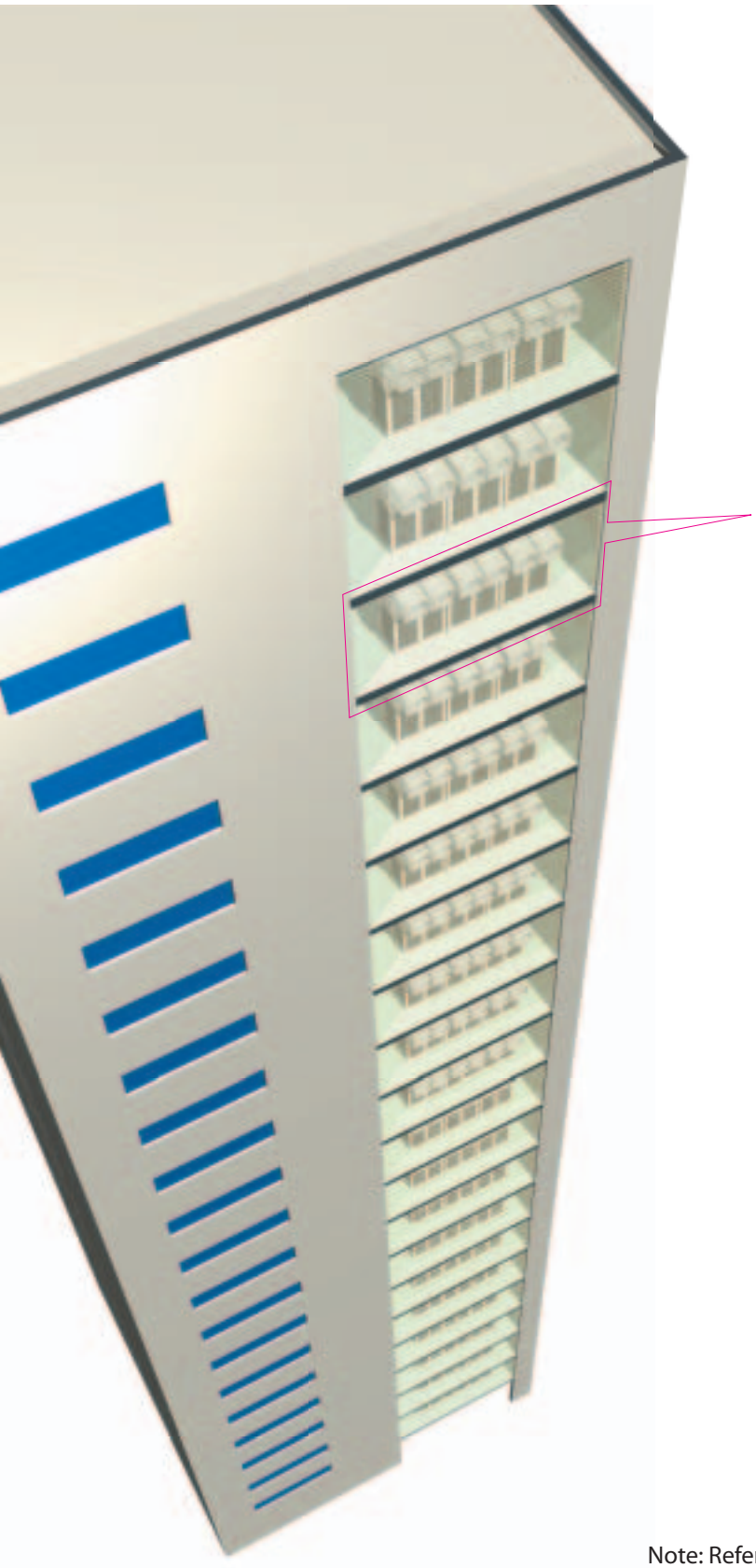
Notes

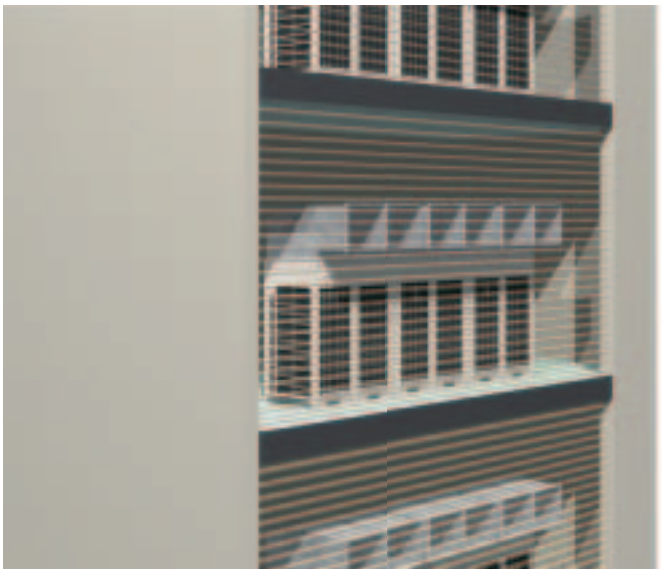
1. Heights of walls in case of Patterns 1 and 2 :
   Front : 1500mm
   Suction side : 500mm
   Side : Height unrestricted.
   Installation space to be shown in this drawing is based on the cooling operation at 35 degrees outdoor air temperature. When the design outdoor air temperature exceeds 35 degrees or the load exceeds maximum ability because of much generation load of heat in all outdoor unit, take the suction side space more broadly than the space to be shown in this drawing.
2. If the above wall heights are exceeded then h2/2 and h1/2 should be added to the front and suction side service spaces respectively as shown in the figure on the right.
3. When installing the units most appropriate pattern should be selected from those shown above in order to obtain the best fit in the space available always bearing in mind the need to leave enough space for a person to pass between units and wall and for the air to circulate freely. (If more units are to be installed than are catered for in the above patterns your layout should take account of the possibility of short circuits.)
4. The units should be installed to leave sufficient space at the front for the on site refrigerant piping work to be carried out comfortably.

Floor-by-floor installation

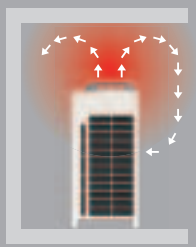
(Ducts required)

Floor-by-floor installation is suitable for a VRV system if it is equipped with a duct.



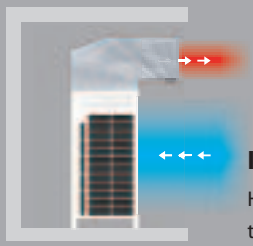


Why a duct is needed



If ducts are not used:

Discharged air cannot escape completely, and heat is drawn in again



If ducts are used:

Heat is allowed to escape through ducts to the outside

Note: Refer to guidelines (page 16) for maximum capacity per floor and maximum number of consecutive floors.

Floor-by-floor installation

(Possibility of short circuit occurring)

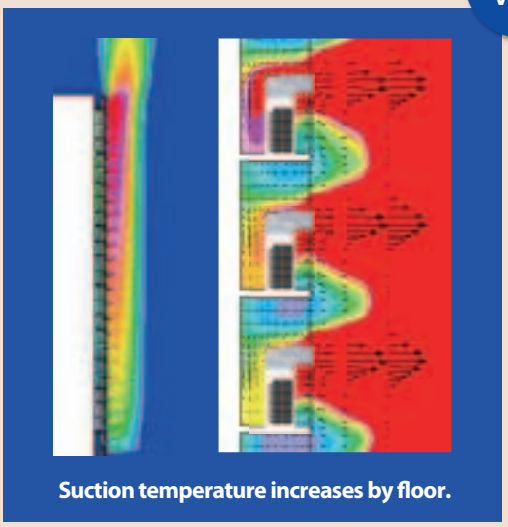
Conditions under which short circuits are likely to occur

- When there is some kind of shielding structure in front of the building(see illustration).
- When units are installed in high-rise buildings.
- When a large number of units are installed on every floor.

Discharged air from the lower floors is drawn into the suction vents on the upper floors, and upper floors become progressively hotter.

Air temperature and airflow simulation results

SIDE VIEW



Suction temperature increases by floor.

low Temperature — high Temperature

Note: refer to guidelines (page 16) for maximum capacity per floor and maximum number of consecutive floors.

Floor-by-floor installation

(Possible improvement)

Supply fresh air from the side, and orient the suction and discharge sides in different directions.

To prevent friction loss, we recommend not using louvres in front of discharge ducts.

Original Layout

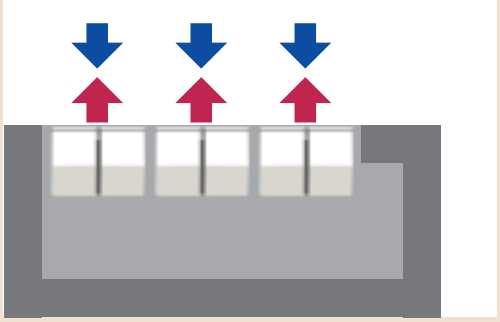
Outdoor units on the upper floors draw in the exhaust heat from the lower floors. (Suction vents of outdoor units and discharge ducts are facing the same direction.)

Close the front louvre (or use a solid wall) everywhere except in front of the discharge area to avoid recirculation of discharged air.

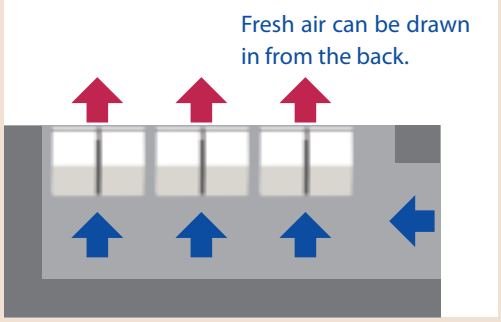
Note: Be aware of friction loss through the louvre on suction side.

TOP VIEW

When an air passageway cannot be created on the side:
Air is drawn in and released from the front.

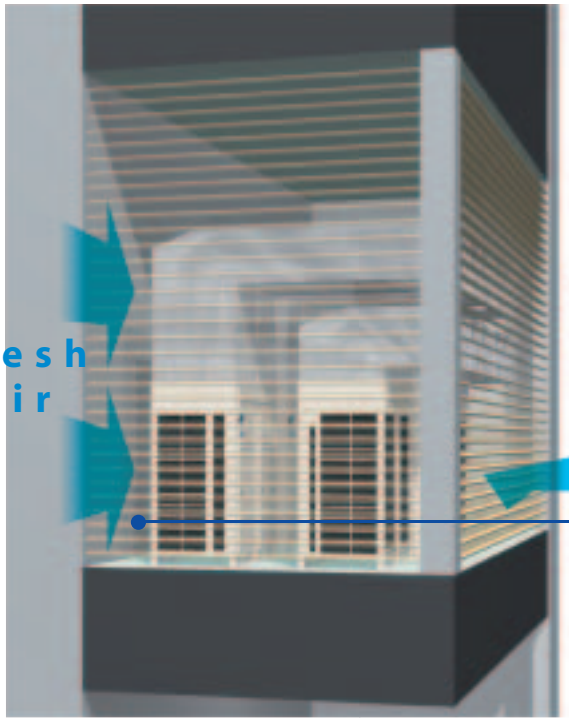


When an air passage can be created on the side:
Air is drawn in from the back and released from the front.

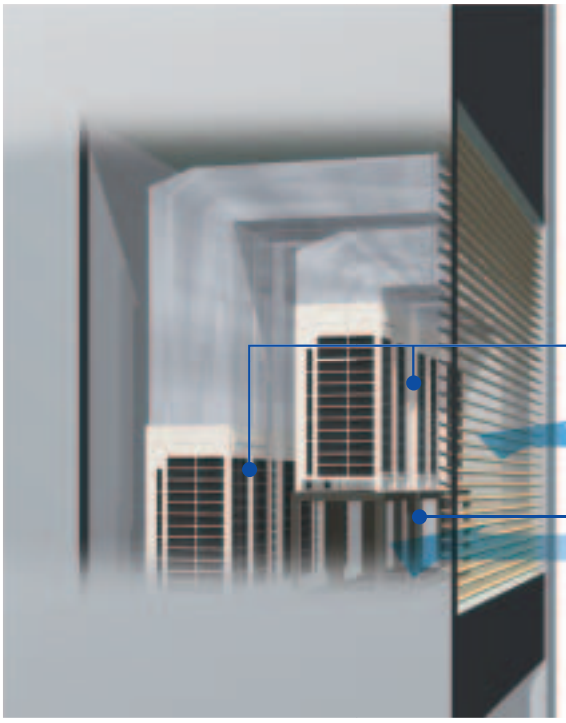


Installing units in two rows on intermediate floor

When installing two rows of units on one floor, it is necessary to arrange the air suction mechanism.



When there is no wall to the side
The front row of units draw in air from the front, and the back row draw in air from the back.



When there is a wall to the side
Elevate the front row of units, so that both rows can draw in air from the front.

Note: Do not merge ducts. Only one duct is to be installed on each fan in order to prevent air from being directly circulated into the neighbouring fan.

Guideline for the installation of VRV outdoor units, floor by floor

1. Technical background

To make sure there is no risk of short-circuits in a system is a key point to bear in mind prior to deciding on the outdoor units layout with a floor-by-floor installation.

Short-circuits affects the general performance of the equipment and may lead to some shortage in capacity, increase of energy consumption (as the COP decreases) and in the worse case, lead to a complete stop of the system if suction temperature exceeds a certain level.

The limitations concerning the outdoors layout described in this document are based on these specific concerns.

Other important concerns in a floor-by-floor installation:

① Discharged air should not cause nuisance to neighborhood (direct discharge onto residents or other people).

② Operating noise should not cause environmental problems, and its level should comply with local regulations.

2. Domain of application of the present guidelines

Models:VRVII&III

Layout: Floor-by-floor installation.

3. Maximum number of floors

Maximum number of floor where outdoors can be installed with a given capacity installed per floor can be determined according to the distance from the nearest structure facing the installation.

How to read the graph:

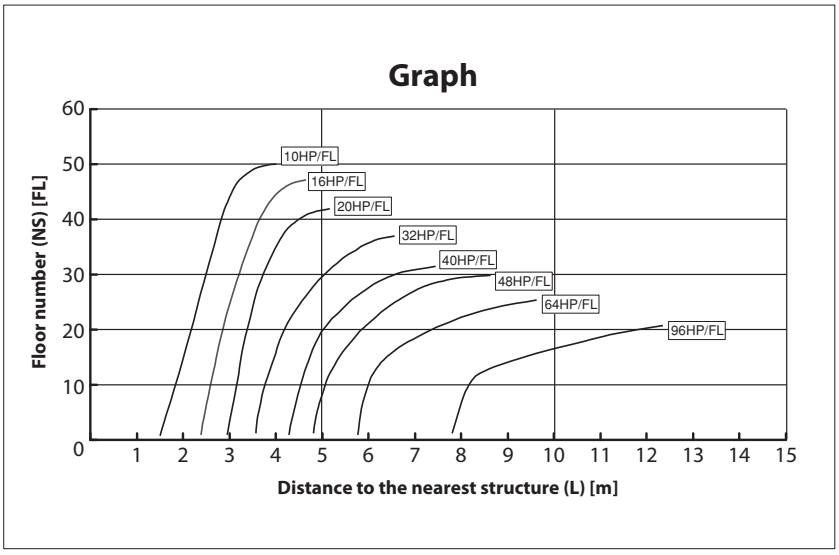
Maximum number of floors (NS) is drawn as a function of the distance to the nearest structure (L), for different "total capacity of outdoor units installed" per floor (HP/FL).

Conditions:

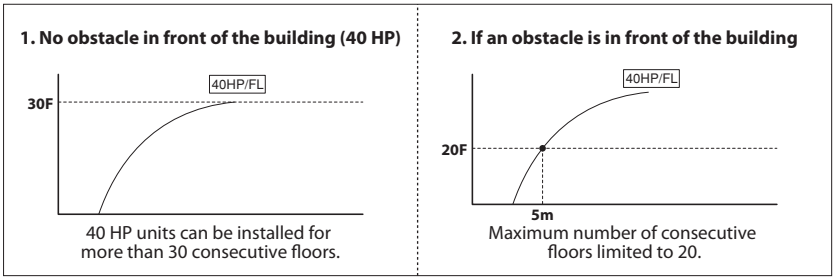
1. The air discharge velocity: 6 m/s.
2. Outdoor temperature: 35 Deg.C DB.
3. Design guideline condition described in 4 satisfied.

Note:

If actual conditions differ from above, please contact Daikin Industries Ltd.



How to read the graph



4. Design guidelines

(1) Remove outdoor fan protective casing.

(2) Install air discharge ducts on all outdoor units. Fix the duct against the louver if existing.

(3) Louver angle: 20 degrees from horizontal

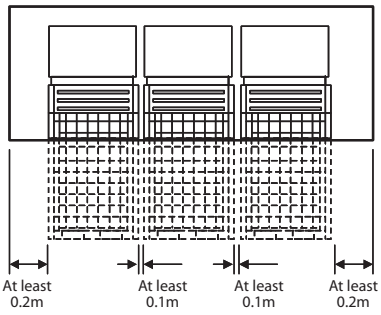
(4) Air velocity: Discharge air V_D=5–8 m/s and Suction air V_S ≤1.6 m/s

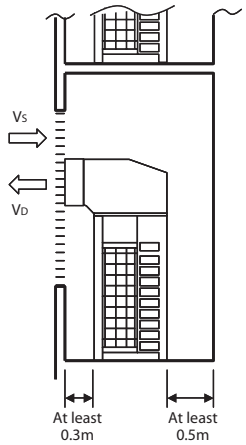
(5) Total pressure loss (through the discharge duct and the louver) should be less than 58.8 Pa for VRVII and 78.4Pa for VRVIII (with high static pressure setting).

(6) Space should be left for suction air to circulate freely and for installation/service/maintenance to be done.

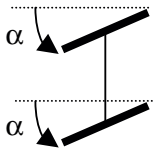
5. Illustration

Diagram below indicated the minimum distance for the unit layout in case of a floor-by-floor installation





Louver angle: α≤ 20° downwards



Air velocity

V_D: Air discharge effective velocity

$$V_D = \frac{\text{Flow rate}}{\text{Discharge effective surface}}$$

V_S: Air suction effective velocity

$$V_S = \frac{\text{Flow rate}}{\text{Suction effective surface}}$$

Discharge effective surface = Actual discharge surface x Louver opening ratio Suction effective surface = Actual suction surface x Louver opening ratio

$5\ m.s^{-1} \le V_D \le 8\ m.s^{-1}$ $V_S \le 1.6\ m.s^{-1}$

Total pressure loss: Less than 58.8 Pa for VRVII and 78.4Pa for VRVIII

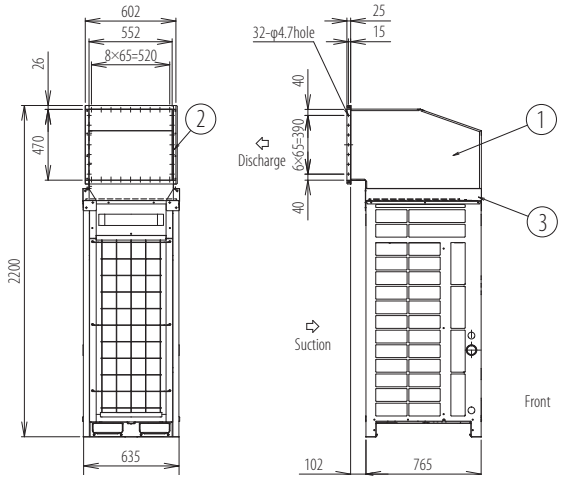
Example:

40HP per floor installed, with a structure facing the installation at 5 meters distance.

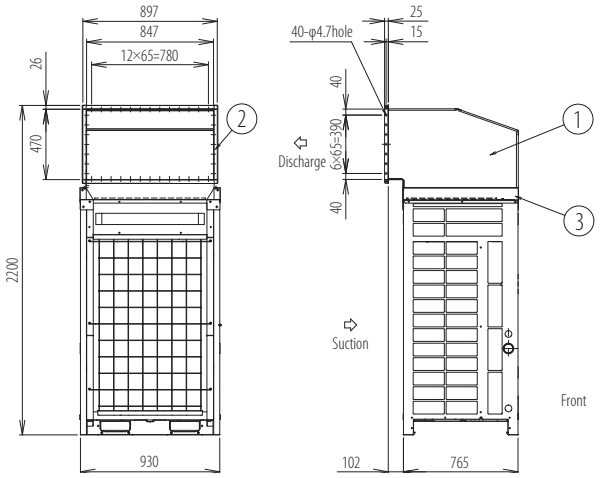
From graph, maximum number of floors the installation can be safely done: 20 Floors.

Appendix:Duct

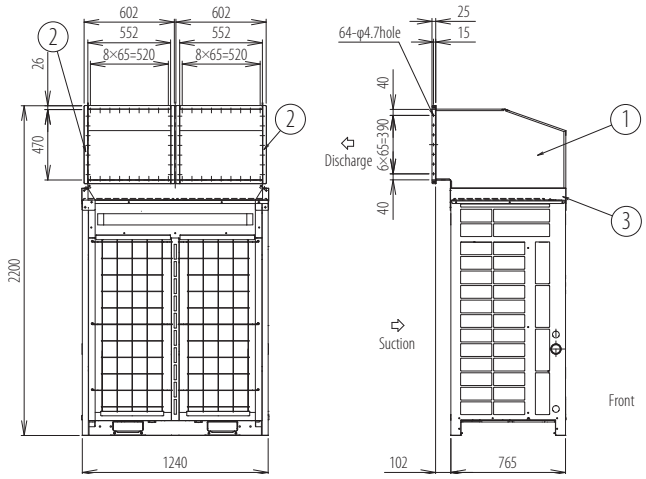
Discharge duct
635mm width casing with 1 fan



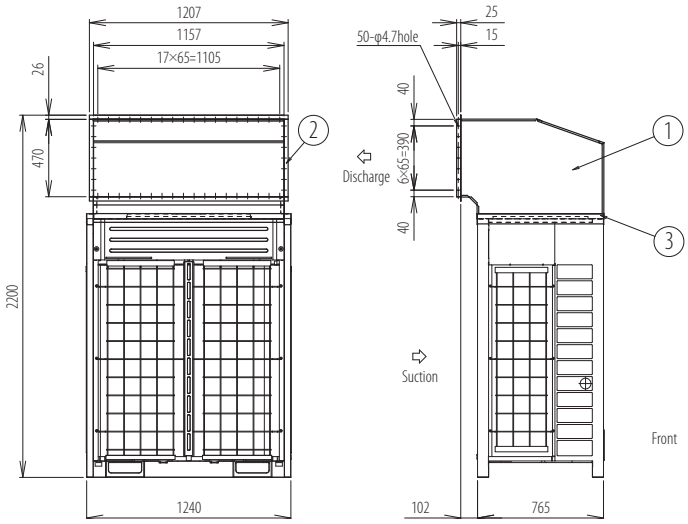
Discharge duct
930mm width casing with 1 fan



Discharge duct
1240mm width casing with 2 fans



Discharge duct
1240mm width casing with 1 fan



Note 1: A gradual curve (large curve) in the discharge duct is effective in preventing friction loss.

Note 2: Use only one duct per fan.

Memo

VRV® Outdoor Unit Layout Guide

VRV

In all of us, a green heart

Daikin's unique position as a manufacturer of air conditioning equipment, compressors and refrigerants has led to its close involvement in environmental issues. For several years Daikin has had the intension to become a leader in the provision of products that have limited impact on the environment. This challenge demands the eco design and development of a wide range of products and an energy management system, resulting in energy conservation and a reduction of waste.

Daikin Europe N.V. is approved by LRQA for its Quality Management System in accordance with the ISO9001 standard. ISO9001 pertains to quality assurance regarding design, development, manufacturing as well as to services related to the product.

ISO14001 assures an effective environmental management system in order to help protect human health and the environment from the potential impact of our activities, products and services and to assist in maintaining and improving the quality of the environment.

CE Daikin units comply with the European regulations that guarantee the safety of the product.

VRV® products are not within the scope of the Eurovent certification programme.

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The present publication supersedes EEDEN09-208
Prepared in Belgium by Lannoo (www.lannooprint.be), a company whose concern for the environment is set in the EMAS and ISO 14001 systems.
Responsible Editor: Daikin Europe N.V., Zandvoordestraat 300, B-8400 Oostende

EEDEN10-208