DAIKIN

VRV

VRV Reference Guide

01.17

About Daikin:

Daikin Industries, Ltd. (DIL) is a global Fortune 1000 company which celebrated its 90th anniversary in May 2014. The company is recognized as one of the largest HVAC (Heating, Ventilation, Air Conditioning) manufacturers in the world. DIL is primarily engaged in developing indoor comfort products and refrigeration systems for residential, commercial and industrial applications. Its consistent success is derived, in part, from a focus on innovative, energy-efficient and premium quality indoor climate and comfort management solutions.

TABLE OF CONTENTS


VRV

System Overview

The Features of VRV

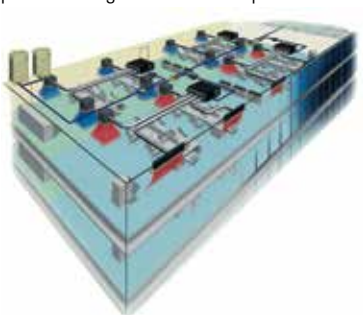
Features & Benefits to Using VRV

A VRV system is similar to a chiller but circulates refrigerant to each zone instead of water

A VRV heat pump system has performance and design attributes similar to a 2 pipe chiller

A VRV heat recovery system has performance and design attributes similar to a 4 pipe chiller system

- Industry Leadership since 1982, VRV is a registered TM
- 8 development series and 4 generations of VRV technology
- Scalable project opportunities with modular design
- Broad coverage of most vertical markets and climates
- Tested and Rated in accordance with AHRI Std 1230
- Individual zone control for Advanced zoning capabilities
- Can operate up to 64 indoor fan coil units
- Auto charging function
- Continuous heating during defrost operation
- Flexible piping limitations to meet a variety of building needs
- Excellent energy efficiency, especially at part load conditions (IEER)
- Daikin's optimized scroll compressor designed for R-410A provides a quiet, reliable energy-efficient operation
- Anti-corrosion treatment standard on exterior metal parts and heat exchanger
- Fully compatible with the complete Daikin control suite including iTC, and iTM
- Tie in to open protocol Building Automation systems through LonWorks® and BACnet® gateways
- 10-Year Limited Parts Warranty*



* Complete warranty details are available from your local Daikin manufacturer's representative or distributor or online at www.daikincomfort.com.

The Features of VRV (cont.)

The benefits of VRV equipment can categorized three core features:

Simple Modular Design


Outdoor Unit

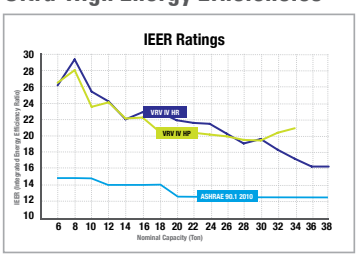

Indoor Units


Piping


Controls

The ease of both design and installation has been a major factor in the success of VRV in the global market. Simple methodology sees VRV regularly utilized in all project sizes from 3 ton to several 1,000 ton.

Ultra-High Energy Efficiencies



Direct expansion systems (those that use refrigerant to directly condition the space) provide an extremely efficient method of heat exchange.

Inverter controlled compressors also ensure optimized system performance.

Optimum refrigerant & system control sees Daikin VRV far exceed industry energy efficiency requirements.

Exceptional Comfort control


Wireless unit Controller


Room or Group Controller


Central Controller


BMS Interface

From controlling temperature in individual areas to the remote monitoring and control of multiple sites, the Daikin VRV system has a wealth of propriety control options to cover all end user requirements and ensuring exceptional levels of comfort control.

Key Points for Selection

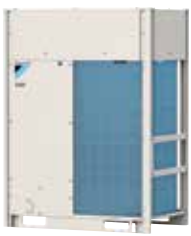
System Diversity vs Connection Ratio

Optimizing VRV System Selection

- The most successful users of VRV equipment understand the importance of a fully optimized design
- A key factor that ensures optimized VRV equipment selection is to understand the correlation between SYSTEM DIVERSITY & CONNECTION RATIO

A fully optimized design can realize a number of benefits:

- Cheaper equipment & installations costs
- Less outdoor unit footprint
- A more energy efficient system
- Far better control of room temperature
- A significant increase in the probability of winning a project



Peak Loads & Block Loads

The first step to optimization is to understand the different load demands of the equipment to be selected:

Unit Type	Selection Scope	Selection Approach
	**PEAK Load**	**Indoor units** should be sized to deliver the PEAK loads (total and/or sensible) of the area it is to serve, at the entering air design conditions determined by the building load calculations
	**BLOCK Load**	**Outdoor units** should be selected to meet the BLOCK Cooling & Heating capacities (The Maximum Load demand of all attached indoor units at a given time of day) determined by the same LOAD Calculations

Diversity & Connection Ratio - What's the Difference?

Connection Ratio:

- Both indoor & outdoor units have a **Capacity Index number** (e.g. FXMQ**30**PBVJU indoor unit & RXYQ**192**TTJU outdoor unit)

Total sum of IDU index numbers ÷ **ODU index number** = **CONNECTION RATIO**

- This ratio is defined as a percentage:
  - **Example:** 8 x FXMQ**30**P connected to 1 x RXYQ**192**T = 240 / 192 = 1.25
  - **Therefore the Connection Ratio** = 125%

System Diversity:

DIVERSITY is the difference between the Maximum System Load demand and the Maximum Capacity of the outdoor unit, at design conditions

- The VRVXpress tool can **define** diversity - also as a percentage

  Example: 8 x FXMQ30P connected to 1 x RXYQ168T
  - **Maximum Load** required at any given time: ..... 170,269 btu
  - **Maximum Capacity** of the ODU at design conditions: ..... 166,315 btu
  - VRV defines the DIVERSITY of the system at: .....-2%
- In this example, if the maximum load is called for, the outdoor unit will fall short of demand by 3,954btu – This VRV design has a 2% system diversity

To summarize: Connection Ratio does NOT indicate the diversity of a VRV system. Use of the VRVXpress selection tool will indicate clearly if selected equipment has a system diversity or not.

Key Points for Selection (cont.)

Obtain Project Data

Before selection of any VRV system, a minimum amount of information is required for accurate equipment selection and to apply an optimized design

For an accurate selection of **indoor** units the following information is required:

PEAK Cooling Loads	PEAK Heating Loads	DESIGN AIR Conditions *The dry & wet bulb temperatures entering the coil*
■ Engineers will usually **provide both Total & Sensible** loads which should be entered ■ However it is possible to select equipment using **only Total or Sensible** load	■ Required when either Heating is the dominant operation or the heating design condition is below 32°F	■ Also known as **"air-on"** or **"mixed air"** conditions ■ **Nominal** conditions are typically 80°F db & 67°F wb but rarely reflect actual conditions ■ Design air-on can also be given as db/RH% (e.g. 74°F & 50% RH)

For an accurate selection of **outdoor** units the following information is required:

AMBIENT Conditions *The design ambient temperature for the location of the project*	PIPE LENGTH *The estimated distance between the outdoor unit and the furthest indoor unit*
■ Both engineers and D&B contractors should have this information ■ If this information is not at hand then use ASHRAE standard design conditions for the location	■ This is the linear length from one point to another NOT the total amount of piping ■ Both engineers and D&B contractors should be able to pin point the outdoor unit location ■ Be sure to also establish whether there is any vertical height between outdoor & indoor units

	VRV IV Heat Pump & Heat Recovery, Aurora Series		VRV-IV W-Series	VRV-S
System Limits	FXDQ, FXMQ_P, FXAQ	All other models	All Indoor Units	
Single	200%	200%	130%	130%
Dual Module		160%		N/A
Triple Module		130%		N/A

- On VRV-III, if systems operated >130% indoor unit thermo-ON, all FCU were set to low fan speed. On VRV IV this function can now be overridden at commissioning stage
- For FXFQ 07, 09 models, connection ratio is limited to 130%

Indoor Unit Size	07	09	12	15	18	24	30	36	42	48	54	72	96
Indoor Unit Capacity Index	7.5	9.5	12	15	18	24	30	36	42	48	54	72	96

VRV System Selection - Avoid the common pitfalls

Common Mistake	Best Practice
Thinking VRV is just a "big" multi split DX system	VRV is a chiller circulating refrigerant instead of water
It's a Zoning system thus an Indoor unit in EVERY room	Design VRV systems using same approach as VAV or WSHP
VRV is a "Ductless System"	More than 55% of units used in North America are Ducted types!
Upgrade Indoor Units to the next capacity size	Use accurate load calc values and trust selection software
Optimum selection of Controls is not important	Be knowledgeable on controls capabilities – minimize BAS or even elimination of BAS is often possible
The entire application needs to be VRV	Use VRV where it makes sense for the customer & project

Capacity Range & Operating Limits

ODU Capacity Range & Piping Limitations

Outdoor Unit Range

VRV IV

Capacity MBH (Tn)	Voltage	Type	# of Modules	# of Compressors	Max. # IDU[1]
36 (3)	1/208-230/60Hz	HEAT PUMP	1	1	6
48 (4)					8
60 (5)					10
72 (6)	3/208-230V/60Hz 3/460V/60Hz	HEAT RECOVERY		2	12
96 (8)			1		16
120 (10)					20
144 (12)					25
168 (14)					29
192 (16)			2	3	33
216 (18)					37
240 (20)					41
264 (22)				4	45
288 (24)					49
312 (26)					54
336 (28)					58
360 (30)			3	6	62
384 (32)					64
408 (34)					64
432 (36)					64
456 (38)					64

Aurora Series & 575V

VRV IV

Capacity MBH (Tn)	Voltage	# of Modules / Compressors[2]		Max. # IDU[3]	
		575	Aurora	575	Aurora
72 (6)	575V/3/60Hz	1	1	12	16
96 (8)					
120 (10)					20
144 (12)			2		25
168 (14)				29	
192 (16)		2	2	33	
216 (18)				37	
240 (20)			2	41	
264 (22)				45	
288 (24)				49	
312 (26)				54	
336 (28)				58	
360 (30)		3		62	
384 (32)				64	

Aurora Series & 575V VRV IV units are currently only available in an air-cooled heat recovery model.

1. Total capacity index of connectable indoor units for VRV IV must be within 50% - 200%.
2. Aurora Series & 575V VRV IV have only 1 compressor per module.
3. Total capacity index of connectable indoor units for Aurora Series and 72 MBH 575V VRV IV must be within 70% - 200%. Total capacity index of connectable indoor units for 575V VRV IV 96MBH – 384MBH must be within 50% - 200%.

VRV IV W Series Water Cooled System

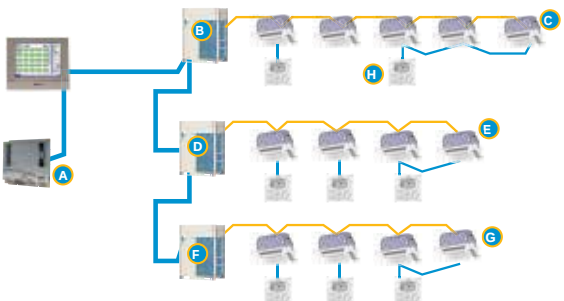
Capacity	Voltage	Type	# of Modules	# of Compressors	Max. # IDU
72 (6)	3/208-230V/60Hz 3/460V/60Hz	Unified HP or HR	1	1	12
84 (7)			1	1	14
144 (12)			2	2	24
168 (14)			2	2	29
216 (18)			3	3	36
252 (21)			3	3	36

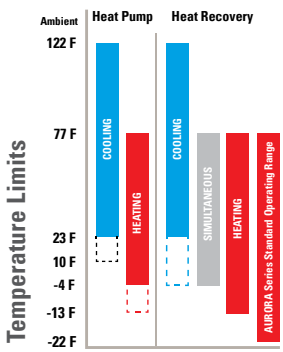
Total capacity index of connectable indoor units must be within 50%-130%.

Communication Wiring should be 18-2AWG stranded, no polarity, no shielding

maximum linear distance = 3280ft, maximum total distance = 6560ft

- Maximum linear distance in the example below is the longest of either
- (A) to (C), (A) to (E), (A) to (G) or (C) to (G)
- Maximum total distance is (A to F) + (B to C) + (D to E) + (F to G)
- Each local controller (H to C) can run up to a distance of 1640ft

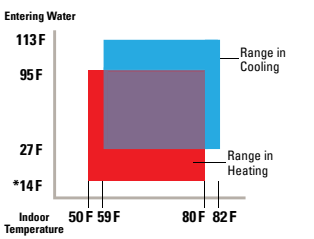




VIA extended capacity tables

VIA technical cooling function

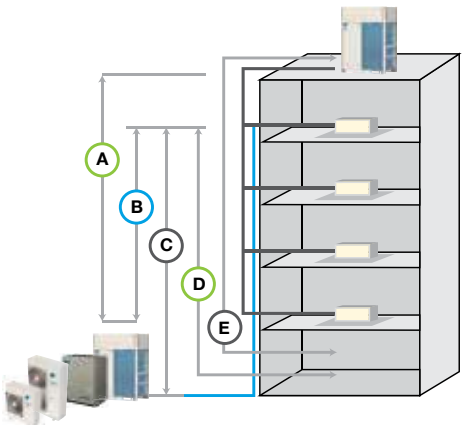
Cooling operation for VRV IV Heat Pump single module systems (RXYQ72/96/120/144/168T) can be extended down to 10˚F, from the standard limitation of 23˚F under defined conditions. *Contact your local Daikin manufacturer's representative or distributor for details.*



* Conditions apply when entering water temperature is below 50ºF. Refer to your local Daikin Representative for further information.

Capacity Range & Operating Limits (cont.)

Refrigerant Piping Limitations



Liquid Line Max (feet)		VRV-IV Heat Pump	VRV-IV Heat Recovery	VRV Aurora Series	VRV-IV W-Series Water Cooled	VRV-IV S (36)	VRV-IV S (48-60)
A	Vertical Drop	164 (295)*	164 (295)*	164 (295)*	164	98	98
B	Between IDU	100	100 (49)†	100 (49)†	49	33	49
C	Vertical Rise	130 (295)*	130 (195)*	130 (195)*	130	98	98
D	From 1st Joint	130 (295)**	130 (295)**	130 (295)**	130 (295)**	130	130
E	Linear Length	540	540	540	390	164	230
	Total Network	3280	3280	1640	980	820	984

* Setting adjustment on condensing unit required.

** Fan coil distance differentials need to be met

† Possible refrigerant noise can be mitigated (via setting adjustments on ODU) when linear length exceeds 390FT.

Nomenclature

How to Read Model Number

Indoor Units

Indoor Unit Category
FX: VRV system indoor unit

Indoor unit type
Example:
M: Concealed ceiling ducted
Z: 4-way ceiling mounted cassette

Refrigerant type
Q: R-410A

Nominal cooling capacity
Example:

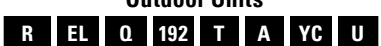
Btu/h	(Tons)
24 = 24000	(2)
60 = 60000	(5)

Series/ Design Change
Major Design Change

Power supply symbol
VJ: 1 phase, 208/230V, 60 Hz

Standard compatibility symbol
U: United States of America

Outdoor Units



Outdoor Unit Category
R: Air cooled
RW: Water cooled

Mode of Operation
XY: Heat Pump
EY: Heat Recovery
XT: Heat Pump (1ø)
EL: Heat Recovery cold climate

Refrigerant type
Q: R-410A

Nominal cooling capacity
Example:

Btu/h	(Tons)
192 = 192,000	(16)
456 = 456,000	(38)

Series / Design Change
Major Design Change

Series / Design Change
Minor Design Change

Power supply symbol
TJ: 3ø, 208/230V, 60 Hz
YD: 3ø, 460V, 60 Hz
YC: 3ø, 575, 60 Hz
VJ: 1ø, 208/230V, 60 Hz

Standard compatibility symbol
U: United States of America


VRV

System Selection

Indoor Unit Range

Sizes & Accessories Available of all IDU's

A Complete Line Up of VRV Indoor Units

TYPE	MODEL	UNIT SIZES			
Round-flow Ceiling mounted cassette	FXFQ-T 	07	09	12	15
		18	24	30	36
		48			
4 way blow ceiling mounted cassette	FXZQ 	07	09	12	15
		18			
Under Ceiling Mounted Cassette	FXUQ 				
		18	24	30	36
Ceiling-Mounted Cassette (Single Flow)	FXEQ 	07	09	12	15
		18	24		
Slim Ducted Ceiling Concealed	FXDQ 	07	09	12	
		18	24		
DC Ducted Concealed Ceiling	FXMQ_PB 	07	09	12	15
		18	24	30	36
		48	54		
Large Capacity Celling Concealed	FXMQ_M 				
				72	96
Flat Panel Wall Mounted	FXAQ 	07	09	12	
		18	24		
Ceiling Suspended	FXHQ 			12	
			24		36
Floor Mounted	FXLQ 	07	09	12	
		18	24		
Concealed Floor Standing	FXNQ 	07	09	12	
		18	24		
Multi Position AHU	FXTQ-TA 		09	12	
		18	24	30	36
		42	48	54	60

= Filter Included =Pump Included =OA Connection

= Filter Options =Pump Options 07=Size Available

Optional Indoor Unit Accessories available to enhance your Daikin VRV solution:

Options	FXAQ	FXDQ	FXFQ-T	FXHQ	FXLQ	FXMQ-PB	FXMQ-M	FXNQ	FXTQ	FXZQ	FXUQ	FXEQ
MERV 8 Filters							✔					
MERV 13 Filters			✔			✔	✔					
Economizer Option						✔	✔					
DZK (Zoning Kit)						✔						
OA Connection Kit			✔							✔		
AUX Heat Adaptor PCB		✔	✔	✔	✔	✔	✔	✔	STD	✔	✔	✔
Humidifier Adaptor PCB		✔	✔	✔	✔	✔	✔	✔	STD	✔	✔	✔
Electric Heater Kits									✔			
Self Cleaning Filter			✔									
Presence Sensor			✔								✔	

Hail Guard	Outdoor Unit Accessory (RXYQ & REYQ only)

Indoor Unit Considerations

CASSETTE UNITS provide the best combination of economic installation with a good level of flexible project design. Fresh air supply is possible but limited

Considerations:

- Is there a ceiling void space?
- What is the height of the void space?
- What type of ceiling (grid or hardboard)?*
- Is there a requirement to introduce fresh air?

***Note:** In hard-board ceilings, service hatches are required

Cassette Range		Model	Height	Air Throw	Max. O.A.
	FXZQ	All	$11^{13}/_{16}$"	12ft (per outlet)	3% of unit AFR
	FXFQ	07 ~ 30	$9^{11}/_{16}$"	14ft (per outlet)	20% of unit AFR*
		36 ~ 48	$11^{5}/_{16}$"		
	FXUQ	18 ~ 24	$7^{13}/_{16}$"	12ft (per outlet)	N/A
		30 ~ 36	$7^{13}/_{16}$"	14ft (per outlet)	
	FXEQ	07 ~ 24	$11^{1}/_{16}$"†	15ft	15%

†less than 10 inches in void space

*requires outdoor air kit (or else only 3%)

Application Examples:	FXZQ	small offices – 2' x 2' ceiling grids
	FXFQ	large open plan areas – shallow void spaces
	FXUQ	retail outlets – restricted or no void spaces
	FXEQ	hotel bedrooms, perimeter retail and offices

DUCTED units offer the ultimate in flexibility of design, air distribution and integration of ventilation. It also tends to be the most expensive installed cost option. However cost can be minimized by serving multiple rooms with a single unit - the loss of individual room units can be countered with thoughtful control design.

Considerations:

- Is there a ceiling void space?
- What is the height of the void space?
- What level of ESP is likely to be required
- Is there a requirement to introduce ventilation into the space via the FCU?
- What level of control is required?

Note: Multiple rooms can be served by one unit (See DZK control section)

Ducted Range		Model	Height	Max. WG	Max. O.A.
	FXDQ	07 ~ 12	7 7/8"	0.12"	20% of unit AFR
		18 ~ 24		0.17"	
	FXMQ-P	07 ~ 15	11 13/16"	0.40"	
		18 ~ 48		0.80"	
		54		0.56"	
	FXMQ-M	72 ~ 96	18 1/8"	0.95" (1.1" 230V)	

Application Examples:		
	FXMQ-P	Most applications – multiple room zoning
	FXMQ-M	Large open plan areas – high ESP requirements
	FXDQ	Bulkheads – hotels – assisted living

Indoor Unit Considerations (cont.)

CONCEALED units offer the opportunity to hide away the equipment when there is no ceiling void but the client does not wish to use exposed units or else has similar equipment existing and sees the benefit of retro fitting with minimum disruption and expense.

In areas where heating is the primary role of the system, floor standing units are sometimes installed around the perimeter of a building for optimum air flow.

Considerations:

- Is there an existing unitary type system?
- Is heating the primary requirement?
- Does the client prefer not to 'see' the units?
- Is there a requirement to introduce fresh air?

Concealed		Model	Height	Max. WG	Typical O.A.
	FXNQ	All	24	Minimal	10% AFR*
	FXTQ	09 - 36	45"	0.9"	20% AFR
		42 - 48	53 ½"		
		54 - 60	58"		

Application Examples:	FXNQ	Perimeter heating – hallways
	FXTQ	Condo's – closet spaces – retrofits

*Via underside - no duct

EXPOSED units usually offer the client the most economical installed cost solution on a VRV system. These types of units are most often used when there are budget constraints or where an area has no void space/enclosure to conceal other unit types. None of these units have integral condensate pumps fitted.

Considerations:

- How big is the space?
- Where can the unit be located?
- Is piping / condensate run clear?
- Is the client accepting of exposed units?

Exposed Units		Model	Approx. Air Throw	Max. WG	Typical O.A.
	FXHQ	All	20'	N/A	NONE
	FXAQ	All	13'		
	FXLQ	All	7'		

Application Examples:		
	FXHQ	Classrooms – retail – restaurants
	FXAQ	Hotels – small offices
	FXLQ	Perimeter heating – condos – churches

Zoning VRV systems with DZK

VRV Meets VAV - Features & Benefits

DZK - Daikin Zoning Kit

The DZK solution increases the flexibility of VRV applications by allowing multiple zones to be served by one indoor unit fan coil while still providing individual temperature control.

Up to 6 separate dampers supply variable air flow to the zones in response to individual zone thermostats.

Zoning Box

The zoning box is a plenum with motorized dampers that constantly modulate the conditioned air flow into each zone through standard ductwork, in response to the demand from the individual zone thermostat.

Main Thermostat

The main thermostat is a wired color touch display master unit used to configure the DZK system. It can also be used as the thermostat for one or all of the zones.

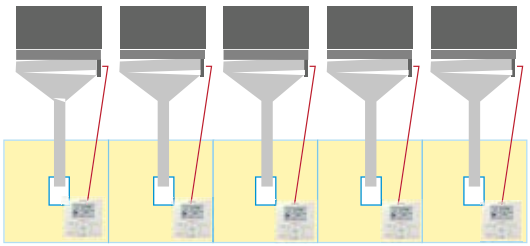
Zone Thermostat

The zone thermostat is a wireless, battery powered, touch display unit that is used for one zone. Each zone thermostat monitors and allows the user to select a comfortable room temperature, and program or adjust the control functions for the room.

DZK BACnet® Gateway Module

The DZK BACnet Gateway module allows individual room control via any BACnet/IP compatible Building Management System.

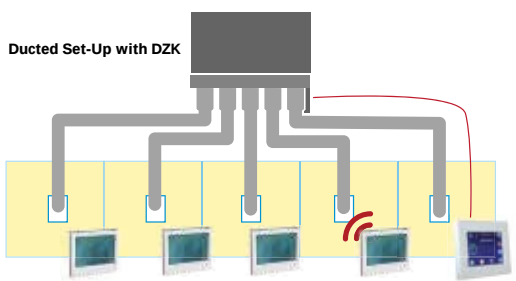
Standard Ducted Set-Up



Advantages

- Reduces system hardware cost - fewer Indoor units required
- Increases comfort levels by allowing more individual zone control
- Reduces installation expense and maintenance costs
- Reduces the amount of refrigerant required in the installation
- Increases the flexibility of the VRV application design

Ducted Set-Up with DZK



	Zoning Box Range			
Product Reference	**DZK030E4**	**DZK030E5**	**DZK048E4**	**DZK048E6**
Compatible Ducted Unit	**FXMQ15PB ~ FXMQ24PB**		**FXMQ30PB ~ FXMQ54PB**	
No. of Air Duct Outlets	**4 x ø8"**	**5 x ø6"**	**4 x ø8"**	**6 x ø6"**
Number of Zones	**2 to 4**	**2 to 5**	**2 to 4**	**2 to 6**

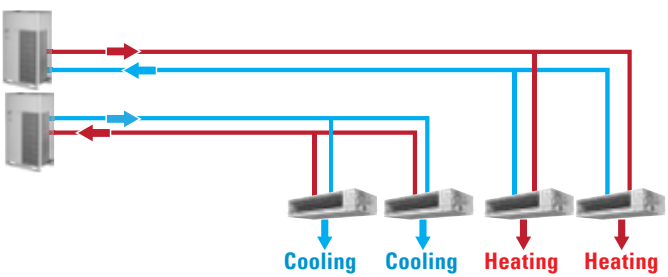
Note: The FXMQ indoor unit must still be connected to a BRC1E73 room controller

Heat Pump or Heat Recovery?

The Various Heat/Cool Changeover Options

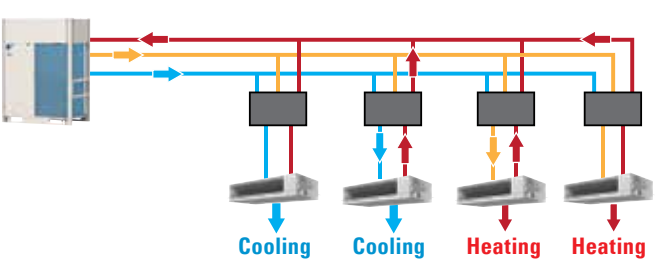
Heat Pump

- The 2 pipe Heat Pump system is the equivalent of a 2-pipe chilled water system
- A heat pump system provides the means of heating OR cooling at any given time
- Multiple heat pump systems can be zoned and will work independently of each other
- When demand is met by an indoor unit the unit will work on fan only or the fan will cycle on/off until demand returns or mode change occurs



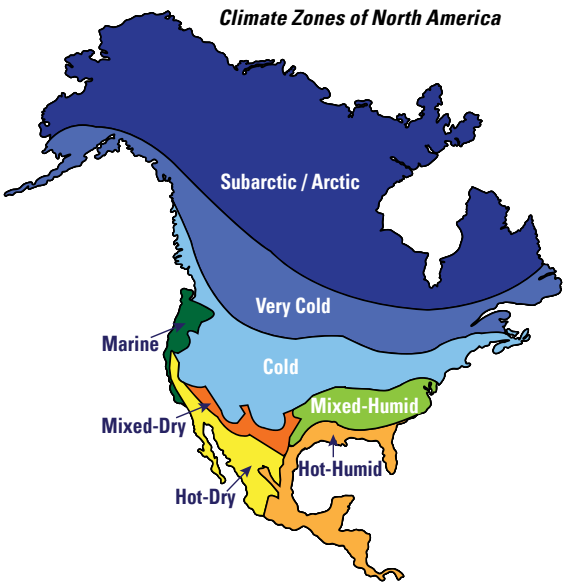
Heat Recovery

- The 3 pipe Heat Recovery system is the equivalent of a 4-pipe chilled water system
- A heat recovery system has the ability to provide simultaneous heating AND cooling
- When both heating and cooling occur simultaneously, system and building energy can be better utilized
- When demand is met by an indoor unit the unit will work on fan only or the fan will cycle on/off until demand returns



Should I Use Heat Pump or Heat Recovery?

There are ***three*** main factors that dictate whether a HP or HR system should be selected. ***All*** these factors should be considered in each case to determine an appropriate selection:



GEOGRAPHY

The location or the project will often dictate what type of system will be required. Projects in temperate climates tend to use Heat Recovery due to the changeable load demands that can occur through the course of a day. However areas with defined seasons or little demand for simultaneous heating or cooling throughout the year will usually utilize Heat Pump.

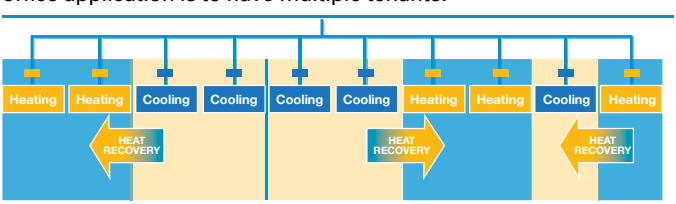
Heat Pump or Heat Recovery? (cont.)

BUILDING LAYOUT

Sites with open plan areas and/or similar orientation will often be satisfied by a heat pump system, irrespective of geography. On the other hand, if the site has many aspects, individual rooms and/or heat loads, this may define the client requirement toward heat recovery. Differing internal room load demands may see the need for cooling for longer periods of the year.

OCCUPANCY

The type of end user will often trump any other consideration. Typically a multi-tenanted site will require a heat recovery system as the ability for individual mode control is paramount. Typical examples of this include hotels, assisted living, condos as well as offices. It is always important to establish from the outset if an office application is to have multiple tenants.



Ultimately there are many applications where the answer will be

both Heat Pump AND Heat Recovery

Air Cooled or Water Cooled?

Factors that Benefit the use of VRV-IV W-Series

Air to air VRV systems make up the majority of VRV installations This is due to the following:

- Ease of installation (no water system required)
- Less initial capital costs

However Water Cooled VRV can have certain advantages:

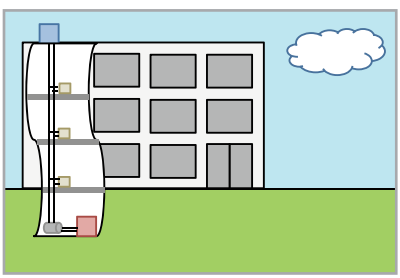
- Greater energy efficiencies
- Localized CU installation (reduced pipe runs)

These advantages come in to play when the following are present:

- An existing chilled water loop
- Extreme ambient conditions
- An ability & desire to utilize a local geothermal source

Internal Plate Heat Exchanger

Water Cooled VRV - Existing Water Loop

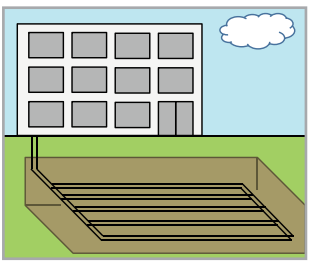


Boiler ~ Tower Water Loop

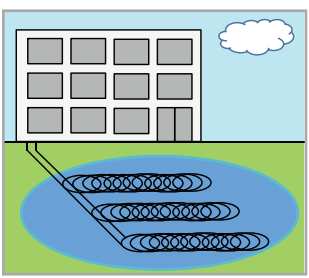
By utilizing an existing water loop in the building, the advantages of greater energy efficiency can be promoted without having to offset capital costs. In addition VRV-IV W-Series CUs are usually located locally to the area they are serving and will typically attach to the water loop already running through the building. This negates the need to run copper piping through risers to a remote plant space (be aware that VRV-IV W-Series CUs are internal mounting units).

Air Cooled or Water Cooled? (cont.)

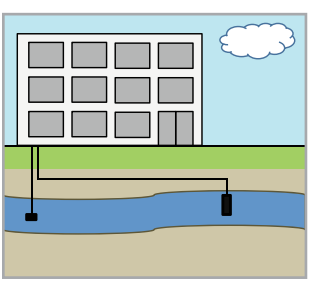
Water Cooled VRV - Geothermal



Closed Loop Buried in Ground



Closed Loop in Surface Water



Open Loop using Ground Water

A ground-source VRV heat pump system combines the advantages of both technologies into one system, making it one of the most efficient HVAC systems available and achieving savings over either GSHP or VRF on their own. The constant ambient conditions below ground also ensure that these savings are realized year round.

There are two main types of systems: closed loop and open loop. Closed loops bury water pipes either in solid ground or in a water source (like a pond or lake). An open loop draws from groundwater, like a well, and returns it back to source.

Design Criteria:

Water loop design is the responsibility of the engineer. However, two facts are needed from Daikin:

The minimum & maximum entering water temperatures:

- 50°F-113°F for Cooling
- 27°F-113°F for Cooling on a Geothermal System
- 50°F-113°F for Heating
- 14°F-95°F for Heating on a Geothermal System

A suitable water flow rate:

- 13.2gpm to 39gpm per module Boiler & Tower System
- 21gpm to 39gpm per module on a Geothermal System).

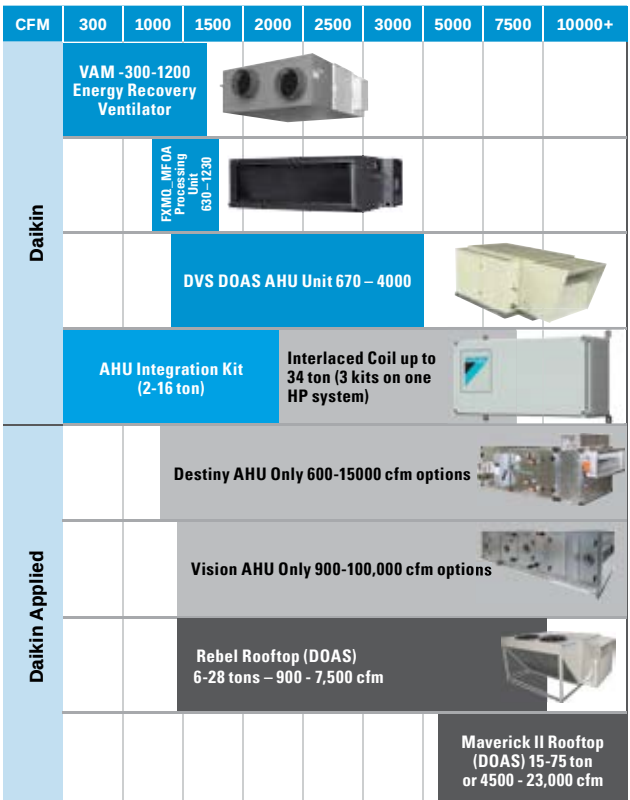
  ** (Be aware that conditions need to be met when EWT for heating is required below 50°F – seek assistance for these applications)*

Other consideration:

- When VRV is to be applied with an open loop system, a 3rd party heat exchanger is required to ensure the plate heat exchanger of the VRV condensing unit operates in a closed loop system.
- The VRV condensing units have a heat output of approx. 2400btu's. Where multiple units are placed in an enclosed area, any potential heat build up must be addressed (either with adequate ventilation or even a fan coil unit).
- From the CU pipe connection to the fan coils, the equipment, controls & selection process is identical to air cooled VRV.

Solutions for Ventilation

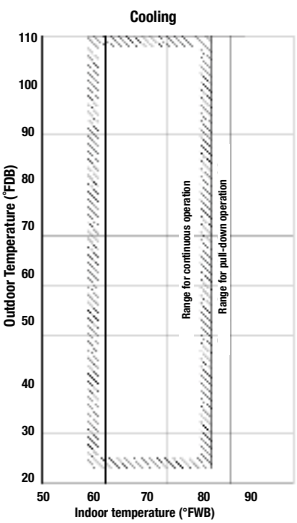
Range & Limitations of our Ventilation Options

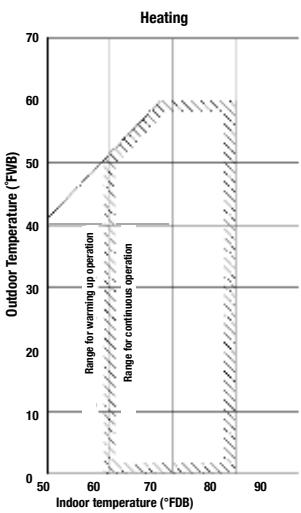


Typically Daikin equipment has been applied using a standard rule of thumb that a maximum of 20% OA should be used for ducted fan coil units (FXMQ, FXDQ and FXNQ). However, this practice is not always applicable as this rule of thumb is based upon introducing OA at nominal conditions.

Basic Rules

1. **COOLING:** Any percentage of OA can be used as long as the resulting mixed air is between **57 and 77˚FWB and 80% RH or lower**.
2. **HEATING:** Any percentage of OA can be used as long as the resulting mixed air is between **59 and 80˚FDB and 80% RH or lower**.





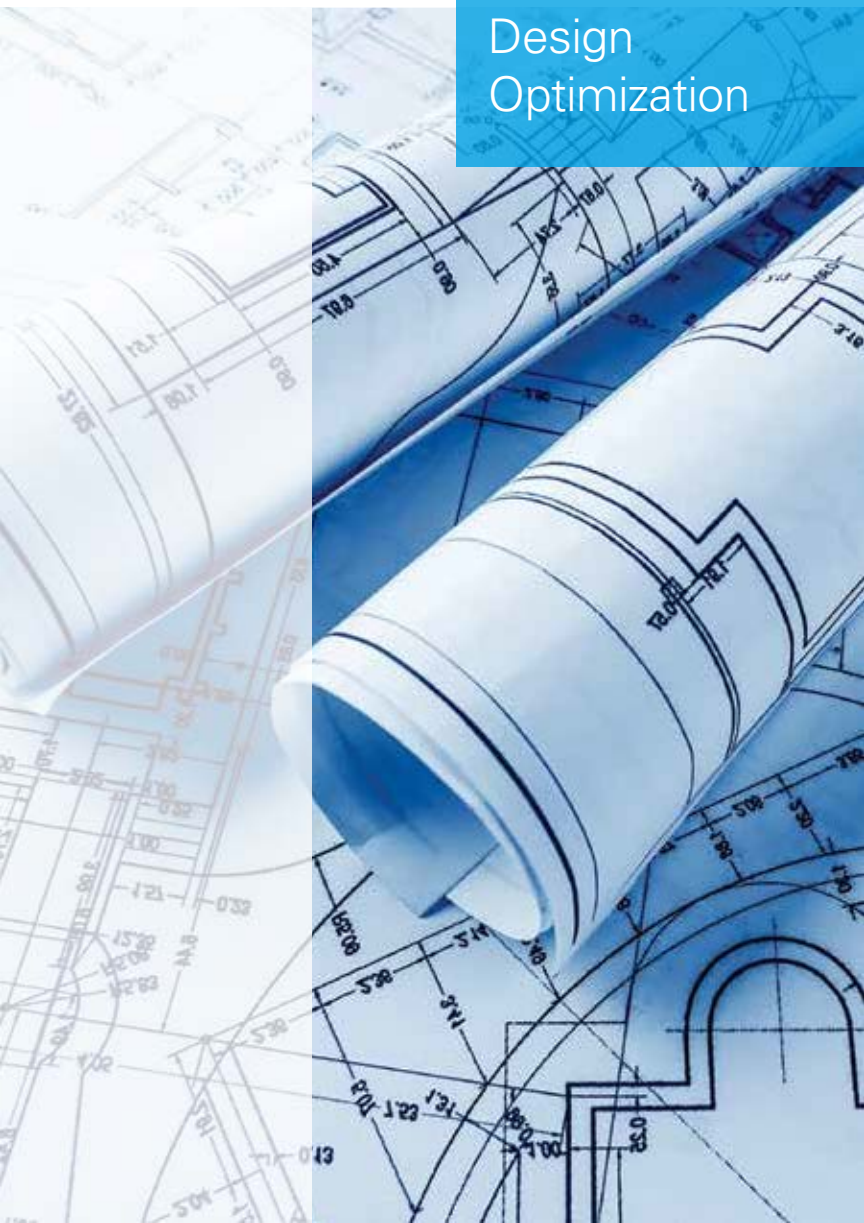
Note: Space temperature sensing should be done via the room zone controller or remote sensor kit if a "mixed air" approach is taken.

Solutions for Ventilation (cont.)

Ventilation Air % – Rule of Thumb
OA / Ventilation considerations

Method	Scope	Options	EA Limits	Connection Limits
Direct	1. Untreated ventilation is supplied directly to the indoor unit 2. Small projects where low CFM volumes are required 3. Projects with budget constraints 4. Suitable for mild climates	FXMQ FXDQ FXNQ FXTQ FXFQ FXZQ FXEQ	Cooling: 57°–77°FWB Heating: 59°F – 80°FDB	1. Units with OA connection (Ducted, Cassettes) 2. Consider Booster Fan & OA % scope
Integrated	1. Pretreated ventilation is supplied directly to the indoor unit 2. Small to medium applications 3. Suitable for all climates 4. Allows for sharing load between ventilation system and VRV system	VAM FXMQ-MF EKEXV	5°F – 122° FDB 23°FDB – 90°FWB (50°FDB – 82°FWB) FCBA = 50°FDB – 95°FDB	No Limits 50 - 100 - (130)% 10 - 30 - (50)% FCB = 90 - 110%
Separate (de-coupled)	1. Pretreated ventilation directly to the space 2. Suitable for all applications and climates 3. Allows for sharing load between ventilation system and VRV system 4. Most flexible layout	EKEXV	FCBA = 50°FDB – 95°FDB	FCB = 90 - 110%
		DVS	TBD	TBD
		Destiny Vision Rebel Maverick	**Select options based on manufacturer guidelines.** **Integrate controls where it makes sense.**	

Design Optimization

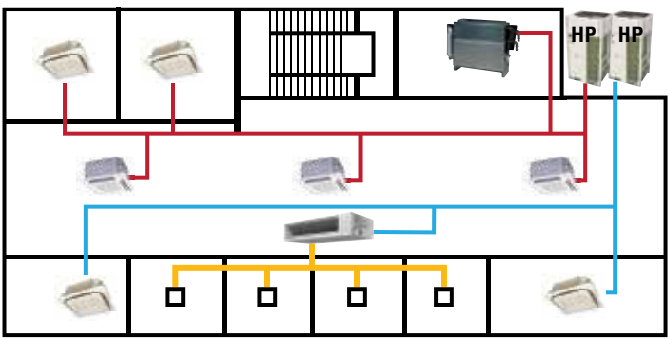


System Zoning

Guideline to Optimized Zoning of Systems

Typical Zoning of Heat Pump

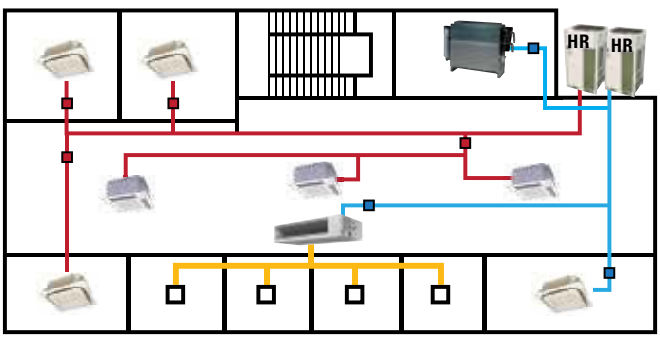
When more than one system is required, it is good practice to zone units that are positioned on the same orientation or are subject to common load profiles. This maximizes the scope for correct heating/cooling demands to be met.



Typical Zoning of Heat Recovery

Conversely, with heat recovery it is better to ensure that units on different orientations are matched together. This ensures more potential for heat recovery to occur at any given time and thereby optimizing energy savings.

Note: FCU Performance is not affected by varying indoor unit combinations.

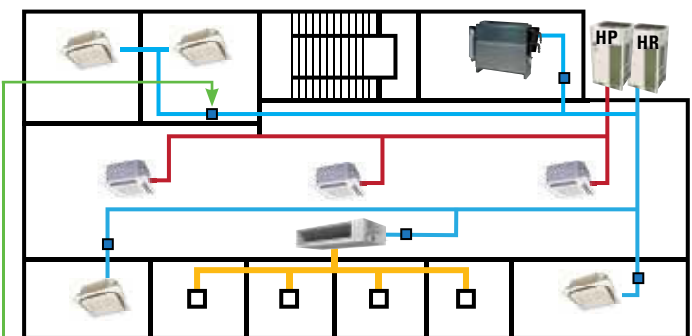


Note: Changing systems from HR to HP through the design process is not uncommon It does NOT affect initial indoor unit selection however re-zoning of fan coil units is usually required.

System Zoning (cont.)

Optimized (mixed)

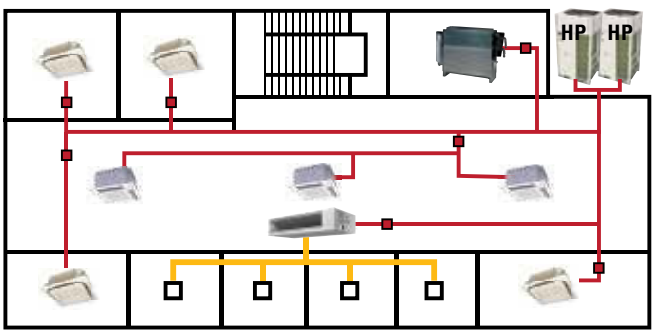
It is important to avoid defining a project as a 'heat recovery job' or 'heat pump job'. There are often applications where a mixture of both types is the best design practice - and can reduce costs to the client.



Note: The use of heat recovery does not always mean a branch selector box for each for each indoor unit or even each area – this is a good way to reduce costs further without compromising flexibility.

When to use MULTIPLE MODULES

There are several advantages to linking VRV condensing units together: Less piping & total refrigerant needs, superior efficiencies due to more outdoor unit heat exchange surface area at partial load and a greater likelihood of heat recovery (on 3-pipe) to occur due to increase in varying zones on the systems.



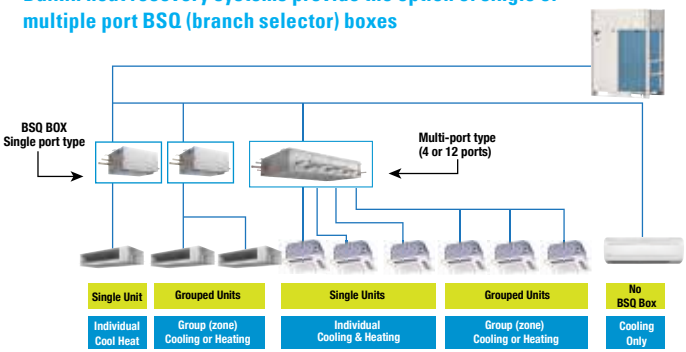
Note: This design option is often overlooked due to refrigerant limitations in small spaces set by ASRAE Std. 15

Current ASHRAE Std. 34 Regulations: 26lbs of R410A refrigerant per 1000ft^3 (0.026lbs/ft^3) in normal occupancies.

Branch Selector Boxes

Overview of BSQ Box Range & Features

Daikin heat recovery systems provide the option of single or multiple port BSQ (branch selector) boxes



Note: When multiple units are grouped together on a single port, although a single heat/cool zone is created, units still operate independent of each other irrespective of whether they are grouped together on one room controller or individual controllers.

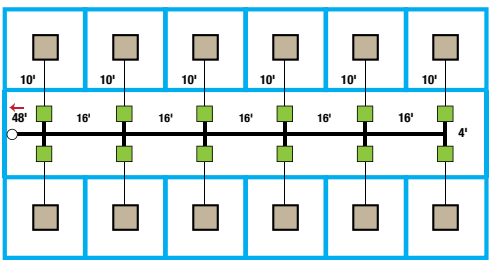
Model		Max units per Port	Max capacity per port
BSQ36		4	36 MBH
BSQ60		8	60 MBH
BSQ96		8	96 MBH
BS4Q54		5	54 MBH
BS6Q54		5	54 MBH
BS8Q54		5	54 MBH
BS10Q54		5	54 MBH
BS12Q54		5	54 MBH`

Single or Multi BSQ Boxes?

Optimized Selection of BSQ Boxes

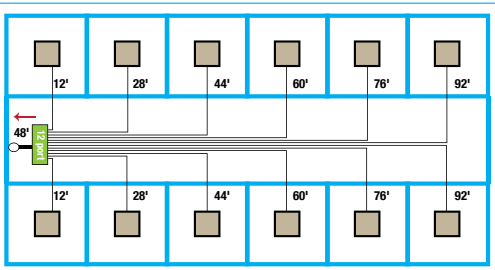
When selecting HEAT RECOVERY BRANCH SELECTOR BOXES there is a limitless number of ways to group indoor units

TOTAL PIPING REQUIRED	696 ft
REFNET JOINT SETS	11
BRAZED CONNECTIONS	186
BSQ BOX HANGING RODS	48



Using single port boxes provides the ultimate in flexibility for branch box location. This method ensures a much reduced total piping. It also significantly reduces the amount of refrigerant required in the system – critical if the allowable level of refrigerant is a major factor

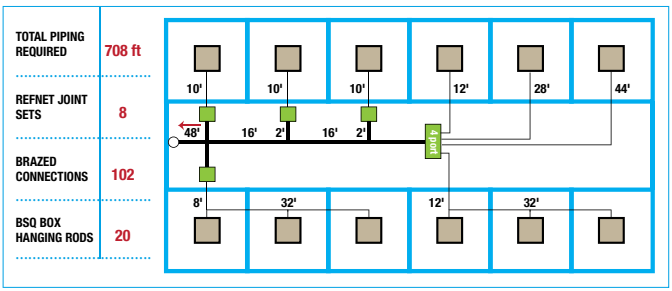
TOTAL PIPING REQUIRED	1392 ft
REFNET JOINT SETS	0
BRAZED CONNECTIONS	54
BSQ BOX HANGING RODS	4



...however, if it is possible to incorporate multiport boxes, a reduction in installation costs can be realized. This example, using a single 12 port multi-box, requires no refnet joints and demonstrates a marked reduction in brazed connections and hanging rods

= BSQ Box = Indoor Unit

Single or Multi BSV Boxes? (cont.)

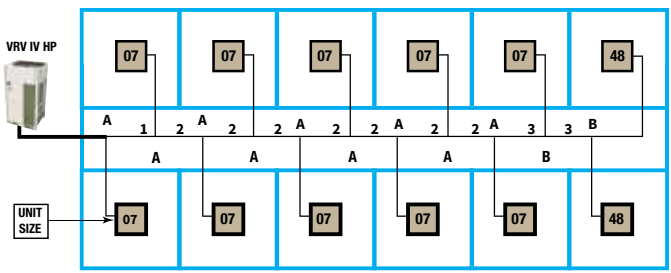


As shown in this scenario, being able to select single or multiple BSV boxes, in addition to zoning some units together on a single port, Daikin heat recovery allows the ultimate in flexibility, even on a single system.

Piping Sizes and Optimization

Tips to Reducing Pipe & Joint Sizes

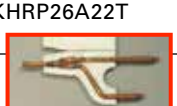
A factor not often considered before installation is establishing an optimum pipe route. This can be due to the limited choice of riser or outdoor unit location. However, establishing an optimum pipe route and order of unit attachment can realize significant reduction in both pipe & REFNET joint sizes.



Piping Required*	REFNETs Required
2 sets of - 3/4 & 5/8	**9** sets of size **72**
7 sets of - 3/4 & 1/2	**2** sets of size **33**
2 sets of - 3/4 & 3/8	**0** sets of size **22**
0 sets of - 5/8 & 3/8	

Shown here and on the following page are two options of piping connection for the same scenario. Pipes & joints are sized for units being served 'downstream'. By simply having the main pipe from the outdoor unit cut in at a different location on the circuit, there is a marked decrease in joint & pipe sizes and therefore install costs.

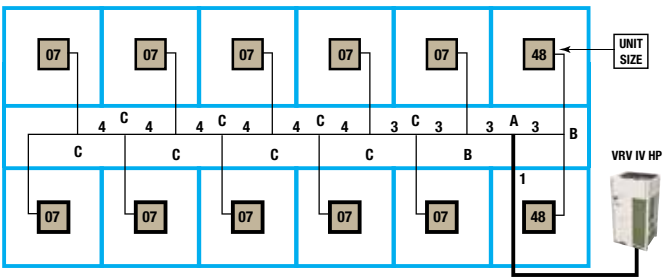
REFNET Size
A KHRP26M72TU
B KHRP26A33T
C KHRP26A22T



Pipe Sizes*
1 3/4 & 5/8
2 3/4 & 1/2
3 3/4 & 3/8
4 5/8 & 3/8

*Pipes to fan coil not included

Piping Sizes and Optimization (cont.)



Piping Required*	REFNETs Required
1 set of - 3/4 & 5/8	**1** set of size **72**
0 sets of - 3/4 & 1/2	**2** sets of size **33**
4 sets of - 3/4 & 3/8	**8** sets of size **22**
6 sets of - 5/8 & 3/8	

Smaller Diameter Pipes = Reduced Cost

Reduced REFNET Sizes = Reduced Cost

Points of Note

- The options shown do not indicate a right and wrong way to install – both are fine as long as required piping limitations are met
- Optimization is a benefit however pipe routes are often dictated by route limitations on site
- The VRVXpress selection tool provides the ability to check this information, very easily, at design stage
- These recommendations apply to both Heat Pump & Heat Recovery
- BE AWARE: VRVXpress automatically generates default piping schematics
  - These show FCU's in a simple linear arrangement based on the order they were added to the ODU on the selection tool
  - In this scenario, pipe & joint sizes listed are based on the default entry
  - Should accurate pipe & joint data be required, manipulation of the piping layout drawing of VRVXpress is necessary

Outdoor Unit Installation Space

Minimum Space Requirements

At concept stage one of the most common requirements, especially in built up areas, is to establish that there is space to fit the outdoor equipment. The 'de-centralized' nature of VRV provides a great deal of flexibility however the multitude of service space combinations in the engineering book still do not cover fully the bespoke nature of project application. Therefore it is important to have a grasp of minimum space requirements.

The 3 criteria to overcome are:

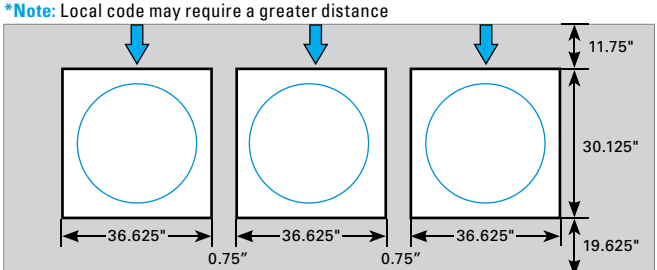
AIR STARVATION • SHORT CIRCUITING • SERVICE SPACE

There are two constants regardless of the application, system type or series:

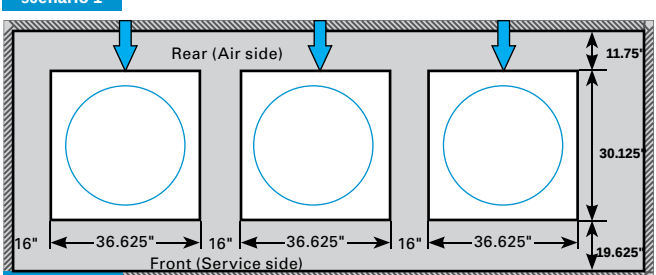
VRV ODU's require a minimum of **11.75"** (300mm) **at the Rear** (or air side) of the unit

VRV ODU's require a minimum of **19.625"** (500mm) **at the Front** (or service side) of the unit

***Note:** Local code may require a greater distance



scenario 1



scenario 2

Enclosed space

Outdoor Unit Installation Space (cont.)

The complexity of design comes in to play when multiple units are to be installed into a restrictive area. The space between units in scenario 1 above are minimal and is only required to avoid any possible issues of vibration.

However when wall heights exceed those shown in the data book (as they usually do) rather than move units away from the wall, the better practice (if the space allows) is to move the units further apart from each other. The distance can vary according to a number of factors however 16" between units will cover most all scenario's.

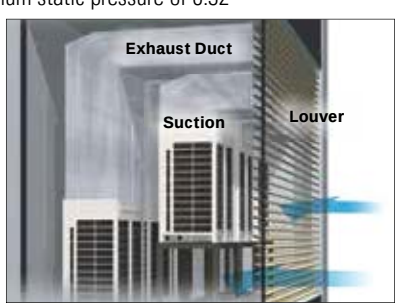
Therefore, a great rule of thumb to see that a space is suitable for VRV equipment is: 12" x 16" x 20"

Think of the service engineer!

- The minimum service space (20") allows for the removal of a compressor however if rows of units are to be located in one area then place the units front to front and allow 40" between each row (24" air side to air side).
- The minimum space between units of 0.75" can make removing the top plate awkward. If space allows, always leave at least 4" between units (although this is not a necessity).

Mechanical Rooms & Acoustic Enclosures

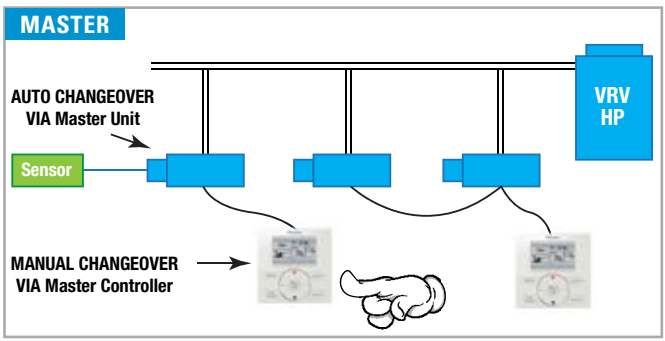
- The same space rules apply in enclosed areas however the air side of a unit can be positioned closer than 12" to a louvered wall. Each unit has a maximum static pressure of 0.32"
- Short circuiting and air starvation must also be addressed. This is specially so when units are to be situated behind acoustic louvers and when multiple units are to be positioned together in a single enclosure.



Heat Pump Changeover

The Various Heat/Cool Changeover Options

There are no less than **six** ways to provide heat/cool changeover on a heat pump system. Most of these also apply to heat recovery FCU's grouped on a single port of a BS Box (think of the BS box as a mini heat pump system).



Master Unit:

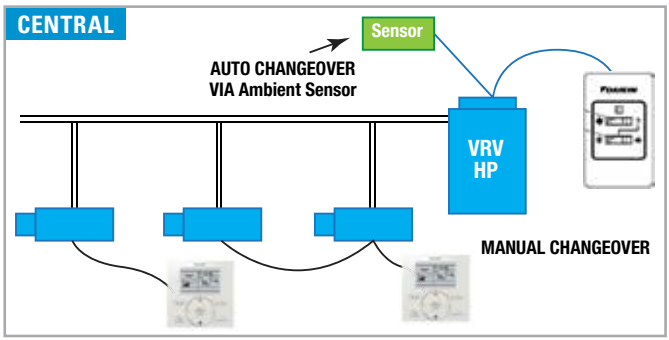
The simplest way to address heat / cool changeover **automatically** is to nominate a master unit. When the unit's return air sensor measures outside the temperature set point limitation, he unit switches itself and all other units on the system to the different mode.

Master Controller:

Similar to the option above except mode selection is made **manually** by via a designated master controller. Again, all other units on the system then switch mode in unison.

Note: A common pitfall is to elect an area that is not in constant use or has no easy access (e.g. managers office) In both options above, if the unit isn't running then mode change is not possible without the intervention of some form of central control.

Heat Pump Changeover (cont.)



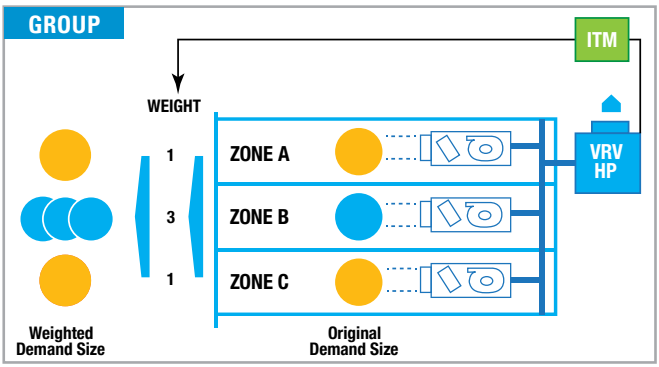
Summer / Winter Switch:

A Daikin supplied switch is attached to "ABC" terminals on the external unit to allow **manual** changeover from a central location. This is commonly found on sites with facilities managers or multi-tenant sites such as hotels where heat pump was installed in an exclusively cooling region.

3rd Part Ambient Sensor:

This option was developed to provide an **automatic** version of the summer winter switch. A remote ambient sensor will dictate when mode change occurs. Occasionally used in temperate climates where budget constraints push the application towards heat pump but is an option rarely seen in this market.

Note: Both the central mode control options above are only utilized on heat pump systems.



Averaging Sensors:

Historically, a popular method is to elect all units to act as joint 'master' units. Automatic mode change occurs when the majority of units demand it.

Voting System:

The most flexible auto change over is the voting system. Changeover operates by continually calculating the demand load of each room by measuring the temperature differential of the set point against the room temperature. Modes are regularly changed accordingly.

This method can be tailored on each application by 'weighting' the demand of a room based on it's importance. Note that this method can be used for units grouped together on a single port of a heat recovery system.

Note: Both "Group" changeover methods require a Daikin i-Touch Manager to operate.

To summarize: With ALL changeover options, when a system mode is changed, the indoor units on the system are not forced into heating or cooling. If there is no demand in the room for the mode that has been selected, the unit(s) will run in fan only mode.

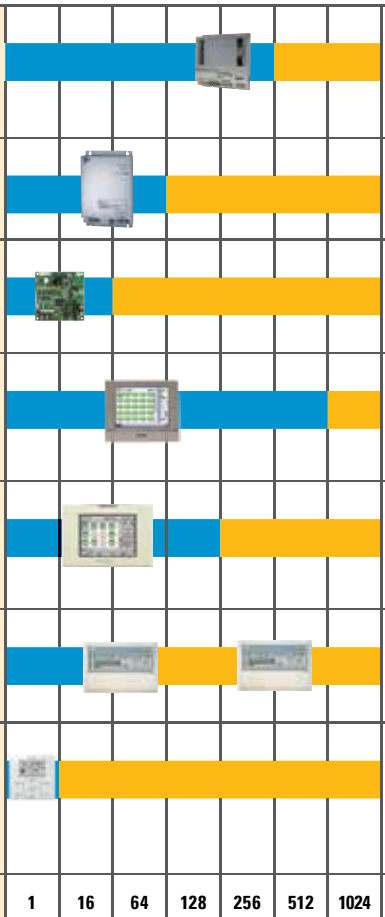

VRV

Controls & Standards

Controls Portfolio

Range of Zone and Centralized Controllers

Scalable controls offering to match a building's requirement



Project requirements drive the controls selection process

Project Requirements	Daikin VRV Controls			
	 BRC1E73 Navigation	 BRC2A71 Simplified	 DCS302C71 Centralized	 DCS301C71 Unified
Simple individual zone control	●	●		
Independent Cool and Heat setpoints	●			
Individual zone control with weekly programmable scheduling	●			
Multi-zone control without scheduling functions			●	●
Basic central point on/off control of all air handling units			●	●
Multi-zone control of small to medium size projects			●	●
Multi-zone control of large commercial projects			●	
Advanced multi-zone control with scheduling logic and calendar				
Automatic cooling/heating changeover for heat pump systems	●			
Single input batch shutdown of all connected air handlers			●	●
Web browser control and monitoring via Intranet and Internet				
E-mail notification of system alarms and equipment malfunctions				
Multiple tenant power billing for shared condenser applications				
Temperature set-point range restrictions	●			

*Requires one or more DEC102A51-US2 the third party energy management system

● Native application or feature Digital Input/Output units.

● Dependent upon capabilities of for this device.

Project requirements drive the controls selection process (cont.)

Project Requirements	Daikin VRV Controls					
	Intelligent Touch Controller 	Intelligent Touch Manager 			WAGO I/O 	WAGO BACnet®/IP Controller 
		Basic	BACnet® Client Option	BACnet® Server Option		
Independent Cool and Heat setpoints	●	●		●		●
Individual zone control with weekly programmable scheduling	●	●				●
Basic central point on/off control of all air handling units	●	●		●		●
Advanced multi-zone control of small to medium size projects	●	●	●	●	●	●
Advanced multi-zone control of large commercial projects	●	●	●	●	●	●
Advanced multi-zone control with scheduling logic and calendar	●	●		●		●
Automatic cooling/heating changeover for heat pump systems	●	●		●		●
Single input batch shutdown of all connected air handlers	●	●		●		●
Web browser control and monitoring via Intranet and Internet	●	●				●
E-mail notification of system alarms and equipment malfunctions	●	●				●
Multiple tenant power billing for shared condenser applications	●	●				●
Temperature set-point range restrictions	●	●		●		●
Graphical user interface with floor plan layout		●				●
Start/Stop Control of External Equipment	●	●	●		●	●
Modulating Control of External Equipment			●			●
Custom Programming for external equipment control						●

● Native application or feature for this device. ● Dependent upon controller programming

Project requirements drive the controls selection process (cont.)

Project Requirements	Daikin VRV Controls			
	BACnet® Interface 		LonWorks® Interface 	Modbus Adaptor 
	Basic	With BMS Plug-in		
Independent Cool and Heat setpoints		●		
Individual zone control with weekly programmable scheduling				
Basic central point on/off control of all air handling units	●	●	●	●
Advanced multi-zone control of small to medium size projects	●	●	●	●
Advanced multi-zone control of large commercial projects	●	●	●	
Advanced multi-zone control with scheduling logic and calendar	●	●	●	●
Automatic cooling/heating changeover for heat pump systems	●	●	●	●
Single input batch shutdown of all connected air handlers	●		●	
Web browser control and monitoring via Intranet and Internet	●		●	●
E-mail notification of system alarms and equipment malfunctions	●		●	●
Multiple tenant power billing for shared condenser applications				
Temperature set-point range restrictions	●	●	●	●
Graphical user interface with floor plan layout	●	●	●	●

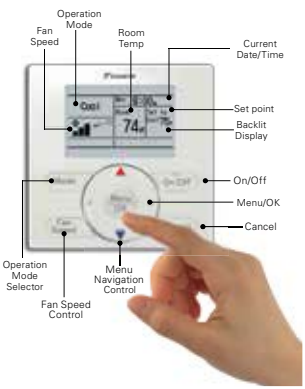
● Native application or feature for this device. ● Dependent upon capabilities of third party energy management system

Local Control Options

Features & Benefits of the Room Controller

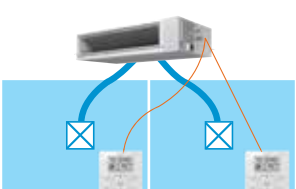
BRC1E73 - Navigation Room Controller

Daikin room controllers offer a vast array of features that provide the ultimate in flexibility and benefits that many other manufacturers' are unable to offer.



A major feature is the ability to have a single ducted unit serve two areas and still provide individual control to the users in both zones.

The controllers operate on the basis of last command priority.



In addition to the basic functions that meet the zone control requirement of all VRV indoor units, the Navigation Remote Controller will provide advanced control functions that historically require a central controller to administer:

- **7 day Schedule**
  Up to 5 actions per day (7 days, 5+1+1,5+2, everyday), Off timer (from 30 mins to 3 hours)
- **Temperature Limiting**
  Configurable upper & lower limit restriction for the occupied cool and heat setpoints
- **Control Lockout**
  Ability to restrict all or some of the buttons. Ability to limit operation mode selection
- **Run-On Timer**
  Allows a unit to be turned on, outside time clock settings, for an extended period
- **Dual setpoints**
  For both occupied and unoccupied (setback) period
- **Auto cool/heat changeover**
- **Automatic adjustment for Daylight Saving Time (DST)**
- **Temperature sensor with configurable offset**

Featured Controllers

DCM601A71 – intelligent Touch Manager

The intelligent Touch Manger (iTM) is an advanced multi-zone controller that controls and monitors Daikin VRV system.

- Easy operation and configuration with LCD touch screen
- Advanced control functions includes dual setpoint, setback control, auto-changeover, setpoint range limitation, weekly schedule with optimum start and etc.
- Web Access and Alert Emails
- Tenant Billing with PPD Option
- Monitor and controls DI, DO, AI, AO signals of external equipment with WAGO I/O kit

DCM009A51 – iTM BACnet Client Option

The iTM BACnet® Client Option enable the iTM to monitor and control external equipment through the BACnet/IP protocol.

- Object Types: AI, AO, AV, DI, DO, DV, MSI, MSO, MSV
- Applications: Integrate the iTM with sensors, lighting, pumps, fan, DOAS, and etc.

DCM014A51 – iTM BACnet Server Gateway Option

With iTM BACnet Server Gateway Option, Building Management Systems (BMS) can monitor and control VRV indoor units via the BACnet/IP protocol. This option provides seamless control logic integration between iTM and BMS.

- BACnet virtual router function implemented to enable individual BACnet device ID for each indoor unit
- iTM's advanced control functions including dual setpoints, setback control, auto-changeover, setpoint range limitation, and schedule can be accessed by the BMS
- Supports Change of Value (COV) and foreign device registration

Featured Controllers (cont.)

DMS502B71 – Interface for use in BACnet®

Interface for use in BACnet is a hardware gateway solution that enables the BMS to monitor and control the VRV indoor units through BACnet/IP protocol.

To resolve the challenges of integrating the VRV systems, Daikin provides BMS Plug-ins to the integrators for easy integration with the VRV system. BMS Plug-ins are pre-programmed objects and graphics built for Niagara AX® specifically for Daikin VRV. By the use of free-of-cost BMS Plug-ins, the integrators work load could be reduced to as little as point linking.

DTA116A51 – DIII-Net/Modbus Communication Adaptor

The DIII-Net/Modbus Communication adaptor can be used for Home automation system integration. With the adaptor, up to 16 indoor units can be controlled through Modbus/RTU.

DMS504C71 – Interface for use in LonWorks®

Interface for use in LonWorks is a hardware gateway solution that enables the BMS to monitor and control the VRV indoor units through LonWorks communication.

750-831 - WAGO BACnet/IP Controller

The WAGO BACnet/IP Controller is a programmable controller that connects the WAGO I/O system to the BACnet protocol. With the customizable programming provide by the Daikin Controls team, WAGO BACnet/IP controller can help fulfill most project control requirements for Daikin and third-party equipment control.

Codes & Standards

Some Key Considerations

Category	Key Codes/ Standards	Situation for VRV
Safety and Electrical	UL 1995 Nat'l Electric Code NFPA 90A, 90B ASHRAE Std 15 Canada: B52	Daikin systems are UL 1995 certified. Install per NEC guidelines. Daikin systems comply via UL 1995. Std is applicable for APPLICATION, Not equipment. RcL not to exceed 26lbs/1000cuft (13lbs in restricted/institutional occupancies).
Efficiency & Performance	AHRI Std 1230 ASHRAE Std 90.1 ASHRAE Std 62	Daikin VRV is tested and rated to AHRI Std 1230. Daikin VRV performance ratings exceed ASHRAE Std 90.1 2010. Daikin VRV systems can be configured to satisfy ASHRAE Std 62 (Ventilation, IAQ) requirements.
Federal Trade Commission	Buy American Act Trade Agreements Act	U.S. DOE has issued waiver for Ductless and VRV products. All projects need to be confirmed through the Daikin legal dept. who can formally issue waiver notice and explanation for compliance purposes
Installation & Application	Int'l Building Code Int'l Energy Conservation Code Int'l Mechanical Code	Wind Loads – Use tie down drawings Seismic – Use OSHPD certification Economizer – Use optional accessory Insulation – Use ¾" thick Armaflex Condensate – Units with Pump & Float Switch are OK. Ductless units no need for secondary pan if level sensor used. Ventilation – similar to ASHRAE Std 62. Refrigeration – fittings used must be UL 1995 which Daikin's are.
Local Code	Code Adoption Varies	Local Code can introduce additional considerations on top of the national codes so always confirm requirements.

Tips & Considerations

- Always refer to the Engineering Data, Installation Manual and Service Manual for detailed explanation and specification for VRV products.
- Utilize VRV Xpress selection software to ensure equipment selections are in accordance with all limitations and system capabilities.
- Maximize the use of Daikin City portal to auto generate submittal packages and streamline project management, update and quoting (where applicable).
- If a document says do SOMETHING – then do it, If it says DON'T DO SOMETHING – then DON'T do it.
- If a document is NOT telling you to do something – Then its NOT NECESSARY to do it (regardless of what might be normal for a U.S. piece of equipment).
- If it says ALWAYS REFER/COMPLY TO _____ CODE – then always refer/comply to _____ code – Local Codes when specified always trump installation instructions.
- Recommendations for optimum piping design (No Drier, 40" between REFNET etc) are not rules – they are recommendations that can help prevent issues in certain circumstances.
- If in doubt – never be afraid to ask and seek clarification

Further Documents and Data

Best Practice Guides

Further information for the application of VRV is available in form of Best Practice Guides. Hard copies are available and can also be obtained online via daikincity.com

Outdoor Unit Layout Guide

Codes & Standards

Daikin Zoning Kit

Building Automation

VRV in Extreme Ambient Conditions

Where to find official information?

Product Detail		Design Guide	Eng. Data	IOM	Submittal	Option Handbook	SVM	Sales Bulletin
Features	**Summary**	◆	◆					◆
Specification	**Summary Table**		◆	◆			◆	◆
	Electrical		◆	◆	◆		◆	
Drawings	**Dimension**		◆		◆		◆	
	Piping		◆		◆		◆	
	Wiring		◆				◆	
Performance	**Capacity Correction**		◆		◆			
	Piping		◆		◆			
	Airflow / ESP		◆		◆			
	Sound Level		◆		◆			
Installation	**Piping**		◆	◆				
	Wiring		◆	◆				
	Fundamentals		◆	◆				
	Sizing & Charging		◆	◆				
Operation	**How to use**			◆				
	Controls	◆	◆	◆				◆
Accessories	**Specification**		◆			◆		◆
	Installation					◆		◆
Characteristics	**Functions**	◆					◆	
Set-up, Commissioning & Service	**Test Operation**			◆			◆	
	Troubleshooting						◆	
	Flow Charts						◆	
	Replace Procedure						◆	

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For more information:

Sales and Technical Support: 1-855-DAIKIN1

www.daikincomfort.com or daikinac.com

Intertek

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Our continuing commitment to quality products may mean a change in specifications without notice.