R-410A VRVII Systems

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R-410A VRVII Systems

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V Indoor Units

R-410A VRVII Systems

VI Control Systems

I Introduction

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1 Possible indoor units using R-410A

Description	Indoor unit	Size											
		20	25	32	40	50	63	71	80	100	125	200	250
4-way blow ceiling mounted cassette (600 mm x 600 mm)	FXZQ-MVE 	x	x	x	x	x							
4-way blow ceiling mounted cassette	FXFQ-M7V1B 	x	x	x	x	x	x		x	x	x		
2-way blow ceiling mounted cassette	FXCQ-M7V1B 	x	x	x	x	x	x		x		x		
Ceiling mounted corner cassette	FXKQ-MVE 		x	x	x		x						
Concealed ceiling unit (small)	FXDQ-M7V1B 	x	x										
Slim Concealed Ceiling Unit	FXDQ-NVE 	x	x	x	x	x	x						
Concealed ceiling unit	FXSQ-M7V1B 	x	x	x	x	x	x		x	x	x		
Concealed ceiling unit (large)	FXMQ-MVE 				x	x	x		x	x	x	x	x
Wall mounted unit	FXAQ-MVE 	x	x	x	x	x	x						
Ceiling suspended unit	FXHQ-MVE 			x			x			x			
4-way blow ceiling suspended unit	FXUQ-MV1 							x		x	x		
Floor standing unit	FXLQ-MVE 	x	x	x	x	x	x						
Concealed floor standing unit	FXNQ-MVE 	x	x	x	x	x	x						

NOTE

1 FXUQ-MV1 & FXMQ200, 250MVE cannot be combined to VRVII-S.

2 Possible outdoor units using R-410A

2-1 VRVII-S

VRVII-S	N° of outdoors	N° of compressors	N° of connectable indoor units	Minimum capacity index	Maximum capacity index	Capacity steps
RXYSQ4M	1	1	6	50	130	*
RXYSQ5M	1	1	8	62.5	162.5	*
RXYSQ6M	1	1	9	70	182	*

2-2 VRVII

VRVII cooling only	VRVII heat pump	VRVII heat reovery	Fixed combinations	N° of outdoors	N° of compressors	N° of connectable indoor units	Minimum capacity index	Maximum capacity index	Capacity steps
RXQ5M	RXYQ5M	–	5HP	1	1	8	62.5	162.5	20
RXQ8M	RXYQ8M	REYQ8M	8HP	1	2	13	100	260	29
RXQ10M	RXYQ10M	REYQ10M	10HP	1	2	16	125	325	29
–	RXYQ12M	REYQ12M	12HP	1	2	19	150	390	29
–	RXYQ14M	REYQ14M	14HP	1	3	20	175	455	35
–	RXYQ16M	REYQ16M	16HP	1	3	20	200	520	35
–	RXYQ18M	REYQ18M	8HP + 10HP	2	4	20	225	585	41
–	RXYQ20M	REYQ20M	10HP x 2	2	4	20	250	650	41
–	RXYQ22M	REYQ22M	10HP + 12HP	2	4	22	275	715	41
–	RXYQ24M	REYQ24M	10HP + 14HP	2	5	32	300	780	46
–	RXYQ26M	REYQ26M	10HP+ 16HP	2	5	32	325	845	46
–	RXYQ28M	REYQ28M	12HP+ 16HP	2	5	32	350	910	46
–	RXYQ30M	REYQ30M	14HP + 16HP	2	6	32	375	975	51
–	RXYQ32M	REYQ32M	16HP x 2	2	6	32	400	1,040	51
–	RXYQ34M	REYQ34M	10HP x 2 + 14HP	3	7	34	425	1,105	56
–	RXYQ36M	REYQ36M	10HP x 2 + 16HP	3	7	36	450	1,170	56
–	RXYQ38M	REYQ38M	10HP + 12HP + 16HP	3	7	38	475	1,235	56
–	RXYQ40M	REYQ40M	10HP + 14HP + 16HP	3	8	40	500	1,300	61
–	RXYQ42M	REYQ42M	10HP + 16HP x 2	3	8	40	525	1,365	61
–	RXYQ44M	REYQ44M	12HP + 16HP x 2	3	8	40	550	1,430	61
–	RXYQ46M	REYQ46M	14HP + 16HP x 2	3	9	40	575	1,495	68
–	RXYQ48M	REYQ48M	16HP x 3	3	9	40	600	1,560	68

2-3 VRV-WII

VRV-WII heat pump	VRV-WII heat recovery	N° of outdoors	N° of compressors	N° of connectable indoor units	Minimum capacity index	Maximum capacity index	Capacity steps
RWEYQ10M		1	1	16	125	325	*
RWEYQ20M		2	2	20	250	650	*
RWEYQ30M		3	3	32	375	975	*

* information was not available at time of publication

2-4 Indoor unit capacity index

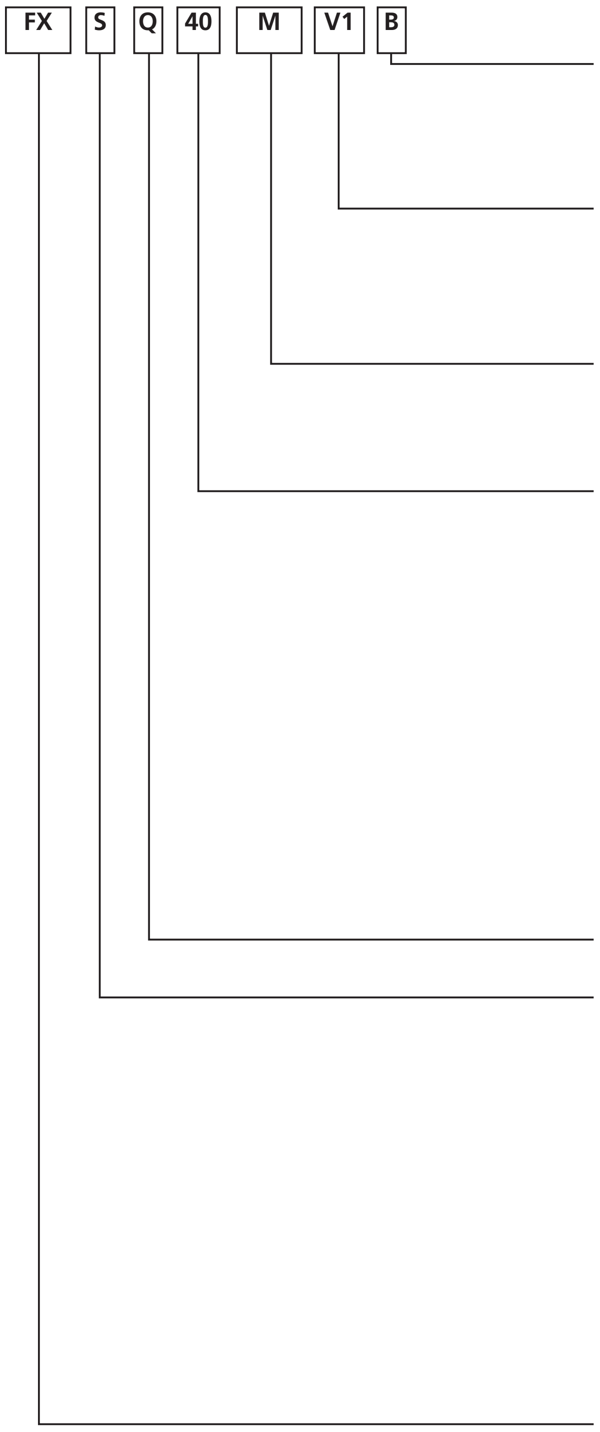
Model	20	25	32	40	50	63	71	80	100	125	200	250
Capacity index	20	25	31.25	40	50	62.5	71	80	100	125	200	250

NOTE

1 e.g. Selected indoor units: FXCQ25 + FXFQ100 + FXMQ200 + FXSQ40
Connection ratio: 25 + 100 + 200 + 40 = 365
→ Possible outdoor unit: RXYQ12M

3 Nomenclature

3-1 Indoor units



Special series for Europe (CE approved)*

Power supply symbol
V1: 1~, 230V, 50Hz
VE: 1~, 220-240V, 50Hz

M: Indicates major design category
M7: Indicates DENV production

Capacity Indication
Conversion to horsepower:

20: 0.8HP
25: 1HP
32: 1.25HP
40: 1.6HP
50: 2.0HP
63: 2.5HP
80: 3.2HP
100: 4HP
125: 5HP
200: 8HP
250: 10HP

Indicates the use of R-410A

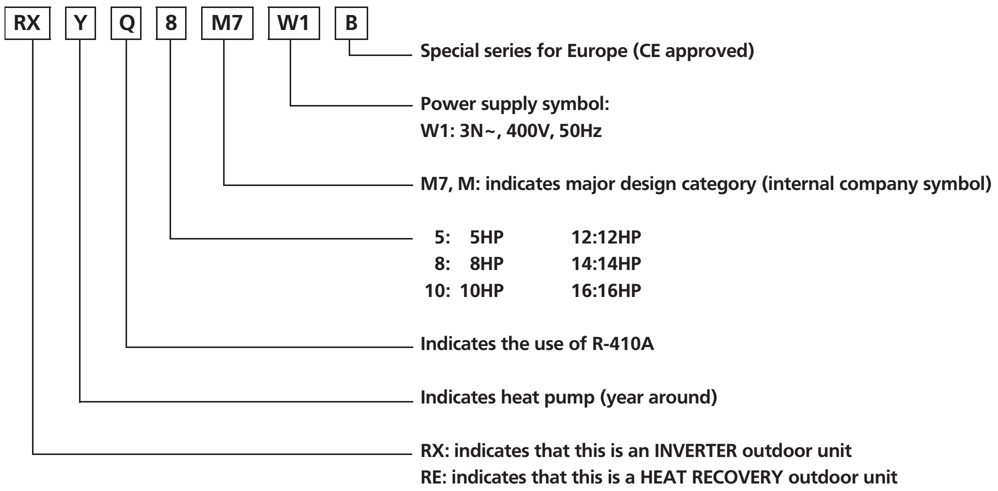
Model name
Z: 4-way blow ceiling mounted cassette (600x600mm)
F: 4-way blow ceiling mounted cassette
C: 2-way blow ceiling mounted cassette
K: Ceiling mounted corner cassette
S: Concealed ceiling unit
D: Concealed ceiling unit (small)
M: Concealed ceiling unit (large)
H: Ceiling suspended unit
A: Wall mounted unit
L: Floor standing unit
LM: Concealed floor standing unit

Indicates that this is an INVERTER HEAT PUMP/COOLING ONLY or a HEAT RECOVERY indoor unit

* B is not mandatory for indoor units

3 Nomenclature

3-2 Outdoor units



RX Y Q 8 M7 W1 B

Special series for Europe (CE approved)

Power supply symbol:
W1: 3N~, 400V, 50Hz

M7, M: indicates major design category (internal company symbol)

5: 5HP	**12:12HP**
8: 8HP	**14:14HP**
10: 10HP	**16:16HP**

Indicates the use of R-410A

Indicates heat pump (year around)

RX: indicates that this is an INVERTER outdoor unit
RE: indicates that this is a HEAT RECOVERY outdoor unit

II Main features VRVII

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VRVII-S features

1 Features

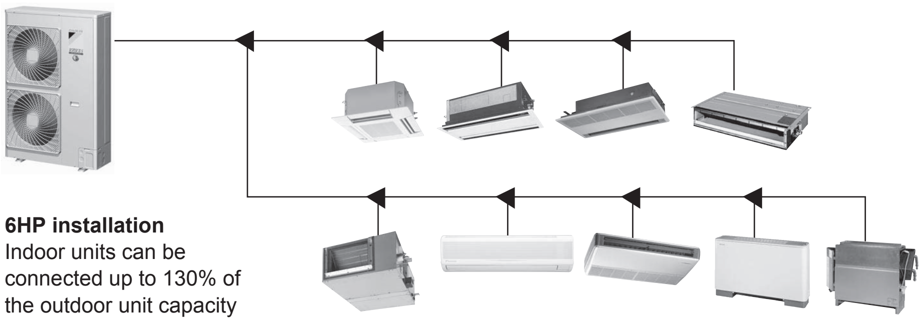
VRVII-S:

- Space saving
- Small capacity
- Slim design
- Silent operation
- Super wide range of indoor units

1 - 1 Flexible design & easy installation

① **Up to 9 indoor units can be connected ot a single outdoor unit**

- 9 indoor units for a 6HP installation
- 8 indoor units for a 5HP installation
- 6 indoor units for a 4HP installation

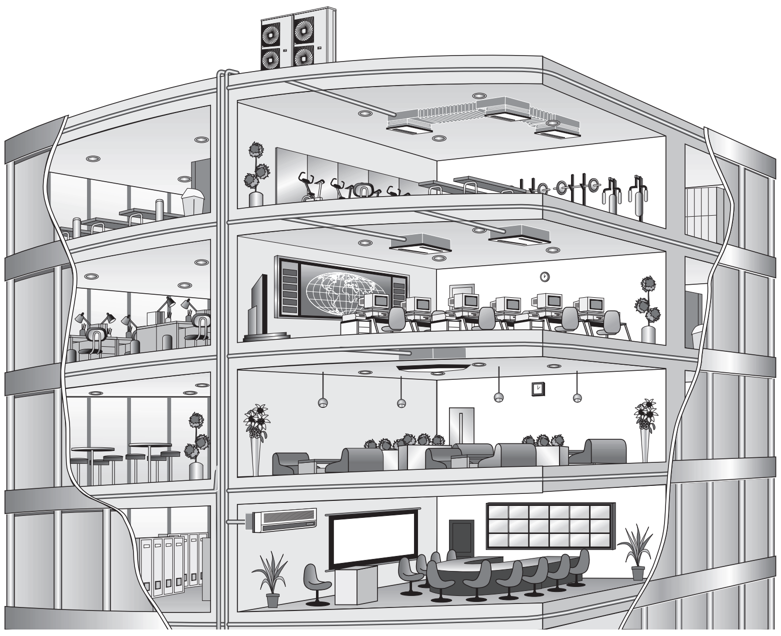


6HP installation
Indoor units can be connected up to 130% of the outdoor unit capacity

② **Flexible piping design**

The VRVII-S provides the long piping length possibility of 150m (175m equivalent piping length), with a total piping length of 300m. If the outdoor unit is installed above the indoor units, the height difference can be up to a maximum of 50m$^{1/2}$.

These generous allowances facilitate an extensive variety of system designs.



NOTES

1 40 m when the outdoor unit is installed below indoor units.

2 Maximum piping length between the indoor unit and the first branch is 40 m.

1 Features

1 - 1 Flexible design & easy installation

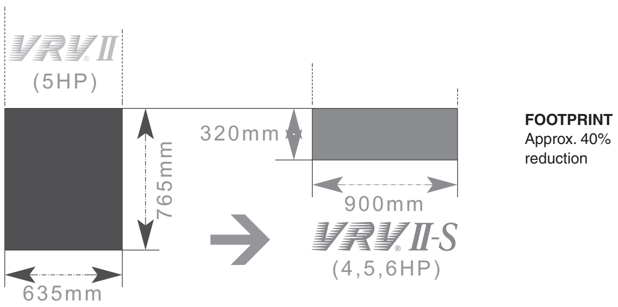
③ Super wide range of indoor units

Whatever the air conditioning requirement, a Daikin indoor unit can provide the solution. The VRVII-S can be combined with 12 different indoor units in a total of 70 variations.

Indoor units		20	25	32	40	50	63	80	100	125
600x600 4-way blow ceiling mounted cassette	FXZQ	x	x	x	x	x				
4-way blow ceiling mounted cassette	FXFQ	x	x	x	x	x	x	x	x	x
2-way blow ceiling mounted cassette	FXCQ	x	x	x	x	x	x	x		x
Ceiling mounted corner cassette	FXKQ		x	x	x		x			
Small concealed ceiling unit	FXDQ-M	x	x							
Slim concealed ceiling unit	FXDQ-N	x	x	x	x	x	x			
Concealed ceiling unit	FXSQ	x	x	x	x	x	x	x	x	x
Large concealed ceiling unit	FXMQ				x	x	x	x	x	x
Wall mounted unit	FXAQ	x	x	x	x	x	x			
Ceiling suspended unit	FXHQ			x			x		x	
Floor standing unit	FXLQ	x	x	x	x	x	x			
Concealed floor standing	FXNQ	x	x	x	x	x	x			

④ Space saving design

The VRVII-S is slimmer and more compact, resulting in significant savings in installation space.



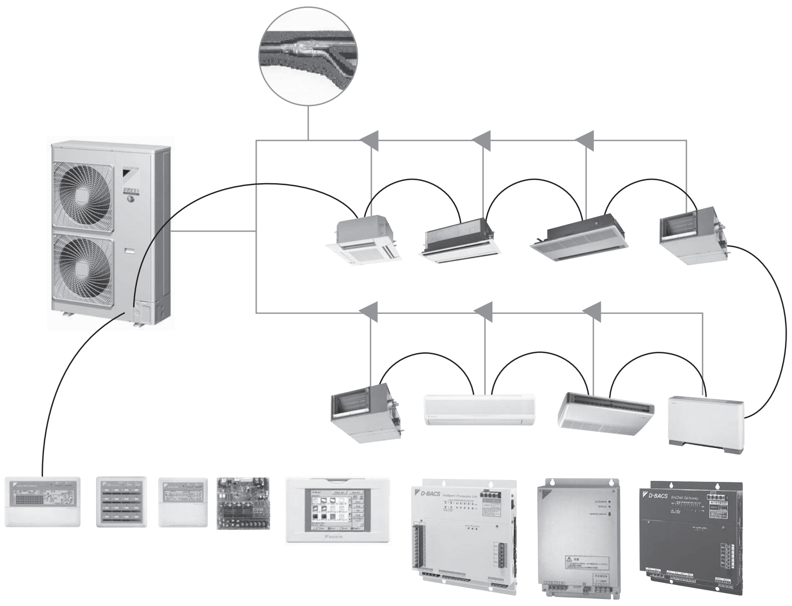
⑤ Simple wiring and piping connection

— **SIMPLE WIRING**

- Super Wiring allows the shared use of wiring between indoor units, outdoor units and the centralised remote controls.
- This system makes it easy for the user to retrofit the existing system with a centralised remote control, simply by connecting it to the outdoor units.
- The use of non polarity wiring, makes incorrect connection impossible and reduces installation time.

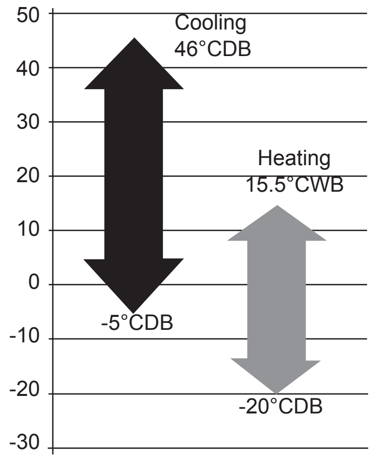
— **PIPING CONNECTION**

- The unified Daikin REFNET piping system is specially designed for simple installation
- REFNET joints and headers (both accessories) can cut down on installation work and increase system reliability



⑥ Wide operation range

The VRVII-S system can be installed practically anywhere. The incorporation of a high pressure “dome” type compressor results in a remarkable outdoor operating temperature range from as low as -20°C in heating mode to as high as 46°C in cooling mode.



Outdoor temperature operating range

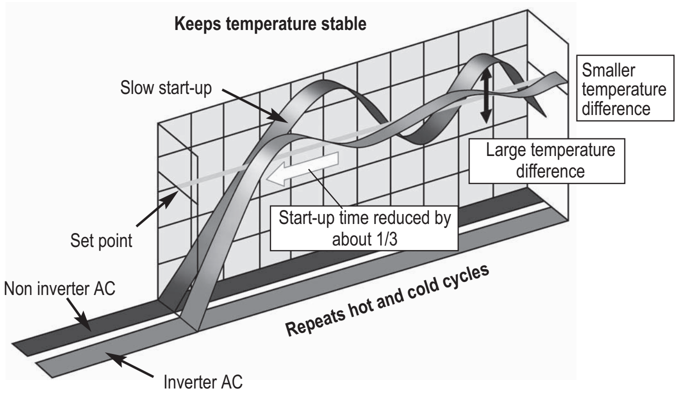
1 Features

1 - 2 Energy efficient solution and quiet operation

① Inverter control

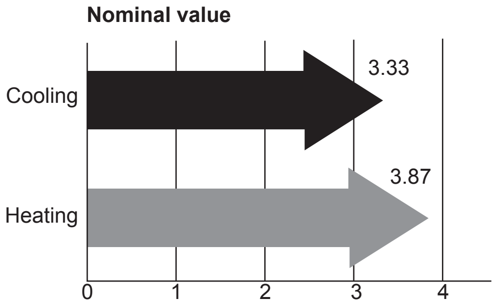
The application of inverter control saves energy for two basic reasons:

1. It enables compressor speed to vary according to the cooling/heating load and therefore consume only the power necessary to match that load. The 50 Hz frequency of the power supply is inverted to a higher or lower frequency according to the required capacity to heat or cool the room. If a lower capacity is needed, the frequency is decreased and less energy is used.
2. Under partial load conditions, the energy efficiency is higher. If the compressor rotates more slowly because less capacity is needed, the coil becomes virtually oversized. Improved efficiencies can therefore be achieved than are possible with non inverter compressors, which always run at the same speed.



② High COP values

A major feature of VRVII-S is its exceptional energy efficiency, the system achieving high COPs during both cooling and heating operation by the use of refined components and functions.



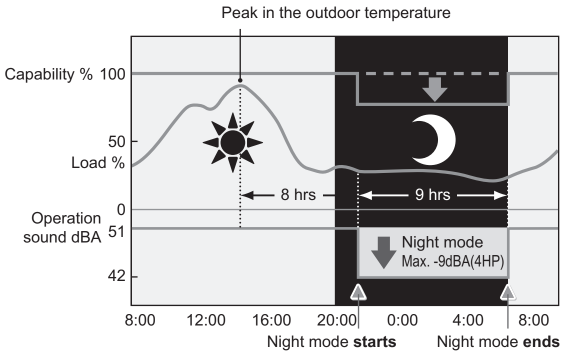
1 Features

1 - 2 Flexible design & easy installation

③ Super silent operation

Quietness is another important feature. To reduce noise and ensure comfortable operation, the latest technologies and features have been applied to the outdoor units.

Night quiet function (max. - 9dBA)



NOTES

- This function is available for on site setting.
- The relationship between outdoor temperature (load) and time shown in the graph is merely an example

During the night the sound level of the outdoor unit can be reduced for a certain period: starting time and ending time can be input

2 modes[1] with low operating sound level at night:

- **Mode 1** Automatic mode
  Set on the outdoor PCB. Time of maximum temperature is memorised. The low operating mode will become active 8 hours[2] after the peak temperature in the daytime and operation will return to normal after 9 hours[3].
- **Mode 2** Customized mode
  Starting and ending times can be input. (External control adapter for outdoor unit, DTA104A61 or DTA104A62 and a separately ordered timer are necessary.)

NOTES

1 Determine which mode to select depending on the climatic characteristics of each country.
2 Initial setting. Can be selected from 6, 8 and 10 hours.
3 Initial setting. Can be selected from 8, 9 and 10 hours.

Daikin indoor units operate at sound levels as low as 25 dBA

dB(A)	Perceived loudness	Sound
0	Treshold of hearing	-
20	Extremely soft	Rustling leaves
40	Very soft	Quiet room
60	Moderately loud	Normal conversation
80	Very loud	City traffic noise
100	Extremely loud	Symphonic orchestra
120	Threshold of feeling	Jet taking off

Daikin indoor units

1 Features

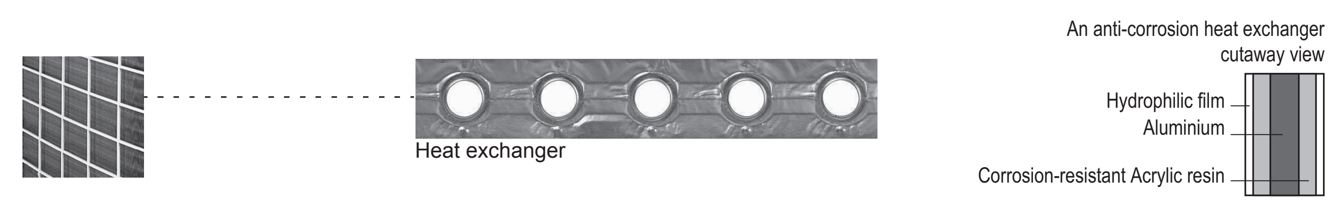
1 - 3 Reliability

① Anti corrosion treatment

Special anti corrosion treatment of the heat exchanger provides 5 to 6 times greater resistance against acid rain and salt corrosion. The use of rust proof steel sheet on the underside of the unit gives additional protection.

Improvement in corrosion resistance

Corrosion resistance rating		
	Non-treated	Anti-corrosion treated
Salt corrosion	1	5 to 6
Acid rain	1	5 to 6

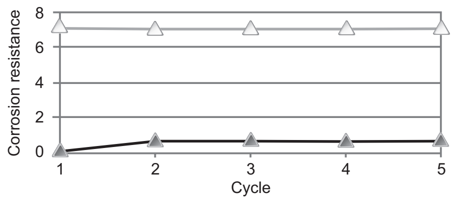


Performed tests:

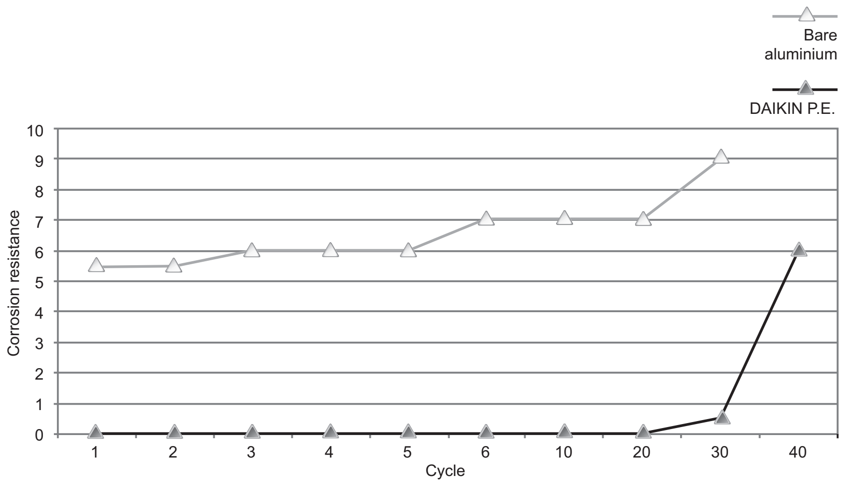
- **VDA Wechseltest**

  Contents of single cycle (7 days):
  - 24 hours salt spray test SS DIN 50021
  - 96 hours humidity cycle test KFW DIN 50017
  - 48 hours room temperature & room humidity

  Testing period: 5 cycles

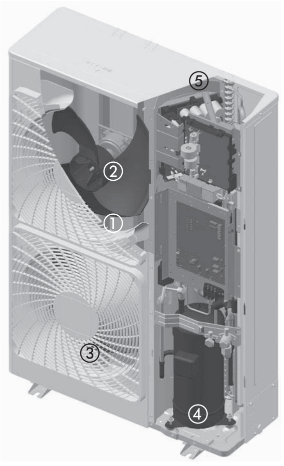


- **Kesternich test (SO2)**
  - Contents of single cycle (48 hours) according to DIN50018 (0.21)
  - Testing period: 40 cycles



1 Features

1 - 4 VRVII-S Technology

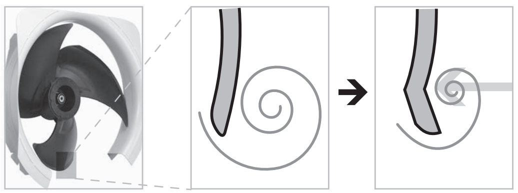


① Smooth air inlet bell mouth and aero spiral fan

These new features assist in significantly reducing noise. Guides are added to the bell mouth intake to reduce turbulence in the air flow generated by fan suction.

The new aero spiral fan features fan blades with bent blade edges, further reducing turbulence.

New aero spiral fan blade tips

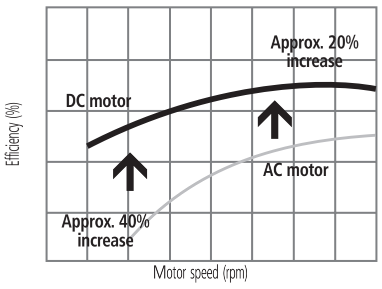

Conventional New

Escaping edges are sucked in by the bent blade edges, reducing overall turbulence.

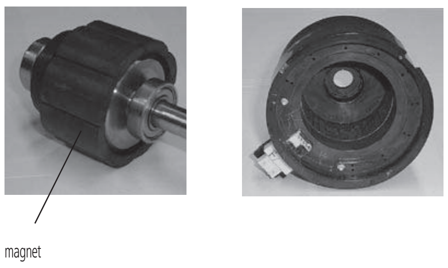
② DC fan motor

The use of a DC fan motor offers substantial improvements in operating efficiency compared to conventional AC motors, especially during low speed rotation.

DC motor efficiency
(comparison with a conventional AC motor)



DC fan motor structure



NOTE

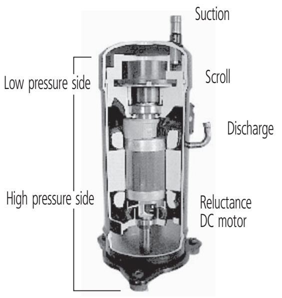
Data are based on studies conducted under controlled conditions at a Daikin laboratory

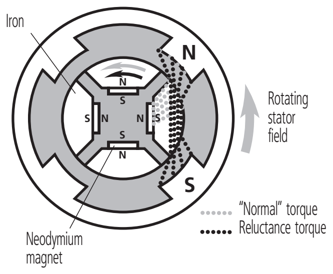
③ Super aero grille

The spiral shaped ribs are aligned with the direction of discharge flow in order to minimise turbulence and reduce noise.

④ Reluctance brushless DC compressor

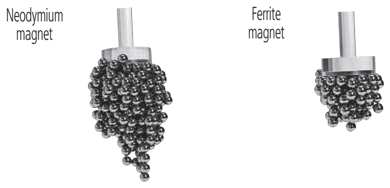
The reluctance brushless DC motor provides significant increases in efficiency compared to conventional AC inverter motors, simultaneously using two different forms of torque (normal and reluctance torque) to produce extra power from small electric currents.





Powerful magnets

The motor comprises powerful neodymium magnets that create the reluctance torque. These magnets are approximately 12 times stronger than ferrite types and make a major contribution to its energy saving characteristics

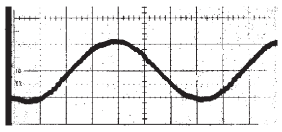


1 Features

1 - 4 VRVII-S Technology

Smooth sine wave DC inverter

Optimizing the sine wave curve results in smoother motor rotation and improved motor efficiency.



Optimal refrigerant configuration

Changes to the shape of the spiral and volume ratio result in optimal refrigerant layout.

Stronger materials

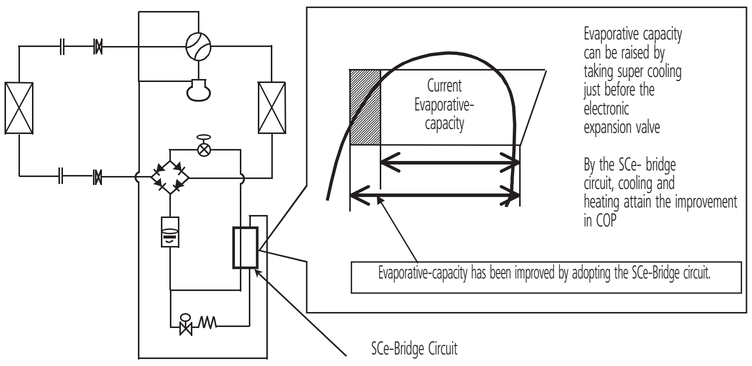
The strength of the casing has been increased by boosting the internal dome pressure.

⑤ e-Bridge circuit

Prevents accumulation of liquid refrigerant in the condenser. This results in more efficient use of the condenser surface under all conditions

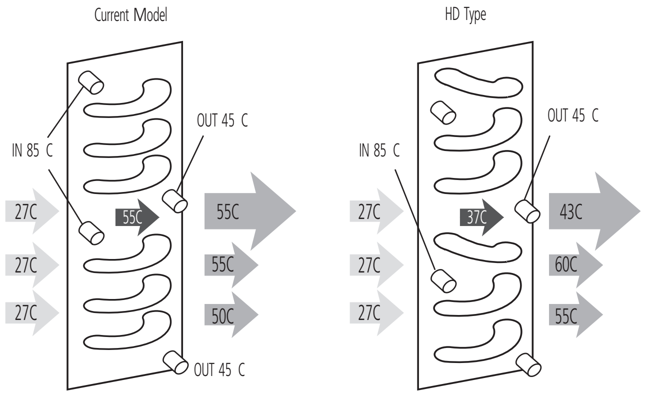
and leads in turn to better energy efficiency. Increased evaporative capacity stems from the newly developed refrigeration circuit, the SCe-bridge

circuit, which adds super cooling prior to the expansion cycle. By adopting this circuit, the COPs in both cooling and heating have been drastically improved.



⑥ e-Pass heat exchanger

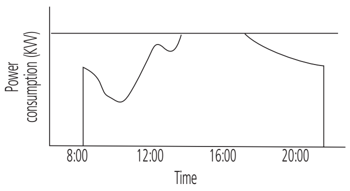
Optimization of the layout path of the heat exchanger prevents heat transferring from the overheated gas section towards the sub cooled liquid section, a more efficient use of the heat exchanger.



In cooling mode, the heat exchanger of the condensor is improved. This means an improvement of COP by 3%.

⑦ i-Demand function

The newly introduced current sensor minimizes the difference between actual power consumption and predefined power consumption.



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VRVII & VRV-WII features
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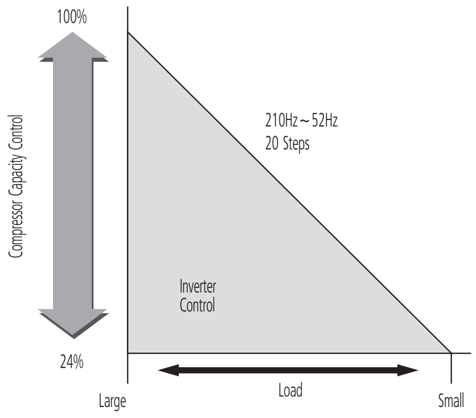
6 Simple and rapid installation

1 Creating maximum comfort

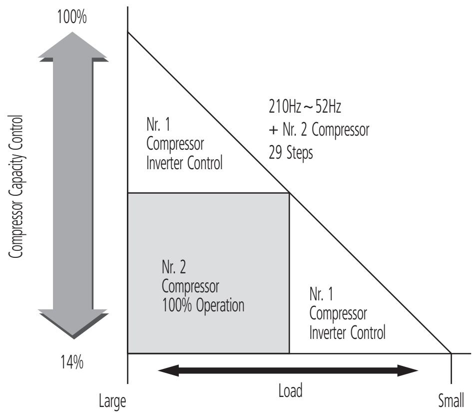
1-1 Inverter technology - VRVII & VRV-WII

The linear VRV system makes use of a variable Proportional Integral (PI) control system which uses refrigerant pressure sensors to give added control over inverter and ON/OFF control compressors in order to abbreviate control steps into smaller units to provide precise control in both small and larger areas.
This in turn enables individual control of up to 40 indoor units of different capacity and type at a ratio of 50~130 % in comparison with outdoor units capacity. 5 HP outdoor units use inverter control compressors only.

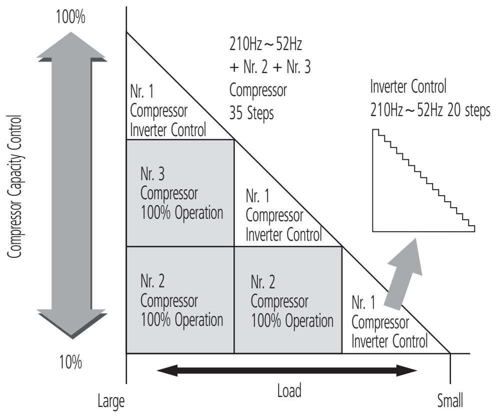
5HP Outdoor Unit



8,10,12HP Outdoor Unit



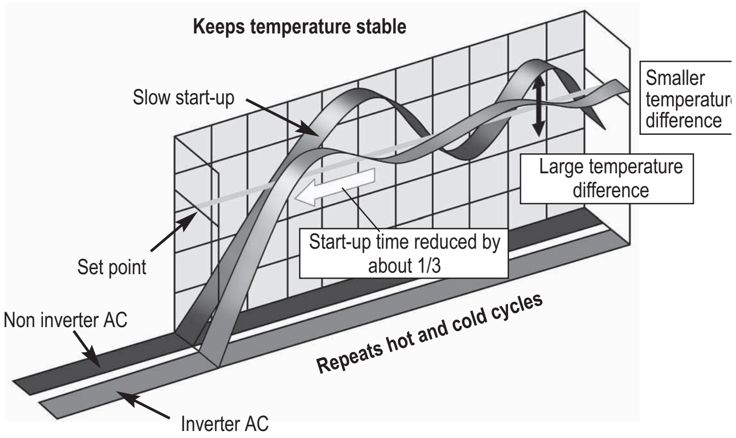
14,16HP Outdoor Unit



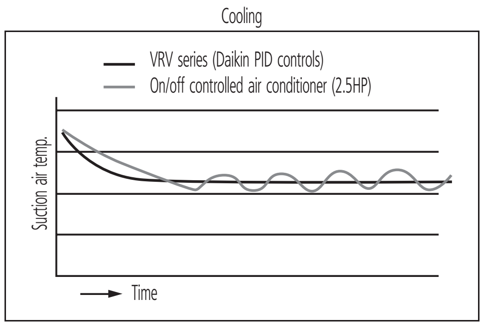
1 Creating maximum comfort

1-2 Smart control brings comfort - VRVII & VRV-WII

An electronic expansion valve, using PID control, continuously adjusts the refrigerant volume in respond to load variations of the indoor units. The VRV system thus maintains comfortable room temperatures at a virtually constant level, without the temperature variations typical of conventional ON/OFF control systems.



The thermostat can control stable room temperature at ± 0.5°C from set point.

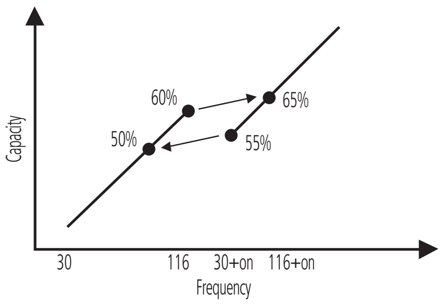


NOTE

1 the graph shows the data, measured in a test room assuming actual heating load.

1-3 Less frequent start/stop cycle - VRVII & VRV-WII

- The technique adopted by Daikin, of regulating the capacity using multiple compressors clearly results in minimum switching losses and power surges because of the overlap in capacity and frequency
- Since Daikin utilises small 5HP inverter compressors, the influence of harmonics is less than that generated by a single large compressor
- The use of multiple compressors by Daikin also ensures a 50 % standby facility
- Smaller compressors are cheaper and faster to replace



1 Creating maximum comfort

1-4 PID control

Proportional Integral Derivative control with an automatic capacity balancing circuit:

– enables the use of lengthy piping up to 100 meters (actual length)

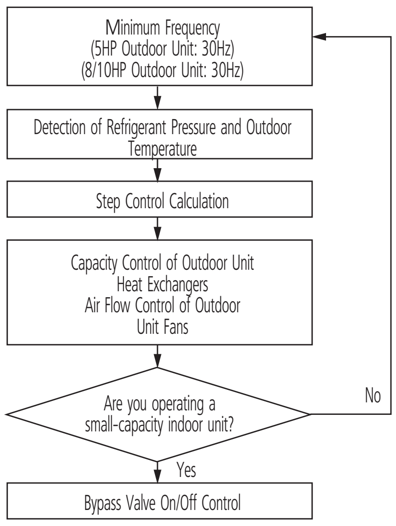
– consists of two control systems:

1 Oil control system that controls the refrigerant oil volume to prevent it from raising or backing up in the pipes

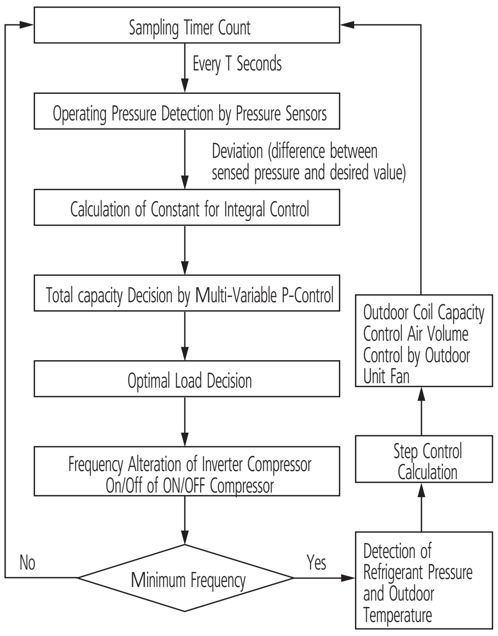
2 Refrigerant flow stabilization mechanism: prevents refrigerant drift, caused by level difference of indoor units in the same system.

1-5 Operation control of small capacity indoor units

If the operating frequency is minimal, the refrigerant pressure and outdoor temperature are detected, the number of control steps are calculated, and capacity of outdoor unit heat exchanger (refrigerant accumulates in coils) and air flow of outdoor unit fans (controls pole change of the two fans) are controlled.
If operating a small-capacity indoor unit, the bypass valve is controlled (ON/OFF), with capacity control being executed at a minimum of 14% for a 5HP outdoor unit (when operating one 20-class indoor unit), or a minimum of 8% for 8 and 10HP outdoor units (when operating one 20-class indoor unit.



1-6 Control flow



2 Energy efficient solution

2-1 Low running costs - VRVII & VRV-WII

- VRV systems have low running costs because it permits each zone to be controlled individually. That is, only those rooms that require air conditioning will be heated or cooled, while the system can be shut down completely in rooms where no air conditioning is required.
- VRV units have the highest COP/EER in the market in the most common operating area

2-2 Most advanced reluctance brushless DC compressor technology - VRVII & VRV-WII

The scroll compressor is driven by the newly developed motor, enabling better performance, higher enery efficiency resulting in higher energy cost savings.

2-3 HRV - Heat Reclaim Ventilation System - VRVII & VRV-WII

- Heat and humidity are exchanged between supply and exhaust air, which
  -brings outdoor air close to indoor air conditions
  - recovers energy loss
  - realises considerable reduction of air conditioning capacity
- The heat exchanger modulates the humidity and temperature of incoming fresh air to match indoor conditions.
- The balance achieved between indoor and outdoor ambients, enables the cooling/heating load placed on the air conditioning system to be reduced. (heat and humidity are exchanged)
- Most energy saving solution as smaller indoor units can be selected:
  -size down of indoor units down to 40 %
  -payback total VAM system: ±2.5 years*

  *conditions: outside cooling conditions: 30°C / outside heating conditions: - 8°C
  inside cooling conditions: 24°C / inside heating conditions: 22°C
  ventilation per room: 150m3/h
- Ideal modular concept to cope with the fresh air requirements

2-4 Auto restart capability - VRVII & VRV-WII

Even after exceptionally long power failures, the built-in auto restart capability ensures automatic system start up. Since the preset memory is not erased by interruptions in power supply, no programme resetting is necessary.

2 Energy efficient solution

2-5 Low operation sound level - VRVII

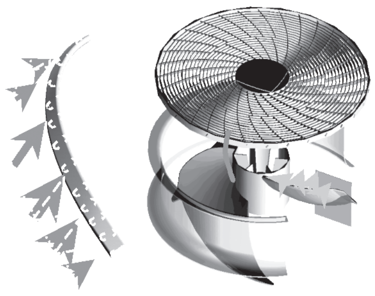
- Continuous research by Daikin into reducing operation sound levels has resulted in the development of a purpose designed inverter scroll compressor and fan.
- The new grille and fan offer low noise, high volume airflow and are housed in a compact casing together with the associated compressor components. The use of this new technology assembly enables a 16hp unit to be housed in a single casing.

Aero spiral fan:

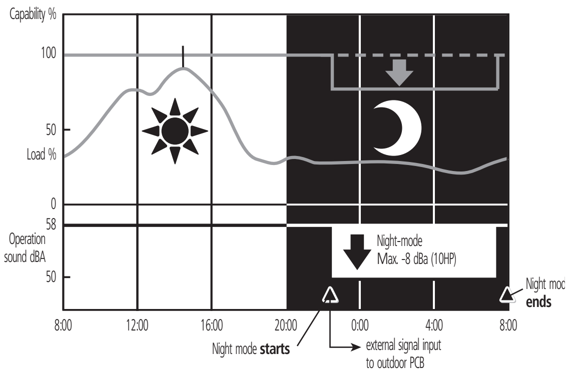
Bending the fan blade edge reduces turbulence, resulting in less pressure loss

Aero fitting grille:

New shape promotes spiral discharge airflow, resulting in reduced pressure loss



- Night quiet function (max. -8dBA)
  During night time, sound level of the outdoor unit can be reduced for a certain period : starting time and ending time can be input



NOTES

1 This function is available in setting at site.

2 The relationship of outdoor temperature (load) and time shown in the graph is just an example.

VRV-WII

Water-cooled air conditioning can be acceptable in certain critical areas in which the operating sound of air-cooled air conditioning could be a little intrusive. This results from:

- the low operating sound level of the condensing unit
- indoor installation capabilities of the unit
- custom engineered sound level of the dry cooler

VRVII & VRV-WII

- Daikin indoor units have very low sound operation levels, down to 25 dBA.

dB(A)	Perceived loudness	Sound
0	Treshold of hearing	-
20	Extremely soft	Rustling leaves
40	Very soft	Quiet room
60	Moderately loud	Normal conversation
80	Very loud	City traffic noise
100	Extremely loud	Symphonic orchestra
120	Threshold of feeling	Jet taking off

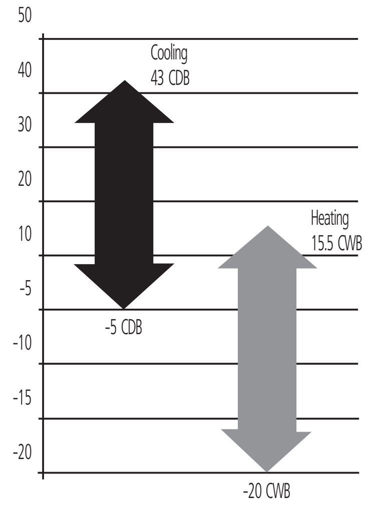
Daikin indoor units

2 Energy efficient solution

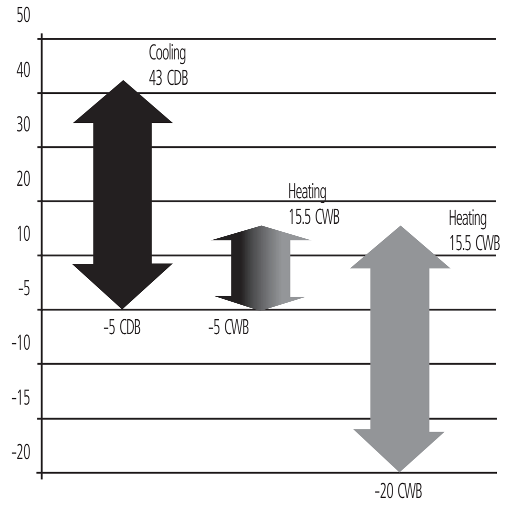
2-6 Operation range of outdoor temperature - VRVII

Standard operation down to -20°C outdoor ambient temperature

Advanced PI control of the outdoor unit enables VRVII heat recovery and Inverter cooling only/heat pump series to operate at outdoor ambients down to -5°C in cooling mode and down to -20°C in heating mode.



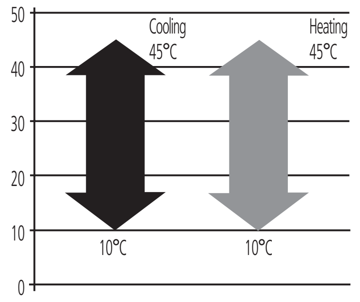
VRV II heat pump



VRVII heat recovery

VRV-WII

Wide operating range of the water-cooled units between 10 C & 45 C, both in cooling and heating.



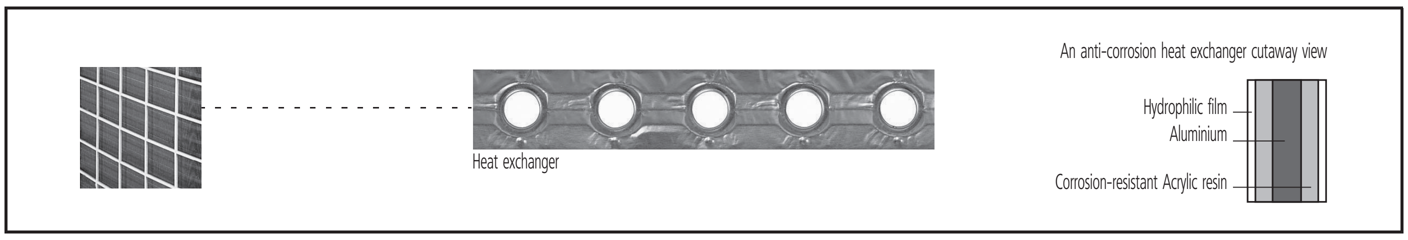
3 High reliability

3-1 Nr. 1 anti-corrosion treatment - VRVII

- Special anti corrosion treatment of the heat exchanger provides 5 to 6 times greater resistance against acid rain and salt corrosion. The provision of rust proof steel sheet on the underside of the unit gives additional protection.

Improvement in corrosion resistance

	Corrosion resistance rating	
	Non-treated	Anti-corrosion treated
Salt corrosion	1	5 to 6
Acid rain	1	5 to 6

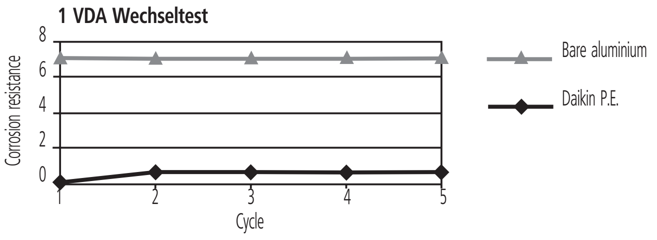


Performed tests

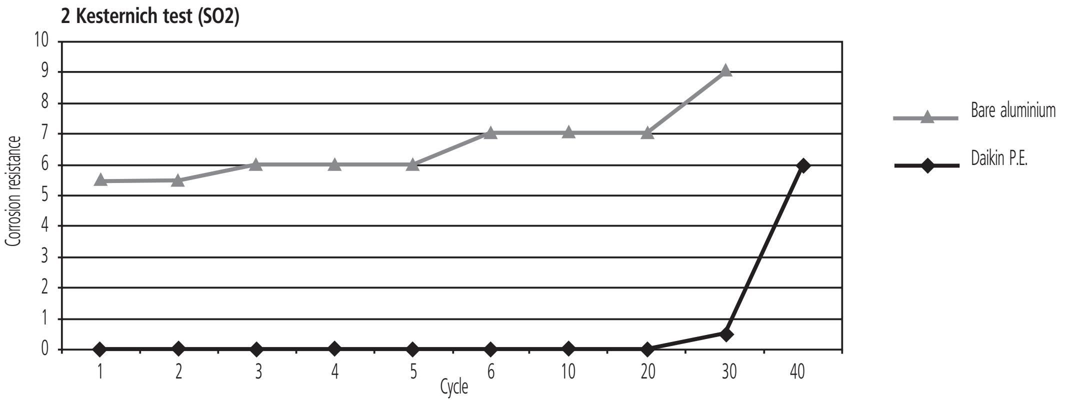
contents of 1 cycle (7 days):

- 24 hours salt spray test SS DIN 50021
- 96 hours humidity cycle test KFW DIN 50017
- 48 hours room temperature & room humidity

testing period : 5 cycles



contents of 1 cycle (48 hours):
according to DIN50018 (0.21)
testing period : 40 cycles



3 High reliability

3-2 Double back-up function - VRVII

In the event of a compressor malfunction, the remotely controlled or field set back-up function in the outdoor unit in question (and also between different outdoor units) will allow emergency operation of another compressor in order to maintain 8 hour maximum interim capacity

3-3 Duty cycling - VRVII & VRV-WII

The cyclical start-up sequence of multiple outdoor unit systems equalises compressor duty and extends operating life.

3-4 Special oil equalising technology

The incorporation of this technology ensures that the optimum quantity of oil is contained in each outdoor unit module in order to maintain compressor reliability. Automatic checks are carried out every 6 minutes on the number of compressors in operation and also to ascertain that there is enough oil to keep them running.

Each compressor in a VRVII outdoor unit is equipped with an internal oil equalising circuit, comprising an oil separator and oil return circuit. This ensures that the maximum quantity of oil is returned to the compressor case before entering the REFNET piping network.

4 Eco friendly

4-1 Lowest refrigerant amount in the total system - VRVII

18 HP	VRVII	Comparable VRF system
Total refrigerant amount in the system*	100 %	160 %

NOTE

* based on average installation

4-2 Dramatic reduction in initial refrigerant charge - VRVII

Reduction of 20.5 %

16 HP	R-22 VRV-K series	R-407C VRV-K series	R-410A VRVII series
Refrigerant charge	100 %	85.6 %	79.5 %

4-3 Optimised R-410A design - VRVII & VRV-WII

Daikin Europe has achieved a quantum leap forward in commercial air conditioning technology by the introduction of its VRVII, the world's first R-410A operated variable refrigerant flow system. Available in cooling only, heat pump and heat recovery versions, the new system, which represents a considerable advance over earlier VRV systems, demonstrates Daikin's innovative application of new technology and the latest HFC refrigerants to its VRV product programmes.

4-4 Less waste and improved re-cycling - VRVII

The lead free, soldered PCB obviates environmental contamination, whilst the re-cyclable galbarium steel bottom plate is designed to last around 6 times longer than the traditional galvanised base.

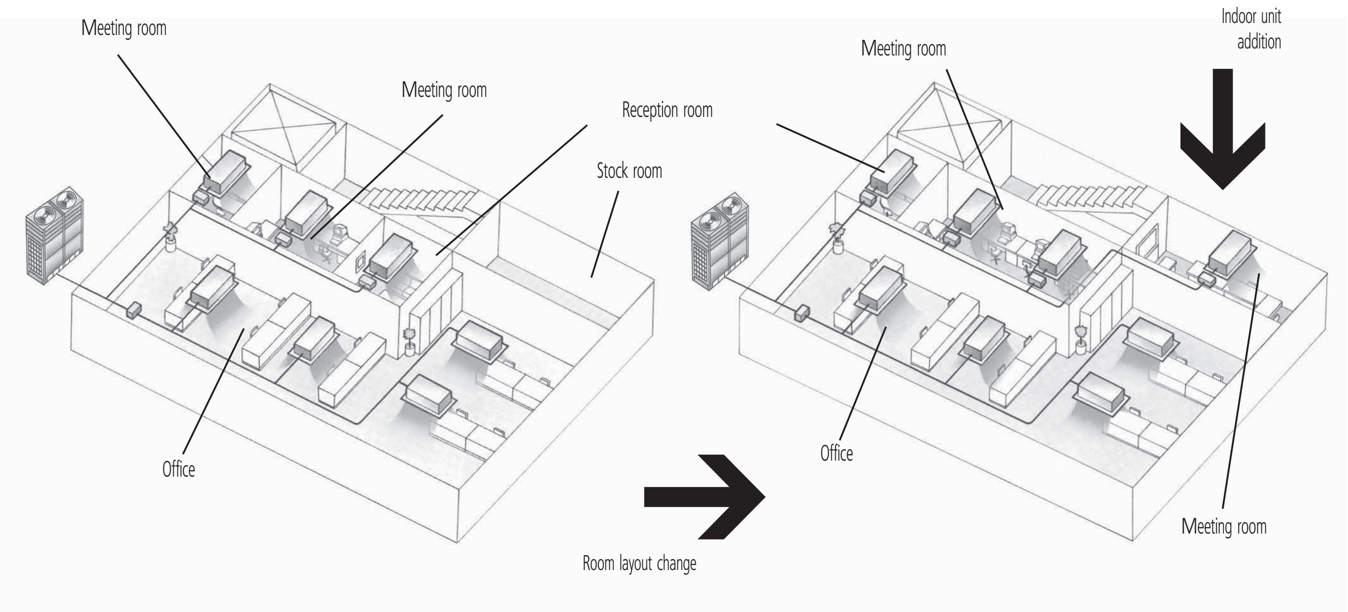
4-5 Refrigerant recovery function - VRVII & VRV-WII

The refrigerant recovery function enables all expansion valves to be opened. In this way the refrigerant can be drained from the piping system and stored in the receiver and the condenser.

5 Easy and flexible design

5-1 Total room layout flexibility - VRVII & VRV-WII

- VRVII systems are easily adaptable to changes in room layout : extra indoor units can be added to a VRV outdoor unit up to a capacity level of 130%.
- Also, since VRVII heat recovery systems offer simultaneous cooling and heating, existing indoor and outdoor units can continue to provide year round air conditioning from their existing locations, even if office layouts are altered or extended.



5-2 Complete flexibility - VRVII & VRV-WII

- The VRVII/VRV-WII system enables different floors or even rooms to be rented to different customers, because each room has independent control of its air conditioning.
- Thanks to inverter technology, as many as 40 indoor units (32 indoor units for VRV-WII) with different types and capacities can be installed in one system. This system automatically and effectively controls each unit to provide individual rooms of different sizes with a comfortable working or living environment.

5-3 Year round cooling and/or heating

VRVII & VRV-WII

- Designed to provide simultaneous year round cooling and/or heating, VRVII heat reovery systems are modular in concept and are therefore, ideal for use in rooms or zones that generate varying thermal loads according to building orientation or local cold or hot spots.

VRVII & VRV-WII

- It is possible for the same meeting room to give rise to differing thermal loads depending on the time of day, number of occupants present, location and usage pattern of lighting and electronic office equipment.

VRVII & VRV-WII

- Until the advent of the VRV, a complex 4-pipe fan coil was needed to meet this requirement. The VRV however, is easier to design and install an in its heat recovery format, can conserve energy in two or more rooms at the same time.

VRV-WII

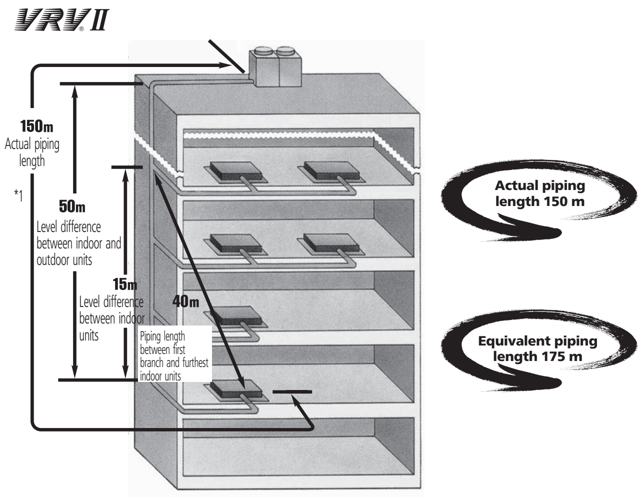
- The colder it is outside, the warmer it needs to be indoors, which means that the capacity of the air-cooled outdoor unit drops. Water-cooled air conditioners are not subject to this problem. The boiler ensures that sufficient enough additional heat is always available indoors.

5 Easy and flexible design

5-4 Longest refrigerant piping run

VRVII

The ability to sustain refrigerant piping in lengths up to 150m (175m equivalent), allows systems to be designed with level differences of 50m between indoor and outdoor units and 15m between individual indoor units. Thus, even with installations in 15 storey buildings, all outdoor units can be located at rooftop level.

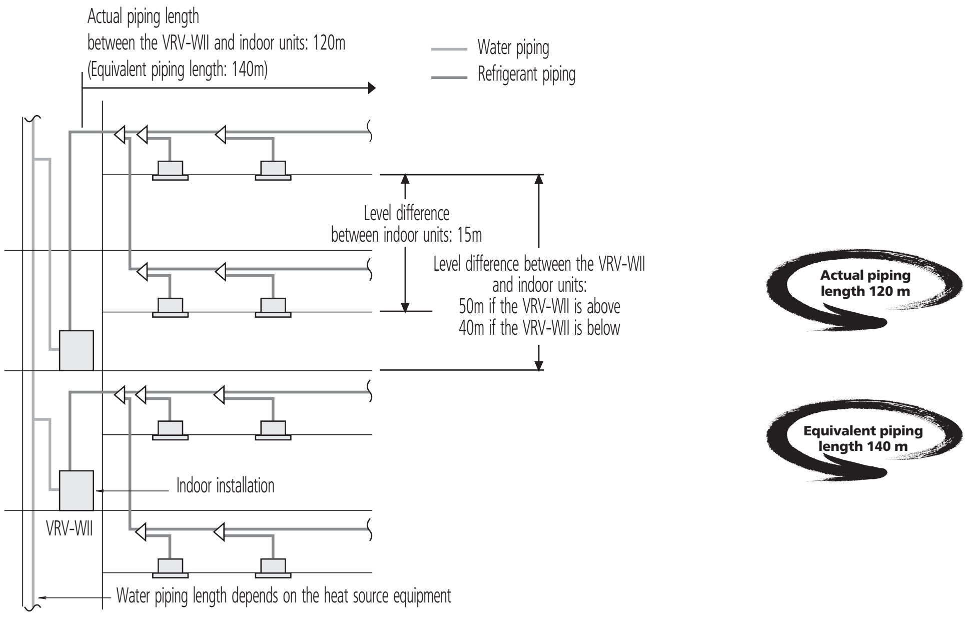


NOTES

1 In this case the outdoor unit is located above the indoor unit. If the outdoor unit is located underneath the indoor unit the level difference is a maximum of 40m.

VRV-WII

- The water-cooled VRV-WII, uses water as its heat source and since there are no limitations on water piping length, is eminently suitable for application to tall multi storey or large buildings. Considerable flexibility is available within the refrigerant circuit since up to 120m actual piping length and 50m* (if the VRV-WII is above the indoor units) in height can exist between the VRV-WII and indoor units. Water piping does not intrude on the occupied spaces, so there are no leakage problems.
- * 40m if the VRV-WII is below the indoor units.



5 Easy and flexible design

5-5 VRV Pro selection programme

A simple to use, Daikin Hi-VRV air conditioning computerised selection programme, designed for use with Windows 95®, Windows 98® and WindowsNT® systems, enables consulting engineers, design and build contractors, property developers and architects etc. to plan a Daikin air conditioning project on a step by step basis, complete with detailed drawings, bills of quantities and costs.

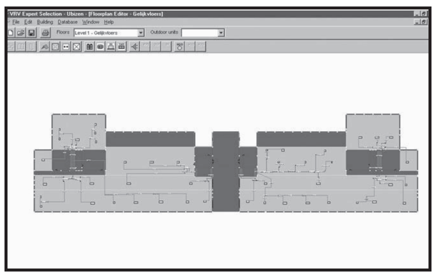
The programme thus enables VRV air conditioning systems to be engineered precisely and economically (without over-sizing units), thereby ensuring optimum operating cycles and maximum energy efficiency.

Features

- The VRV Pro selection programme offers 3 separate modes to accommodate different design formats according to customer requirements. Multi languages are possible.

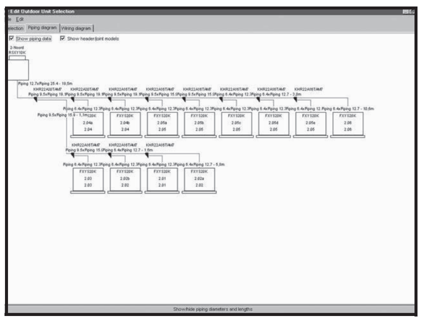
1. **Expert mode**

   Once the cooling and heating loads in the different rooms have been calculated, the software will select the most appropriate system plus an estimate of the power consumption



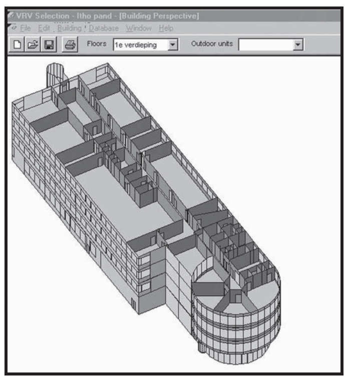
2. **Quick mode**

   Based on calculated system loads, the software will select the most appropriate system



3. **Drawing mode**

   Selecting the indoor and outdoor units from a list enables the user to design a system in no time at all



•AutoCAD and scanned drawings can be used to help draw up a floor plan

•Piping diameters can be automatically calculated

•Indoor and outdoor units, headers and joints etc can be automatically selected

Windows95®, Windows98® and WindowsNT® are registered trademarks of Microsoft corporation.

5-6 VRV Xpress

This new super rapid response VRV selection tool is easy to understand, easy to use and enables automated piping and wiring diagrams of up to 3MB to be transmitted via e mail. The package comes complete with single file software and update, requires no installation or drawings and is available in multi language options.

6 Simple and rapid installation

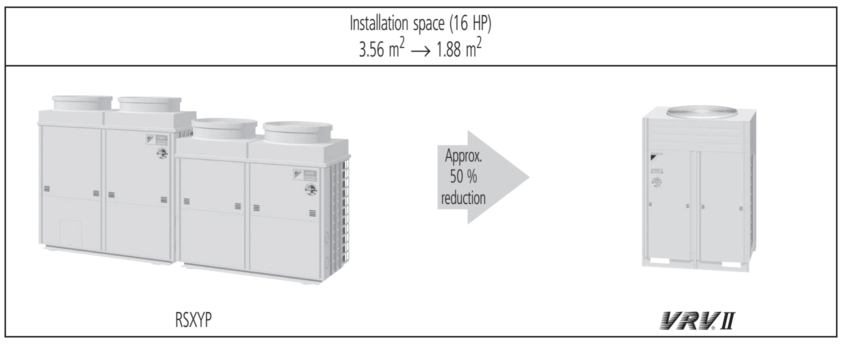
6-1 Short installation time - VRVII & VRV-WII

- Thanks to small bore refrigerant pipes and REFNET piping options, the VRVII/VRV-WII piping system can be installed very easily and quickly.
- Installation of the VRVII/VRV-WII system can also be implemented floor by floor, so that sections of the building can be put into use very quickly, or enabling the air conditioning system to be commissioned and operated in stages, rather than on final completion of the project.

6-2 Dramatic reduction in installation space

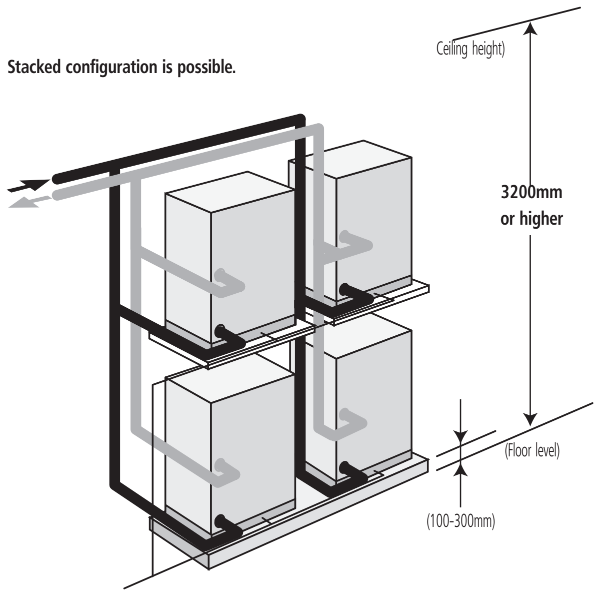
VRVII

VRVII features a dramatic reduction in installation space - for example, the 16hp outdoor unit is housed in a single casing outdoor unit, providing a 50 % reduction in required installation space.



VRV-WII

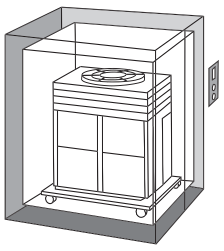
The adoption of a new water heat exchanger and optimization of the refrigerant control circuit has resulted in the industry's most compact and lightweight design. The unit weight of 150kg and height of 1,000mm makes installation easy. Stacked configuration is also possible, contributing further to space savings.



6 Simple and rapid installation

6-3 Modular & lightweight

- Modular design enables units to be joined together in rows with an outstanding degree of uniformity.
- The design of the outdoor units is sufficiently compact to allow them to be taken up to the top of a building in a commercial elevator, overcoming site transportation problem, particularly when outdoor units need to be installed on each floor.

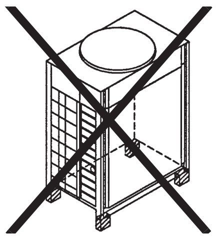
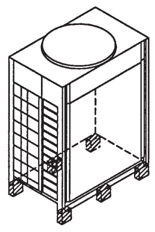
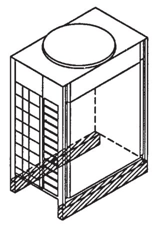
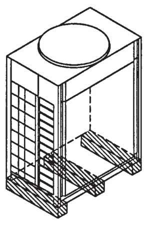


Reduction of 42%

10HP	VRV	VRVII	VRV-WII
WEIGHT REDUCTION	100 %	84 %	58 %

6-4 No structural reinforcement necessary - VRVII

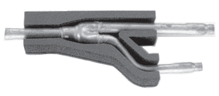
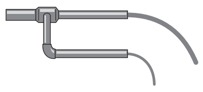
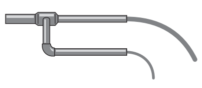
- The galbarium steel allows the use of block foundations. Earlier VRVK and L systems required full beam foundations.
- Thanks to the lightweight and vibration-free construction of the outdoor units, floors do not need to be reinforced, reducing the overall cost of the building.

6 Simple and rapid installation

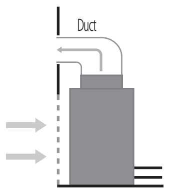
6-5 Unified REFNET piping - VRVII

- The unified Daikin REFNET piping system is especially designed for simple installation
- The use of REFNET piping in combination with electronic expansion valves, results in a dramatic reduction in imbalance in refrigerant flowing between indoor units, despite the small diameter of the piping.
- REFNET joints and headers (both accessories) can cut down on installation work and increase system reliability.
- Compared to regular T-joints, where refrigerant distribution is far from optimal, the Daikin REFNET joints have specifically been designed to optimise refrigerant flow.

REFNET joint	Attached insulators for REFNET joint	REFNET header	Attached insulators for REFNET header	REFNET joint	T-joint
					

6-6 Increased installation flexibility - VRVII

Outdoor units can be installed far back from former location.



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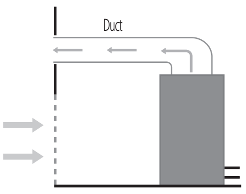
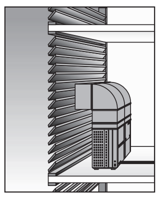


VRV II

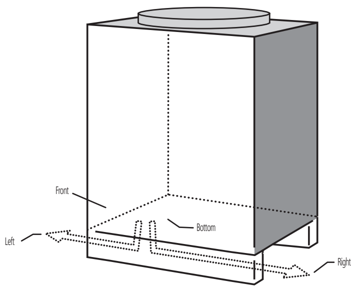


6-7 High external static pressure : 6mm H_2O - VRVII

Daikin now offers high external static pressure as standard to meet requirements of indoor installation.

6-8 4-way piping connection - VRVII & VRV-WII

VRVII series not only offer the possibility to run piping from the front, but also from the left, right or bottom, thus providing greater freedom of layout.



6 Simple and rapid installation

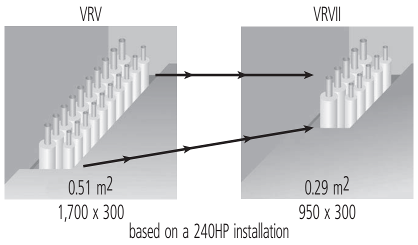
6-9 Downsizing refrigerant piping

- **Reduced piping diameters**

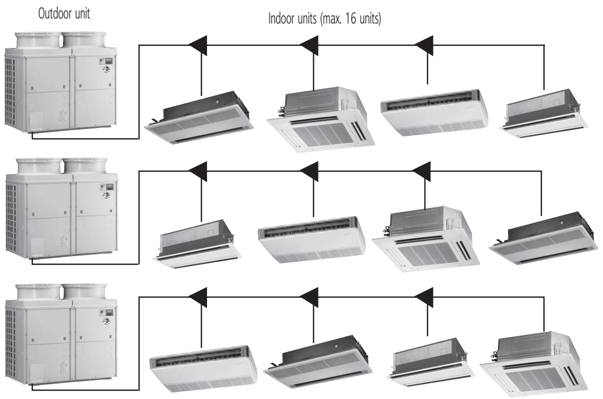
Use of high efficiency R-410A enables the VRVII to operate on a smaller refrigerant charge to be used, leading to a reduction in liquid and gas pipe diameters.

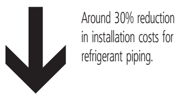
- **Reduced piping costs thanks to modular design**

Smaller diameter liquid and gas piping contributes to a reduction in installation space and installation costs.

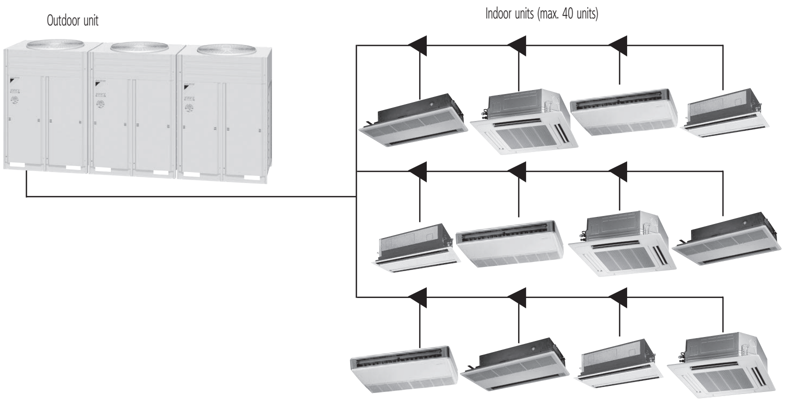


Standard VRV System

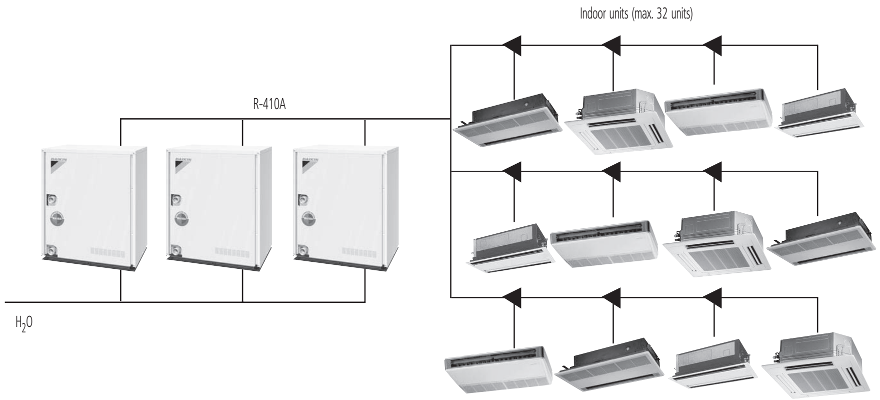




VRVII System



VRV-WII System



6 Simple and rapid installation

6-10 Sequential start - VRVII & VRV-WII

Up to 3 outdoor units can be connected to 1 power supply and can be turned on sequentially. This allows the number of breakers and their capacities to remain small and simplifies wiring (for models of 10Hp or less).

6-11 Self diagnosis - VRVII & VRV-WII

Detects malfunctions in major locations of the system and displays the type of malfunction and location, which in turn allows servicing and maintenance to be performed more efficiently.

6-12 Crosswiring check - VRVII & VRV-WII

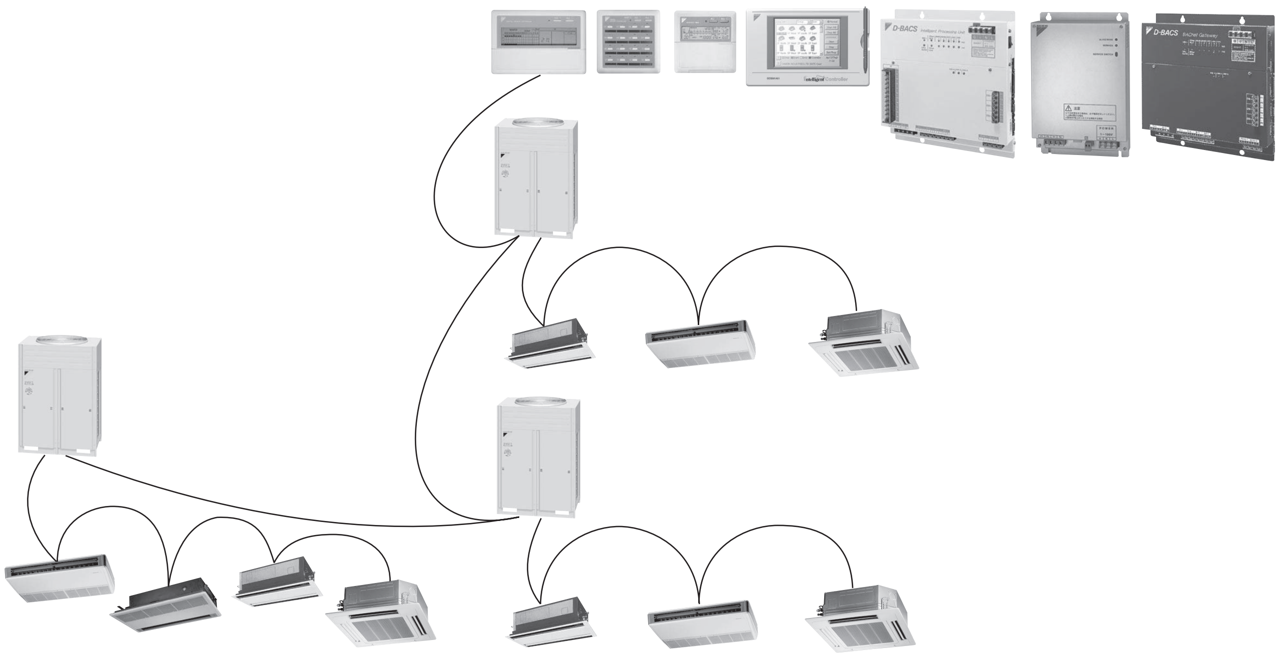
The cross wiring check facility available on the VRVII is the first of its type in the industy to warn operatives of connection errors in interunit wiring and piping. This function identifies and alerts system errors by means of on/off LEDs on the outdoor unit's PC boards.

6-13 Simplified wiring - VRVII & VRV-WII

- A simple 2-wire non-shielded multiplex transmission system links each outdoor unit to multiple indoor units using one 2-core wire, thus simplifying the wiring operation.
- Furthermore, outdoor units have power connection outlets on side and front, resulting in easier installation and maintenance and saving space when rows of units are connected together.

6-14 "Super Wiring" system - VRVII & VRV-WII

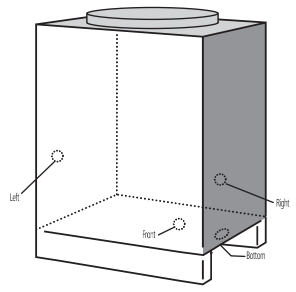
- A Super Wiring system is used to enable the shared use of wiring between indoor units, outdoor units and the centralised remote control.
- This system makes it easy for the user to retrofit the existing system with a centralised remote control, simply by connecting it to the outdoor units.
- Thanks to a non polarity wiring system, incorrect connections become impossible and installation time is reduced.



6 Simple and rapid installation

6-15 4-way wiring connection - VRVII & VRV-WII

Wiring can be fed from the front panel, both left and right side panels or bottom panel of the outdoor unit.



6-16 Auto address setting function - VRVII & VRV-WII

Allows wiring between indoor and outdoor units, as well as group control wiring of multiple indoor units, to be performed without the bothersome task of manually setting each address.

III Selection procedure
Table of contents

Air-cooled VRVII
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1 Selection procedure VRVII system based on cooling load

1-1 Indoor unit selection

Enter indoor unit capacity tables at given indoor and outdoor temperature.

Select the unit that the capacity is the nearest to and higher than the given load.

NOTE

1 Individual indoor unit capacity is subject to change by the combination. Actual capacity has to be calculated according to the combination by using outdoor units capacity table.

1-2 Outdoor unit selection

Allowable combinations are indicated in indoor unit combination total capacity index table.

In general, oudoor units can be selected as follows though the location of the unit, zoning and usage of the rooms should be considered.

The indoor and outdoor unit combination is determined that the sum of indoor unit capacity index is nearest to and smaller than the capacity index at 100 % combination ratio of each outdoor unit. Up to 16 indoor units can be connected to one outdoor unit. It is recommended to choose a larger outdoor unit if the installation space is large enough.

If the combination ratio is higher than 100 %, the indoor unit selection will have to be reviewed by using actual capacity of each indoor unit.

Indoor unit combination total capacity index table

Outdoor unit	Indoor unit combination ratio								
	130 %	120 %	110 %	100 %	90 %	80 %	70%	60 %	50 %
RXYSQ4M	130	120	110	100	90	80	70	60	50
RXYSQ5M	162.5	150	137.5	125	112.5	100	87.5	75	62.5
RXYSQ6M	182	168	154	140	126	112	98	84	70

Outdoor unit	Indoor unit combination ratio								
	130 %	120 %	110 %	100 %	90 %	80 %	70%	60 %	50 %
RX(Y)Q5M	162.5	150	137.5	125	112.5	100	87.5	75	62.5
RX(Y)Q8M/REYQ8M	260	240	220	200	180	160	140	120	100
RX(Y)Q10M/REYQ10M	325	300	275	250	225	200	175	150	125
RXYQ12M/REYQ12M	390	360	330	300	270	240	210	180	150
RXYQ14M/REYQ14M	455	420	385	350	315	280	245	210	175
RXYQ16M/REYQ16M	520	480	440	400	360	320	280	240	200
RXYQ18M/REYQ18M	585	540	495	450	405	360	315	270	225
RXYQ20M/REYQ20M	650	600	550	500	450	400	350	300	250
RXYQ22M/REYQ22M	715	660	605	550	495	440	385	330	275
RXYQ24M/REYQ24M	780	720	660	600	540	480	420	360	300
RXYQ26M/REYQ26M	845	780	715	650	585	520	455	390	325
RXYQ28M/REYQ28M	910	840	770	700	630	560	490	420	350
RXYQ30M/REYQ30M	975	900	825	750	675	600	525	450	375
RXYQ32M/REYQ32M	1,040	960	880	800	720	640	560	480	400
RXYQ34M/REYQ34M	1,105	1,020	935	850	765	680	595	510	425
RXYQ36M/REYQ36M	1,170	1,080	990	900	810	720	630	540	450
RXYQ38M/REYQ38M	1,235	1,140	1,045	950	855	760	665	570	475
RXYQ40M/REYQ40M	1,300	1,200	1,100	1,000	900	800	700	600	500
RXYQ42M/REYQ42M	1,365	1,260	1,155	1,050	945	840	735	630	525
RXYQ44M/REYQ44M	1,430	1,320	1,210	1,100	990	880	770	660	550
RXYQ46M/REYQ46M	1,495	1,380	1,265	1,150	1,035	920	805	690	575
RXYQ48M/REYQ48M	1,560	1,440	1,320	1,200	1,080	960	840	720	600

Indoor unit capacity index

Model	20	25	32	40	50	63	71	80	100	125	200	250
Capacity index	20	25	31.25	40	50	62.5	71	80	100	125	200	250

1 Selection procedure VRVII system based on cooling load

1-3 Actual performance data

Use outdoor unit capacity tables

Determine the correct table according to the outdoor unit model and combination ratio.

Enter the table at given indoor and outdoor temperature and find the outdoor capacity and power input. The individual indoor unit capacity (power input) can be calculated as follows:

$$ICA = \frac{OCA \times INX}{TNX}$$

ICA: Individual indoor unit capacity (power input)
OCA: Outdoor unit capacity (power input)
INX: Individual indoor unit capacity index
TNX: Total capacity index

Then, correct the indoor unit capacity according to the piping length.
If the corrected capacity is smaller than the load, the size of indoor unit has to be increased. Repeat the same selection procedure.

1-4 Selection example based on cooling load

1 Given

- Design condition
  Cooling: indoor 20°CWB, outdoor 33°CDB
- Cooling load

Room	A	B	C	D	E	F	G	H
Load (kW)	2.9	2.7	2.5	4.3	4.0	4.0	3.9	4.2

- Power supply: 3-phase 380V/50Hz

2 Indoor unit selection

Enter indoor unit capacity table at:
20°CWB indoor temperature
33°CDB outdoor air temperature.

Selection results are as follows:

Room	A	B	C	D	E	F	G	H
Load (kW)	2.9	2.7	2.5	4.3	4.0	4.0	3.9	4.2
Unit size	25	25	25	40	40	40	40	40
Capacity	3.0	3.0	3.0	4.8	4.8	4.8	4.8	4.8

3 Outdoor unit selection

- Assume that the indoor and outdoor unit combination is as follows.
  Outdoor unit: RXYQ10M
  Indoor unit: FXCQ25M7 x 3, FXCQ40M7 x 5
- Indoor unit combination total capacity index
  25 x 3 + 40 x 5 = 275 (110 %)

1 Selection procedure VRVII system based on cooling load

1-4 Selection example based on cooling load

4 Actual performance data (50Hz)

- Outdoor unit cooling capacity: 30.5kW (RXYQ10M, 110 %)
- Individual capacity
  Capacity of FXCQ25M = 30.5 x $\frac{25}{275}$ = 2.77kW

  Capacity of FXCQ40M = 30.5 x $\frac{40}{275}$ = 4.44kW

Actual combination capacity

Room	A	B	C	D	E	F	G	H
Load (kW)	2.9	2.7	2.5	4.3	4.0	4.0	3.9	4.2
Unit size	25	25	25	40	40	40	40	40
Capacity	2.77	2.77	2.77	4.44	4.44	4.44	4.44	4.44

The unit size for room A has to be increased from 25 to 32 because the capacity is less than the load. For new combination, actual capacity is calculated as follows.

- Indoor unit combination total capacity index
  (25 x 2) +31.25 + (40 x5) = 281.25 (112.5 %)
- Outdoor unit cooling capacity:
  27,610 kcal/h (direct interpolation between 110 % and 120 % in the table)
- Individual capacity
  Capacity of FXCQ25M = 30.0 x $\frac{25}{281.25}$ = 2.7kW

  Capacity of FXCQ32M = 30.0 x $\frac{32}{281.25}$ = 3.4kW

  Capacity of FXCQ40M = 30.0 x $\frac{40}{281.25}$ = 4.3kW

Actual capacity of new combination

Room	A	B	C	D	E	F	G	H
Load (kW)	2.9	2.7	2.5	4.3	4.0	4.0	3.9	4.2
Unit size	32	25	25	40	40	40	40	40
Capacity	3.4	2.7	2.7	4.3	4.3	4.3	4.3	4.3

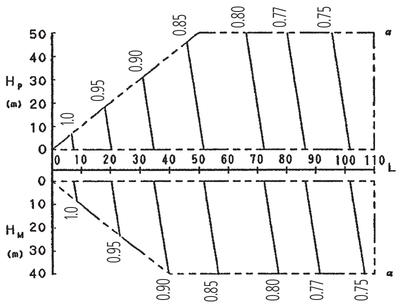
Then, the capacities have to be corrected for actual piping length according to the location of indoor and outdoor units and the distance between them.

2 Capacity correction ratio

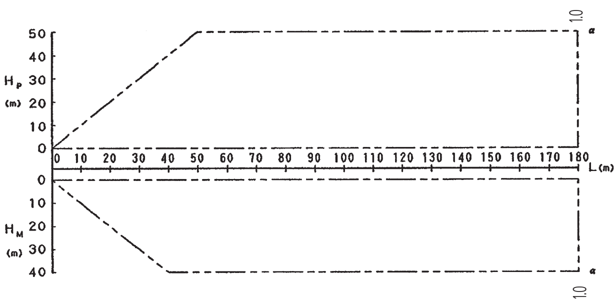
2-1 VRVII-S

RXYSQ4-5M7V3B

- Rate of change in cooling capacity



- Rate of change in heating capacity



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NOTES

1 These figures illustrate the rate of change in capacity of a standard indoor unit system at maximum load (with the thermostat set to maximum) under standard conditions.
Moreover, under partial load conditions there is only a minor deviation from the rate of change in capacity shown in the above figures.

2 With this outdoor unit, evaporating pressure constant control when cooling, and condensing pressure constant control when heating is carried out.

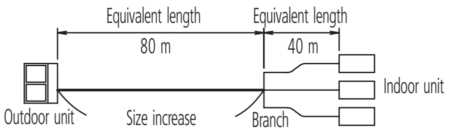
3 Method of calculating cooling / heating capacity (max. capacity for combination with standard indoor unit)
cooling / heating capacity = cooling / heating capacity obtained from performance characteristics table x each capacity rate of change
When piping length differs depending on the indoor unit, maximum capacity of each unit during simultaneous operation is:
cooling / heating capacity = cooling / heating capacity of each unit x capacity rate of change for each piping length

4 When overall equivalent pipe length is 90m or more, the diameter of the main gas pipes (outdoor unit-branch sections) must be increased.
Diameter of above case

Model	gas	liquid
RXYSQ4,5M7V3B	ø 19.1	not increased

5 When the main sections of the interunit gas pipe diameters are increased the overall equivalent length should be calculated as follows:
Overall equivalent length = Equivalent length to main pipe x 0.5 + Equivalent length after branching

Example



In the above case (Cooling)
Overall equivalent length = 80m x 0.5 + 40m = 80m
The correction factor in capacity when Hp=0m is thus approximately 0.78

EXPLANATION OF SYMBOLS

H_P : Level difference (m) between indoor and outdoor units with indoor unit in inferior position
H_M : Level difference (m) between indoor and outdoor units with indoor unit in superior position
L : Equivalent pipe length (m)
α : Capacity correction factor

Diameter of pipes

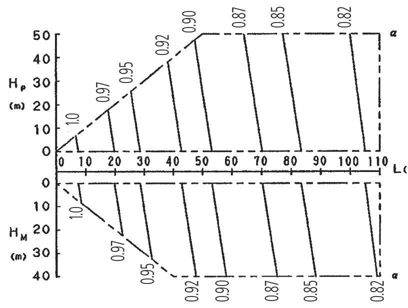
Model	liquid	gas
RXYSQ4,5M7V3B	ø 15.9	ø 9.5

2 Capacity correction ratio

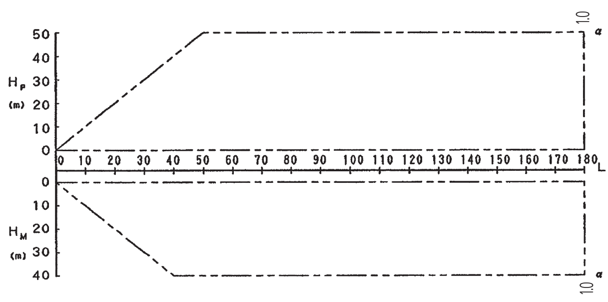
2-1 VRVII-S

RXYSQ6M7V3B

- Rate of change in cooling capacity



- Rate of change in heating capacity



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NOTES

1 These figures illustrate the rate of change in capacity of a standard indoor unit system at maximum load (with the thermostat set to maximum) under standard conditions.
Moreover, under partial load conditions there is only a minor deviation from the rate of change in capacity shown in the above figures.

2 With this outdoor unit, evaporating pressure constant control when cooling, and condensing pressure constant control when heating is carried out.

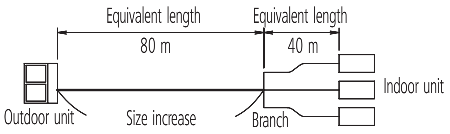
3 Method of calculating cooling / heating capacity (max. capacity for combination with standard indoor unit)
cooling / heating capacity = cooling / heating capacity obtained from performance characteristics table x each capacity rate of change
When piping length differs depending on the indoor unit, maximum capacity of each unit during simultaneous operation is:
cooling / heating capacity = cooling / heating capacity of each unit x capacity rate of change for each piping length

4 When overall equivalent pipe length is 90m or more, the diameter of the main gas pipes (outdoor unit-branch sections) must be increased.
Diameter of above case

Model	gas	liquid
RXYSQ6M7V3B	ø 22.2	not increased

5 When the main sections of the interunit gas pipe diameters are increased the overall equivalent length should be calculated as follows:
Overall equivalent length = Equivalent length to main pipe x 0.5 + Equivalent length after branching

Example



In the above case (Cooling)
Overall equivalent length = 80m x 0.5 + 40m = 80m
The correction factor in capacity when Hp=0m is thus approximately 0.86

EXPLANATION OF SYMBOLS

H_p : Level difference (m) between indoor and outdoor units with indoor unit in inferior position
H_M : Level difference (m) between indoor and outdoor units with indoor unit in superior position
L : Equivalent pipe length (m)
α : Capacity correction factor

Diameter of pipes

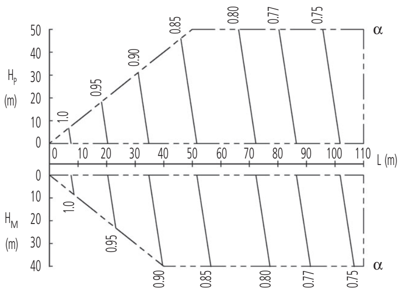
Model	liquid	gas
RXYSQ6M7V3B	ø 19.1	ø 9.5

2 Capacity correction ratio

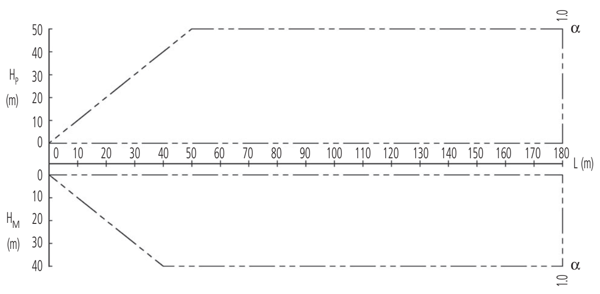
2-2 VRVII cooling only /heat pump

RX(Y)Q5M

- Rate of change in cooling capacity



- Rate of change in heating capacity



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NOTES

1 These figures illustrate the rate of change in capacity of a standard indoor unit system at maximum load (with the thermostat set to maximum) under standard conditions.
Moreover, under partial load conditions there is only a minor deviation from the rate of change in capacity shown in the above figures.

2 With this outdoor unit, evaporating pressure constant control when cooling, and condensing pressure constant control when heating is carried out.

3 Method of calculating A/C (cooling / heating) capacity:
The maximum A/C of the system will be either the total A/C capacity of the indoor units obtained from capacity characteristic table or the maximum A/C capacity of outdoor units as mentioned below, whichever smaller.
Calculating A/C capacity of outdoor units

- Condition: Indoor unit combination ratio does not exceed 100%
  Maximum A./C capacity of outdoor units = A/C capacity of outdoor units obtained from capacity characteristic table at the 100% combination
  x capacity change rate due to piping length to the farthest indoor unit
- Condition: Indoor unit combination ratio exceeds 100%
  Maximum A./C capacity of outdoor units = A/C capacity of outdoor units obtained from capacity characteristic table at the combination
  x capacity change rate due to piping length to the farthest indoor unit

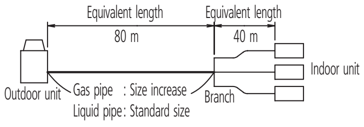
4 When overall equivalent pipe length is 90m or more, the diameter of the main gas and liquid pipes (outdoor unit-branch sections) must be increased.
[Diameter of above case]

Model	gas	liquid
RX(Y)Q5M	ø 19.1	Not increased

5 Read cooling / heating capacity rate of change in the above figures based on the following equivalent length.
Overall equivalent length = (Equivalent length to main pipe) x Correction factor + (Equivalent length after branching)
Choose a correction factor from the following table.
When cooling capacity is calculated: gas pipe size
When heating capacity is calculated: liquid pipe size.

Rate of change (object piping)	Correction factor	
	Standard size	Size increase
Cooling (gas pipe)	1.0	0.5
Heating (liquid pipe)	1.0	-

Example



In the above case
(Cooling) Overall equivalent length = 80m x 0.5 + 40m = 80m
(Heating) Overall equivalent length = 80m x 1.0 + 40m = 120m
The rate of change in cooling capacity when Hp=0m is thus approximately 0.78
The rate of change in heating capacity when Hp=0m is thus approximately 1.0

EXPLANATION OF SYMBOLS

H_p : Level difference (m) between indoor and outdoor units with indoor unit in inferior position
H_M : Level difference (m) between indoor and outdoor units with indoor unit in superior position
L : Equivalent pipe length (m)
α : Rate of change in cooling/heating capacity

Diameter of the main pipes (standard size)

Model	gas	liquid
RX(Y)Q5M	ø 15.9	ø 9.5

Temper grade and Thickness

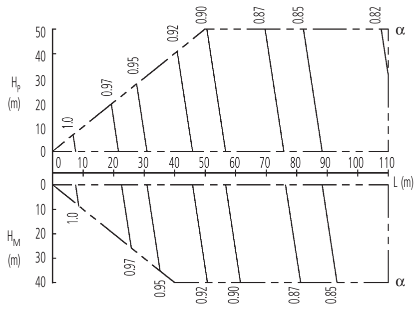
Temper grade	O Type		1/2H Type
Outer diameter	ø 9.5	ø 15.9	ø 19.1
Minimum wall thickness	0.80	0.99	0.80

2 Capacity correction ratio

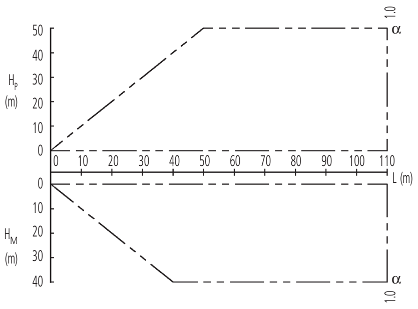
2-2 VRVII cooling only /heat pump

RXYQ8,22M

- Rate of change in cooling capacity



- Rate of change in heating capacity



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NOTES

1 These figures illustrate the rate of change in capacity of a standard indoor unit system at maximum load (with the thermostat set to maximum) under standard conditions.
Moreover, under partial load conditions there is only a minor deviation from the rate of change in capacity shown in the above figures.

2 With this outdoor unit, evaporating pressure constant control when cooling, and condensing pressure constant control when heating is carried out.

3 Method of calculating A/C (cooling / heating) capacity:
The maximum A/C of the system will be either the total A/C capacity of the indoor units obtained from capacity characteristic table or the maximum A/C capacity of outdoor units as mentioned below, whichever smaller.
Calculating A/C capacity of outdoor units

- Condition: Indoor unit combination ratio does not exceed 100%
  Maximum A./C capacity of outdoor units = A/C capacity of outdoor units obtained from capacity characteristic table at the 100% combination
  x capacity change rate due to piping length to the farthest indoor unit
- Condition: Indoor unit combination ratio exceeds 100%
  Maximum A./C capacity of outdoor units = A/C capacity of outdoor units obtained from capacity characteristic table at the combination
  x capacity change rate due to piping length to the farthest indoor unit

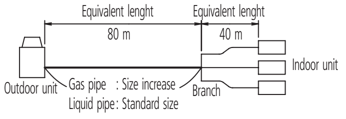
4 When overall equivalent pipe length is 90m or more, the diameter of the main gas and liquid pipes (outdoor unit-branch sections) must be increased.
[Diameter of above case]

Model	gas	liquid
RXYQ8M	ø 22.2	ø 12.7
RXYQ22M	ø 31.8	ø 19.1

5 Read cooling / heating capacity rate of change in the above figures based on the following equivalent length.
Overall equivalent length = (Equivalent length to main pipe) x Correction factor + (Equivalent length after branching)
Choose a correction factor from the following table.
When cooling capacity is calculated: gas pipe size
When heating capacity is calculated: liquid pipe size.

Rate of change (object piping)	Correction factor	
	Standard size	Size increase
Cooling (gas pipe)	1.0	0.5
Heating (liquid pipe)	1.0	0.5

6 Example



In the above case
(Cooling) Overall equivalent length = 80m x 0.5 + 40m = 80m
(Heating) Overall equivalent length = 80m x 0.5 + 40m = 80m
The rate of change in cooling capacity when Hp=0m is thus approximately 0.86
The rate of change in heating capacity when Hp=0m is thus approximately 1.0

EXPLANATION OF SYMBOLS

H_p : Level difference (m) between indoor and outdoor units with indoor unit in inferior position
H_M : Level difference (m) between indoor and outdoor units with indoor unit in superior position
L : Equivalent pipe length (m)
α : Rate of change in cooling/heating capacity

Diameter of the main pipes (standard size)

Model	gas	liquid
RXYQ8M	ø 19.1	ø 9.5
RXYQ22M	ø 28.6	ø 15.9

Temper grade and Thickness

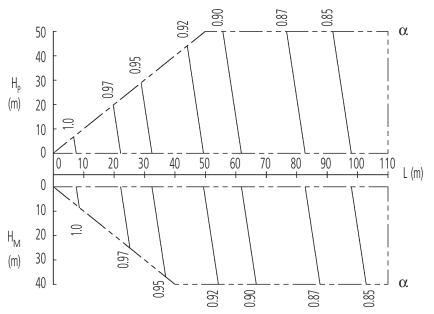
Temper grade	O Type			1/2H Type			
Outer diameter	ø 9.5	ø 12.7	ø 15.9	ø 19.1	ø 22.2	ø 28.6	ø 31.8
Minimum wall Thickness	0.80	0.80	0.99	0.80	0.80	0.99	1.10

2 Capacity correction ratio

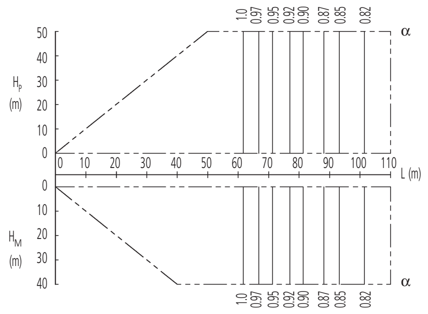
2-2 VRVII cooling only /heat pump

RX(Y)Q10M

- Rate of change in cooling capacity



- Rate of change in heating capacity



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NOTES

1 These figures illustrate the rate of change in capacity of a standard indoor unit system at maximum load (with the thermostat set to maximum) under standard conditions.
Moreover, under partial load conditions there is only a minor deviation from the rate of change in capacity shown in the above figures.

2 With this outdoor unit, evaporating pressure constant control when cooling, and condensing pressure constant control when heating is carried out.

3 Method of calculating A/C (cooling / heating) capacity:
The maximum A/C of the system will be either the total A/C capacity of the indoor units obtained from capacity characteristic table or the maximum A/C capacity of outdoor units as mentioned below, whichever smaller.
Calculating A/C capacity of outdoor units

- Condition: Indoor unit combination ratio does not exceed 100%
  Maximum A/C capacity of outdoor units = A/C capacity of outdoor units obtained from capacity characteristic table at the 100% combination
  x capacity change rate due to piping length to the farthest indoor unit
- Condition: Indoor unit combination ratio exceeds 100%
  Maximum A/C capacity of outdoor units = A/C capacity of outdoor units obtained from capacity characteristic table at the combination
  x capacity change rate due to piping length to the farthest indoor unit

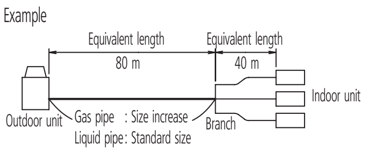
4 When overall equivalent pipe length is 90m or more, the diameter of the main gas and liquid pipes (outdoor unit-branch sections) must be increased.
[Diameter of above case]

Model	gas	liquid
RX(Y)Q10M	ø 25.4	ø 12.7

5 Read cooling / heating capacity rate of change in the above figures based on the following equivalent length.
Overall equivalent length = (Equivalent length to main pipe) x Correction factor + (Equivalent length after branching)
Choose a correction factor from the following table.
When cooling capacity is calculated: gas pipe size
When heating capacity is calculated: liquid pipe size.

Rate of change (object piping)	Correction factor	
	Standard size	Size increase
Cooling (gas pipe)	1.0	0.5
Heating (liquid pipe)	1.0	0.5

6 Example



In the above case
(Cooling) Overall equivalent length = 80m x 0.5 + 40m = 80m
(Heating) Overall equivalent length = 80m x 0.5 + 40m = 80m
The rate of change in cooling capacity when Hp=0m is thus approximately 0.87
The rate of change in heating capacity when Hp=0m is thus approximately 0.90

EXPLANATION OF SYMBOLS

H_p : Level difference (m) between indoor and outdoor units with indoor unit in inferior position
H_M : Level difference (m) between indoor and outdoor units with indoor unit in superior position
L : Equivalent pipe length (m)
α : Rate of change in cooling/heating capacity

Diameter of the main pipes (standard size)

Model	gas	liquid
RX(Y)Q10M	ø 22.2	ø 9.5

Temper grade and Thickness

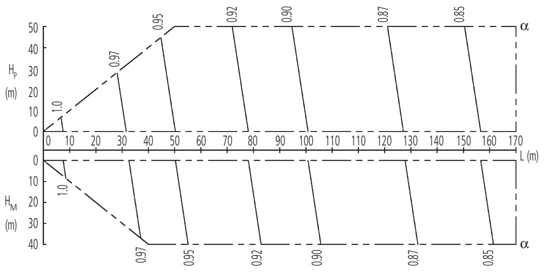
Temper grade	O Type		1/2H Type	
Outer diameter	ø 9.5	ø 12.7	ø 22.2	ø 25.4
Minimum wall Thickness	0.80	0.80	0.80	0.88

2 Capacity correction ratio

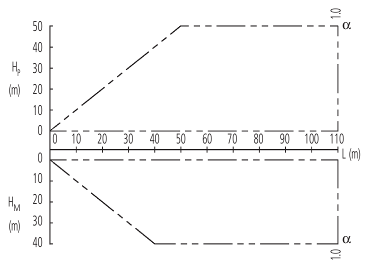
2-2 VRVII cooling only /heat pump

RXYQ12, 14, 24, 36M

- Rate of change in cooling capacity



- Rate of change in heating capacity



3D048207B

NOTES

1 These figures illustrate the rate of change in capacity of a standard indoor unit system at maximum load (with the thermostat set to maximum) under standard conditions.
Moreover, under partial load conditions there is only a minor deviation from the rate of change in capacity shown in the above figures.

2 With this outdoor unit, evaporating pressure constant control when cooling, and condensing pressure constant control when heating is carried out.

3 Method of calculating A/C (cooling / heating) capacity:
The maximum A/C of the system will be either the total A/C capacity of the indoor units obtained from capacity characteristic table or the maximum A/C capacity of outdoor units as mentioned below, whichever smaller.
Calculating A/C capacity of outdoor units

- Condition: Indoor unit combination ratio does not exceed 100%
  Maximum A./C capacity of outdoor units = A/C capacity of outdoor units obtained from capacity characteristic table at the 100% combination
  x capacity change rate due to piping length to the farthest indoor unit
- Condition: Indoor unit combination ratio exceeds 100%
  Maximum A./C capacity of outdoor units = A/C capacity of outdoor units obtained from capacity characteristic table at the combination
  x capacity change rate due to piping length to the farthest indoor unit

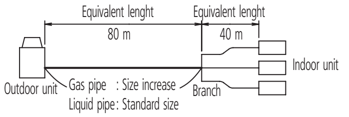
4 When overall equivalent pipe length is 90m or more, the diameter of the main gas and liquid pipes (outdoor unit-branch sections) must be increased.
[Diameter of above case]

Model	gas	liquid
RXYQ12, 14M	Not increased	ø 15.9
RXYQ24M		ø 19.1
RXYQ36M		ø 22.2

5 Read cooling / heating capacity rate of change in the above figures based on the following equivalent length.
Overall equivalent length = (Equivalent length to main pipe) x Correction factor + (Equivalent length after branching)
Choose a correction factor from the following table.
When cooling capacity is calculated: gas pipe size
When heating capacity is calculated: liquid pipe size.

Rate of change (object piping)	Correction factor	
	Standard size	Size increase
Cooling (gas pipe)	1.0	
Heating (liquid pipe)	1.0	0.5

Example



In the above case
(Cooling) Overall equivalent length = 80m x 1.0 + 40m = 120m
(Heating) Overall equivalent length = 80m x 0.5 + 40m = 80m
The rate of change in cooling capacity when Hp=0m is thus approximately 0.88
The rate of change in heating capacity when Hp=0m is thus approximately 1.0

EXPLANATION OF SYMBOLS

H_p : Level difference (m) between indoor and outdoor units with indoor unit in inferior position
H_M : Level difference (m) between indoor and outdoor units with indoor unit in superior position
L : Equivalent pipe length (m)
α : Rate of change in cooling/heating capacity

Diameter of the main pipes (standard size)

Model	gas	liquid
RXYQ12, 14M	ø 28.6	ø 12.7
RXYQ24M	ø 34.9	ø 15.9
RXYQ36M	ø 41.3	ø 19.1

Temper grade and Thickness

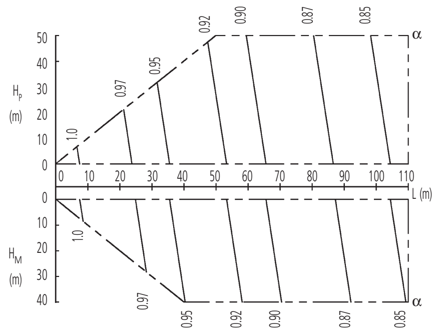
Temper grade	O Type		1/2H Type				
Outer diameter	ø 12.7	ø 15.9	ø 19.1	ø 22.2	ø 28.6	ø 34.9	ø 41.3
Minimum wall Thickness	0.80	0.99	0.80	0.80	0.99	1.21	1.43

2 Capacity correction ratio

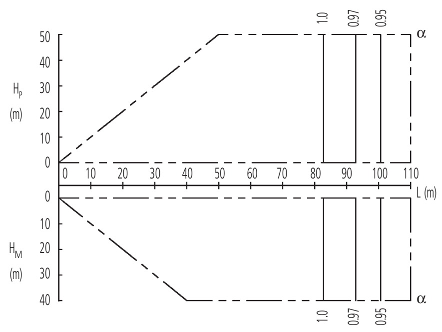
2-2 VRVII cooling only /heat pump

RXYQ16M

- Rate of change in cooling capacity



- Rate of change in heating capacity



3D048208B

NOTES

1 These figures illustrate the rate of change in capacity of a standard indoor unit system at maximum load (with the thermostat set to maximum) under standard conditions.
Moreover, under partial load conditions there is only a minor deviation from the rate of change in capacity shown in the above figures.

2 With this outdoor unit, evaporating pressure constant control when cooling, and condensing pressure constant control when heating is carried out.

3 Method of calculating A/C (cooling / heating) capacity:
The maximum A/C of the system will be either the total A/C capacity of the indoor units obtained from capacity characteristic table or the maximum A/C capacity of outdoor units as mentioned below, whichever smaller.
Calculating A/C capacity of outdoor units

- Condition: Indoor unit combination ratio does not exceed 100%
  Maximum A./C capacity of outdoor units = A/C capacity of outdoor units obtained from capacity characteristic table at the 100% combination
  x capacity change rate due to piping length to the farthest indoor unit
- Condition: Indoor unit combination ratio exceeds 100%
  Maximum A./C capacity of outdoor units = A/C capacity of outdoor units obtained from capacity characteristic table at the combination
  x capacity change rate due to piping length to the farthest indoor unit

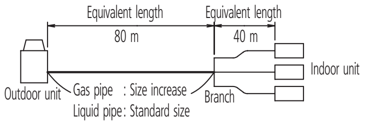
4 When overall equivalent pipe length is 90m or more, the diameter of the main gas and liquid pipes (outdoor unit-branch sections) must be increased.
[Diameter of above case]

Model	gas	liquid
RXYQ16M	ø 31.8	ø 15.9

5 Read cooling / heating capacity rate of change in the above figures based on the following equivalent length.
Overall equivalent length = (Equivalent length to main pipe) x Correction factor + (Equivalent length after branching)
Choose a correction factor from the following table.
When cooling capacity is calculated: gas pipe size
When heating capacity is calculated: liquid pipe size.

Rate of change (object piping)	Correction factor	
	Standard size	Size increase
Cooling (gas pipe)	1.0	0.5
Heating (liquid pipe)	1.0	0.5

Example



In the above case
(Cooling) Overall equivalent length = 80m x 0.5 + 40m = 80m
(Heating) Overall equivalent length = 80m x 0.5 + 40m = 80m
The rate of change in cooling capacity when Hp=0m is thus approximately 0.88
The rate of change in heating capacity when Hp=0m is thus approximately 1.0

EXPLANATION OF SYMBOLS

H_p : Level difference (m) between indoor and outdoor units with indoor unit in inferior position
H_M : Level difference (m) between indoor and outdoor units with indoor unit in superior position
L : Equivalent pipe length (m)
α : Rate of change in cooling/heating capacity

Diameter of the main pipes (standard size)

Model	gas	liquid
RXYQ16M	ø 28.6	ø 12.7

Temper grade and Thickness

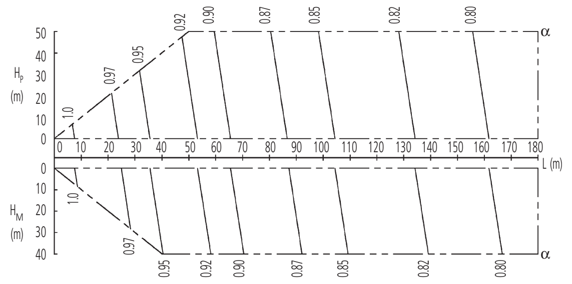
Temper grade	O Type		1/2H Type	
Outer diameter	ø 12.7	ø 15.9	ø 28.6	ø 31.8
Minimum wall Thickness	0.80	0.99	0.99	1.10

2 Capacity correction ratio

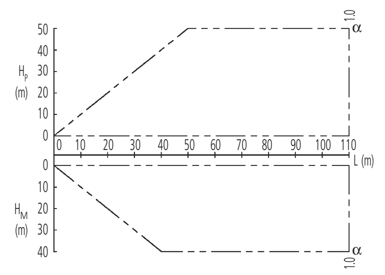
2-2 VRVII cooling only /heat pump

RXYQ18,26,28,30,38,40,42,44M9

- Rate of change in cooling capacity



- Rate of change in heating capacity



3D048213B

NOTES

1 These figures illustrate the rate of change in capacity of a standard indoor unit system at maximum load (with the thermostat set to maximum) under standard conditions.
Moreover, under partial load conditions there is only a minor deviation from the rate of change in capacity shown in the above figures.

2 With this outdoor unit, evaporating pressure constant control when cooling, and condensing pressure constant control when heating is carried out.

3 Method of calculating A/C (cooling / heating) capacity:
The maximum A/C of the system will be either the total A/C capacity of the indoor units obtained from capacity characteristic table or the maximum A/C capacity of outdoor units as mentioned below, whichever smaller.
Calculating A/C capacity of outdoor units

- Condition: Indoor unit combination ratio does not exceed 100%
  Maximum A./C capacity of outdoor units = A/C capacity of outdoor units obtained from performance characteristics table at the 100% combination x capacity change rate due to piping length to the farthest indoor unit
  Condition: Indoor unit combination ratio exceeds 100%
  Maximum A./C capacity of outdoor units = A/C capacity of outdoor units obtained from capacity characteristics table at the combination x capacity change rate due to piping length to the farthest indoor unit

4 When overall equivalent pipe length is 90m or more, the diameter of the main gas and liquid pipes (outdoor unit-branch sections) must be increased except for the gas pipe of 38, 40, 42, 44M type.
[Diameter of above case]

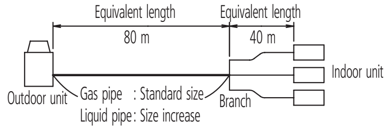
Model	gas	liquid
RXYQ18M9	ø 31.8	ø 19.1
RXYQ26,28,30M9	ø 38.1 ※	ø 22.2
RXYQ38,40,42,44M9	Not increased	ø 22.2

※ If available on the site, use the size. Otherwise, not increased

5 Read cooling / heating capacity rate of change in the above figures based on the following equivalent length.
Overall equivalent length = (Equivalent length to main pipe) x Correction factor + (Equivalent length after branching)
Choose a correction factor from the following table.
When cooling capacity is calculated: gas pipe size
When heating capacity is calculated: liquid pipe size.

Rate of change (object piping)	Correction factor	
	Standard size	Size increase
Cooling (gas pipe)	1.0	0.5
Heating (liquid pipe)	1.0	0.5

Example RXYQ38M9



In the above case
(Cooling) Overall equivalent length = 80m x 1.0 + 40m = 120m
(Heating) Overall equivalent length = 80m x 0.5 + 40m = 80m
The rate of change in cooling capacity when Hp=0m is thus approximately 0.83
The rate of change in heating capacity when Hp=0m is thus approximately 1.0

EXPLANATION OF SYMBOLS

1 H_p : Level difference (m) between indoor and outdoor units where indoor unit in inferior position
2 H_M : Level difference (m) between indoor and outdoor units where indoor unit in superior position
3 L : Equivalent pipe length (m)
4 α : Rate of change in cooling / heating capacity

[Diameter of the main pipes (standard size)]

Model	gas	liquid
RXYQ18M9	ø 28.6	ø 15.9
RXYQ26,28,30M9	ø 34.9	ø 19.1
RXYQ38,40,42,44M9	ø 41.3	ø 19.1

[Temper grade and thickness]]

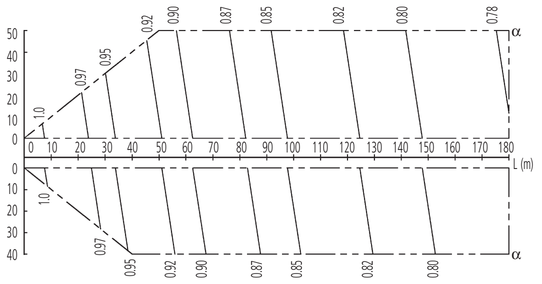
Temper grade	O Type	1/2 H Type						
Outer diameter	ø 15.9	ø 19.1	ø 22.2	ø 28.6	ø 31.8	ø 34.9	ø 38.1	ø 41.3
Maximum wall Thickness	0.99	0.80	0.80	0.99	1.10	1.21	1.32	1.43

2 Capacity correction ratio

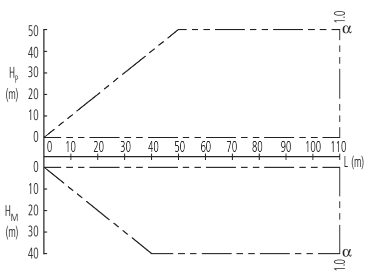
2-2 VRVII cooling only /heat pump

RXYQ20,32,34,46M9

- Rate of change in cooling capacity



- Rate of change in heating capacity



3D048214B

NOTES

1 These figures illustrate the rate of change in capacity of a standard indoor unit system at maximum load (with the thermostat set to maximum) under standard conditions.
Moreover, under partial load conditions there is only a minor deviation from the rate of change in capacity shown in the above figures.

2 With this outdoor unit, evaporating pressure constant control when cooling, and condensing pressure constant control when heating is carried out.

3 Method of calculating A/C (cooling / heating) capacity:
The maximum A/C of the system will be either the total A/C capacity of the indoor units obtained from capacity characteristic table or the maximum A/C capacity of outdoor units as mentioned below, whichever smaller.
Calculating A/C capacity of outdoor units

- Condition: Indoor unit combination ratio does not exceed 100%
  Maximum A./C capacity of outdoor units = A/C capacity of outdoor units obtained from performance characteristics table at the 100% combination x capacity change rate due to piping length to the farthest indoor unit
  Condition: Indoor unit combination ratio exceeds 100%
  Maximum A./C capacity of outdoor units = A/C capacity of outdoor units obtained from capacity characteristics table at the combination x capacity change rate due to piping length to the farthest indoor unit

4 When overall equivalent pipe length is 90m or more, the diameter of the main gas and liquid pipes (outdoor unit-branch sections) must be increased except for the gas pipe of 46M type.
[Diameter of above case]

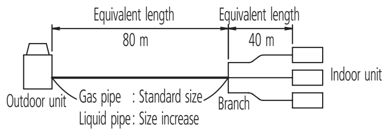
Model	gas	liquid
RXYQ20M9	ø 31.8	ø 19.1
RXYQ32,34M9	ø 38.1 ※	ø 22.2
RXYQ46M9	Not increased	ø 22.2

※ If available on the site, use the size. Otherwise, not increased

5 Read cooling / heating capacity rate of change in the above figures based on the following equivalent length.
Overall equivalent length = (Equivalent length to main pipe) x Correction factor + (Equivalent length after branching)
Choose a correction factor from the following table.
When cooling capacity is calculated: gas pipe size
When heating capacity is calculated: liquid pipe size.

Rate of change (object piping)	Correction factor	
	Standard size	Size increase
Cooling (gas pipe)	1.0	0.5
Heating (liquid pipe)	1.0	0.5

Example RXYQ46M9



In the above case
(Cooling) Overall equivalent length = 80m x 1.0 + 40m = 120m
(Heating) Overall equivalent length = 80m x 0.5 + 40m = 80m
The rate of change in cooling capacity when Hp=0m is thus approximately 0.82
The rate of change in heating capacity when Hp=0m is thus approximately 1.0

EXPLANATION OF SYMBOLS

1 H_p : Level difference (m) between indoor and outdoor units where indoor unit in inferior position
2 H_M : Level difference (m) between indoor and outdoor units where indoor unit in superior position
3 L : Equivalent pipe length (m)
4 α : Rate of change in cooling / heating capacity

[Diameter of the main pipes (standard size)]

Model	gas	liquid
RXYQ20M9	ø 28.6	ø 15.9
RXYQ32,34M9	ø 34.9	ø 19.1
RXYQ46M9	ø 41.3	ø 19.1

[Temper grade and thickness]]

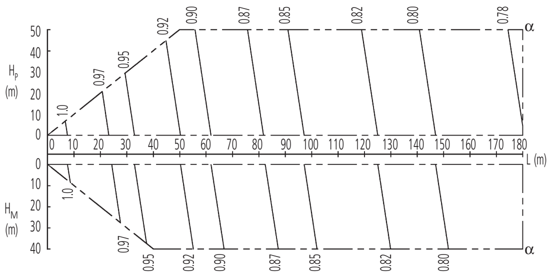
Temper grade	O Type	1/2 H Type						
Outer diameter	ø 15.9	ø 19.1	ø 22.2	ø 28.6	ø 31.8	ø 34.9	ø 38.1	ø 41.3
Minimum wall Thickness	0.99	0.80	0.80	0.99	1.10	1.21	1.32	1.43

2 Capacity correction ratio

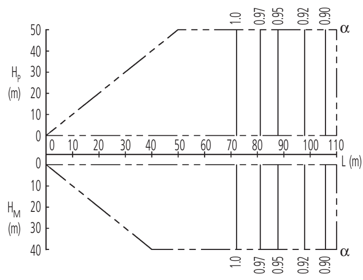
2-2 VRVII cooling only /heat pump

RXYQ48M9

- Rate of change in cooling capacity



- Rate of change in heating capacity



3D048215B

NOTES

1 These figures illustrate the rate of change in capacity of a standard indoor unit system at maximum load (with the thermostat set to maximum) under standard conditions.
Moreover, under partial load conditions there is only a minor deviation from the rate of change in capacity shown in the above figures.

2 With this outdoor unit, evaporating pressure constant control when cooling, and condensing pressure constant control when heating is carried out.

3 Method of calculating A/C (cooling / heating) capacity:
The maximum A/C of the system will be either the total A/C capacity of the indoor units obtained from capacity characteristic table or the maximum A/C capacity of outdoor units as mentioned below, whichever smaller.
Calculating A/C capacity of outdoor units

- Condition: Indoor unit combination ratio does not exceed 100%
  Maximum A./C capacity of outdoor units = A/C capacity of outdoor units obtained from performance characteristics table at the 100% combination x capacity change rate due to piping length to the farthest indoor unit
  Condition: Indoor unit combination ratio exceeds 100%
  Maximum A./C capacity of outdoor units = A/C capacity of outdoor units obtained from capacity characteristics table at the combination x capacity change rate due to piping length to the farthest indoor unit

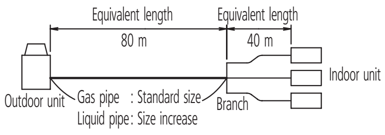
4 When overall equivalent pipe length is 90m or more, the diameter of the main gas and liquid pipes (outdoor unit-branch sections) must be increased.
[Diameter of above case]

Model	gas	liquid
RXYQ48M9	Not increased	ø 22.2

5 Read cooling / heating capacity rate of change in the above figures based on the following equivalent length.
Overall equivalent length = (Equivalent length to main pipe) x Correction factor + (Equivalent length after branching)
Choose a correction factor from the following table.
When cooling capacity is calculated: gas pipe size
When heating capacity is calculated: liquid pipe size.

Rate of change (object piping)	Correction factor	
	Standard size	Size increase
Cooling (gas pipe)	1.0	
Heating (liquid pipe)	1.0	0.5

Example



In the above case
(Cooling) Overall equivalent length = 80m x 1.0 + 40m = 120m
(Heating) Overall equivalent length = 80m x 0.5 + 40m = 80m
The rate of change in cooling capacity when Hp=0m is thus approximately 0.82
The rate of change in heating capacity when Hp=0m is thus approximately 0,97

EXPLANATION OF SYMBOLS

1 H_p : Level difference (m) between indoor and outdoor units where indoor unit in inferior position
2 H_M: Level difference (m) between indoor and outdoor units where indoor unit in superior position
3 L : Equivalent pipe length (m)
4 α : Rate of change in cooling / heating capacity
[Diameter of the main pipes (standard size)]

Model	gas	liquid
RXYQ48M9	ø 41.3	ø 19.1

[Temper grade and thickness]]

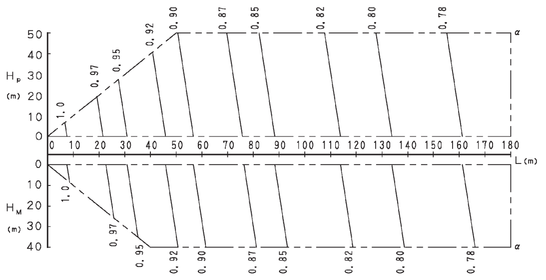
Temper grade	1/2 H Type		
Outer diameter	ø 19.1	ø 22.2	ø 41.3
Minimum wall Thickness	0.80	0.80	1.43

2 Capacity correction ratio

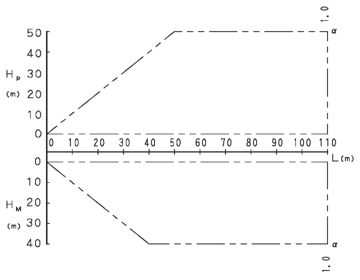
2-3 VRVII heat recovery

2-3-1 REYQ8,22M

- Rate of change in cooling capacity



- Rate of change in heating capacity



3D042141

NOTES

1 These figures illustrate the rate of change in capacity of a standard indoor unit system at maximum load (with the thermostat set to maximum) under standard conditions.
Moreover, under partial load conditions there is only a minor deviation from the rate of change in capacity shown in the above figures.

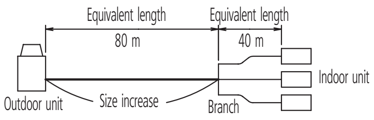
2 With this outdoor unit, evaporating pressure constant control when cooling, and condensing pressure constant control when heating is carried out.

3 Method of calculating cooling / heating capacity (max. capacity for combination with standard indoor unit)
cooling / heating capacity = cooling / heating capacity obtained from performance characteristics table x each capacity rate of change
When piping length differs depending on the indoor unit, maximum capacity of each unit during simultaneous operation is:
cooling / heating capacity = cooling / heating capacity of each unit x capacity rate of change for each piping length

4 When overall equivalent pipe length is 90m or more, the diameter of the main gas pipes (outdoor unit-branch sections) must be increased.
Diameter of above case

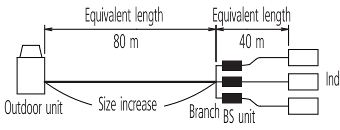
Model	Liquid
REYQ8M	ø 12.7
REYQ22M	ø 19.1

5 When the main sections of the interunit gas pipe diameters are increased the overall equivalent length should be calculated as follows. (Heating only)
Overall equivalent length = Equivalent length to main pipe x 0.5 + Equivalent length after branching
Example



In the above case (Heating)
Overall equivalent length = 80m x 0.5 + 40m = 80m
The correction factor in capacity when H_p = 0m is thus approximately 1.0

6 In the combination which does not include cooling only indoor unit, calculate the equivalent length pipe by the following when you calculate cooling capacity.
Overall equivalent length = Equivalent length to main pipe x 0.5 + Equivalent length after branching
Example



In the above case (Cooling)
Overall equivalent length = 80m x 0.5 + 40m = 80m
The correction factor in capacity when H_p = 0m is thus approximately 0.86

EXPLANATION OF SYMBOLS

H_p : Level difference (m) between indoor and outdoor units with indoor unit in inferior position
H_M : Level difference (m) between indoor and outdoor units with indoor unit in superior position
L : Equivalent pipe length (m)
α : Capacity correction factor

Diameter of pipes

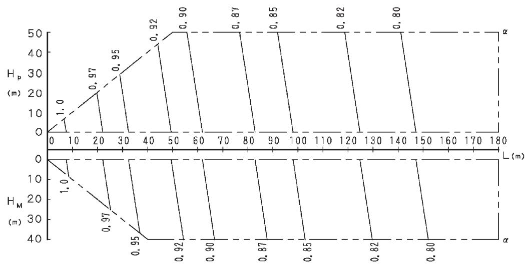
Model	liquid
REYQ8M	ø 9.5
REYQ22M	ø 15.9

2 Capacity correction ratio

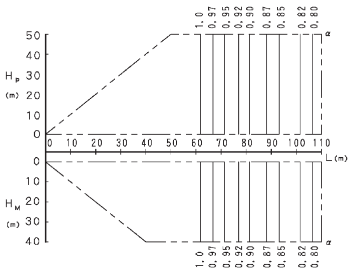
2-3 VRVII heat recovery

2-3-2 REYQ10M

- Rate of change in cooling capacity



- Rate of change in heating capacity



3D042142

NOTES

1 These figures illustrate the rate of change in capacity of a standard indoor unit system at maximum load (with the thermostat set to maximum) under standard conditions.
Moreover, under partial load conditions there is only a minor deviation from the rate of change in capacity shown in the above figures.

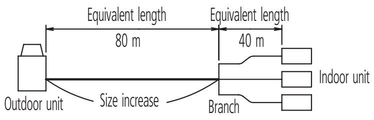
2 With this outdoor unit, evaporating pressure constant control when cooling, and condensing pressure constant control when heating is carried out.

3 Method of calculating cooling / heating capacity (max. capacity for combination with standard indoor unit)
cooling / heating capacity = cooling / heating capacity obtained from performance characteristics table x each capacity rate of change
When piping length differs depending on the indoor unit, maximum capacity of each unit during simultaneous operation is:
cooling / heating capacity = cooling / heating capacity of each unit x capacity rate of change for each piping length

4 When overall equivalent pipe length is 90m or more, the diameter of the main gas and liquid pipes (outdoor unit-branch sections) must be increased.
Diameter of above case

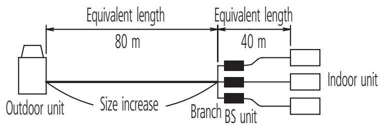
Model	liquid
REYQ10M	ø 12.7

5 When the main sections of the interunit gas pipe diameters are increased the overall equivalent length should be calculated as follows. (Heating only)
Overall equivalent length = Equivalent length to main pipe x 0.5 + Equivalent length after branching
Example



In the above case (Heating)
Overall equivalent length = 80m x 0.5 + 40m = 80m
The correction factor in capacity when H_p = 0m is thus approximately 0.91

6 In the combination which does not include cooling only indoor unit, calculate the equivalent length pipe by the following when you calculate cooling capacity.
Overall equivalent length = Equivalent length to main pipe x 0.5 + Equivalent length after branching
Example



In the above case (Cooling)
Overall equivalent length = 80m x 0.5 + 40m = 80m
The correction factor in capacity when H_p = 0m is thus approximately 0.88

EXPLANATION OF SYMBOLS

H_p : Level difference (m) between indoor and outdoor units with indoor unit in inferior position
H_M : Level difference (m) between indoor and outdoor units with indoor unit in superior position
L : Equivalent pipe length (m)
α : Capacity correction factor

Diameter of gas pipes

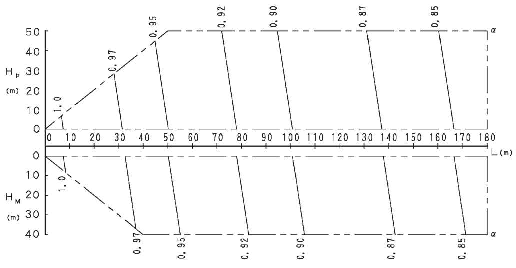
Model	liquid
REYQ10M	ø 9.5

2 Capacity correction ratio

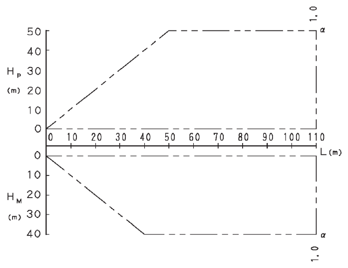
2-3 VRVII heat recovery

2-3-3 REYQ12,14,24,36M

- Rate of change in cooling capacity



- Rate of change in heating capacity



3D042143

NOTES

1 These figures illustrate the rate of change in capacity of a standard indoor unit system at maximum load (with the thermostat set to maximum) under standard conditions. Moreover, under partial load conditions there is only a minor deviation from the rate of change in capacity shown in the above figures.

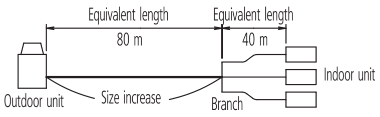
2 With this outdoor unit, evaporating pressure constant control when cooling, and condensing pressure constant control when heating is carried out.

3 Method of calculating cooling / heating capacity (max. capacity for combination with standard indoor unit)
cooling / heating capacity = cooling / heating capacity obtained from performance characteristics table x each capacity rate of change
When piping length differs depending on the indoor unit, maximum capacity of each unit during simultaneous operation is:
cooling / heating capacity = cooling / heating capacity of each unit x capacity rate of change for each piping length

4 When overall equivalent pipe length is 90m or more, the diameter of the main gas and liquid pipes (outdoor unit-branch sections) must be increased.
Diameter of above case

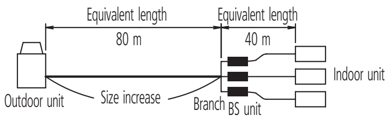
Model	liquid
REYQ12,14M	ø 15.9
REYQ24M	ø 19.1
REYQ36M	ø 22.2

5 When the main sections of the interunit gas pipe diameters are increased the overall equivalent length should be calculated as follows. (Heating only)
Overall equivalent length = Equivalent length to main pipe x 0.5 + Equivalent length after branching
Example



In the above case (Heating)
Overall equivalent length = 80m x 0.5 + 40m = 80m
The correction factor in capacity when H_p = 0m is thus approximately 1.0

6 In the combination which does not include cooling only indoor unit, calculate the equivalent length pipe by the following when you calculate cooling capacity.
Overall equivalent length = Equivalent length to main pipe x 0.5 + Equivalent length after branching
Example



In the above case (Cooling)
Overall equivalent length = 80m x 0.5 + 40m = 80m
The correction factor in capacity when H_p = 0m is thus approximately 0.92

EXPLANATION OF SYMBOLS

H_P : Level difference (m) between indoor and outdoor units with indoor unit in inferior position
H_M : Level difference (m) between indoor and outdoor units with indoor unit in superior position
L : Equivalent pipe length (m)
α : Capacity correction factor

Diameter of gas pipes

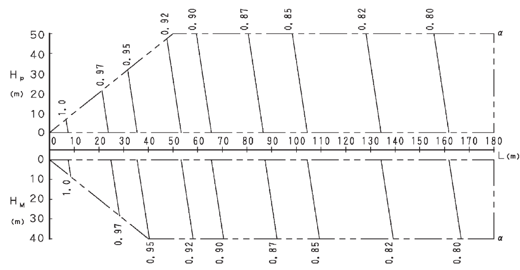
Model	liquid
REYQ12,14M	ø 12.7
REYQ24M	ø 15.9
REYQ36M	ø 19.1

2 Capacity correction ratio

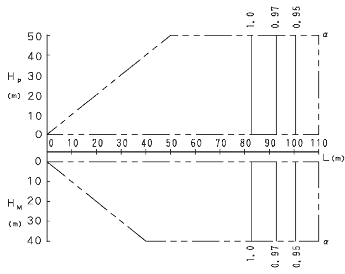
2-3 VRVII heat recovery

2-3-4 REYQ16M

- Rate of change in cooling capacity



- Rate of change in heating capacity



3D042144

NOTES

1 These figures illustrate the rate of change in capacity of a standard indoor unit system at maximum load (with the thermostat set to maximum) under standard conditions.
Moreover, under partial load conditions there is only a minor deviation from the rate of change in capacity shown in the above figures.

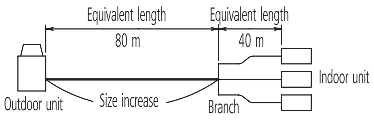
2 With this outdoor unit, evaporating pressure constant control when cooling, and condensing pressure constant control when heating is carried out.

3 Method of calculating cooling / heating capacity (max. capacity for combination with standard indoor unit)
cooling / heating capacity = cooling / heating capacity obtained from performance characteristics table x each capacity rate of change
When piping length differs depending on the indoor unit, maximum capacity of each unit during simultaneous operation is:
cooling / heating capacity = cooling / heating capacity of each unit x capacity rate of change for each piping length

4 When overall equivalent pipe length is 90m or more, the diameter of the main liquid pipes (outdoor unit-branch sections) must be increased.
Diameter of above case

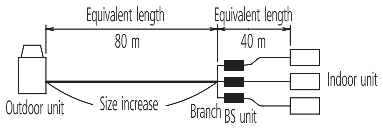
Model	liquid
REYQ16M	ø 15.9

5 When the main sections of the interunit gas pipe diameters are increased the overall equivalent length should be calculated as follows. (Heating only)
Overall equivalent length = Equivalent length to main pipe x 0.5 + Equivalent length after branching
Example



In the above case (Heating)
Overall equivalent length = 80m x 0.5 + 40m = 80m
The correction factor in capacity when H_p = 0m is thus approximately 1.0

6 In the combination which does not include cooling only indoor unit, calculate the equivalent length pipe by the following when you calculate cooling capacity.
Overall equivalent length = Equivalent length to main pipe x 0.5 + Equivalent length after branching
Example



In the above case (Cooling)
Overall equivalent length = 80m x 0.5 + 40m = 80m
The correction factor in capacity when H_p = 0m is thus approximately 0.88

EXPLANATION OF SYMBOLS

H_p : Level difference (m) between indoor and outdoor units with indoor unit in inferior position
H_M : Level difference (m) between indoor and outdoor units with indoor unit in superior position
L : Equivalent pipe length (m)
α : Capacity correction factor

Diameter of gas pipes

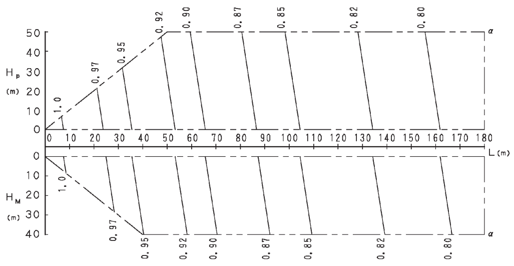
Model	liquid
REYQ16M	ø 12.7

2 Capacity correction ratio

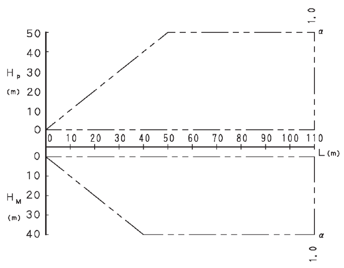
2-3 VRVII heat recovery

2-3-5 REYQ18,26,28,30,38,40,42,44M

- Rate of change in cooling capacity



- Rate of change in heating capacity



3D042145

NOTES

1 These figures illustrate the rate of change in capacity of a standard indoor unit system at maximum load (with the thermostat set to maximum) under standard conditions.
Moreover, under partial load conditions there is only a minor deviation from the rate of change in capacity shown in the above figures.

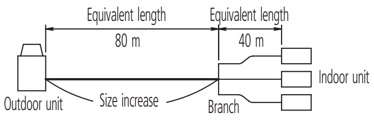
2 With this outdoor unit, evaporating pressure constant control when cooling, and condensing pressure constant control when heating is carried out.

3 Method of calculating cooling / heating capacity (max. capacity for combination with standard indoor unit)
cooling / heating capacity = cooling / heating capacity obtained from performance characteristics table x each capacity rate of change
When piping length differs depending on the indoor unit, maximum capacity of each unit during simultaneous operation is:
cooling / heating capacity = cooling / heating capacity of each unit x capacity rate of change for each piping length

4 When overall equivalent pipe length is 90m or more, the diameter of the main gas and liquid pipes (outdoor unit-branch sections) must be increased.
Diameter of above case

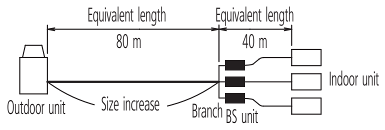
Model	liquid
REYQ18M	ø 19.1
REYQ26,28,30,38,40,42,44M	ø 22.2

5 When the main sections of the interunit gas pipe diameters are increased the overall equivalent length should be calculated as follows. (Heating only)
Overall equivalent length = Equivalent length to main pipe x 0.5 + Equivalent length after branching
Example



In the above case (Heating)
Overall equivalent length = 80m x 0.5 + 40m = 80m
The correction factor in capacity when H_p = 0m is thus approximately 1.0

6 In the combination which does not include cooling only indoor unit, calculate the equivalent length pipe by the following when you calculate cooling capacity.
Overall equivalent length = Equivalent length to main pipe x 0.5 + Equivalent length after branching
Example



In the above case (Cooling)
Overall equivalent length = 80m x 0.5 + 40m = 80m
The correction factor in capacity when H_p = 0m is thus approximately 0.88

EXPLANATION OF SYMBOLS

H_p : Level difference (m) between indoor and outdoor units with indoor unit in inferior position
H_M : Level difference (m) between indoor and outdoor units with indoor unit in superior position
L : Equivalent pipe length (m)
α : Capacity correction factor

Diameter of pipes

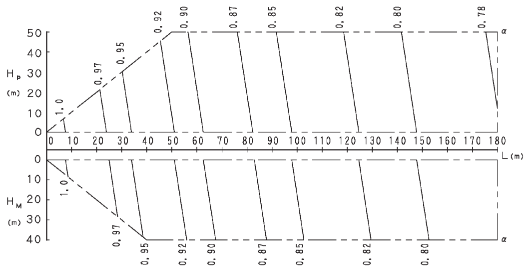
Model	liquid
REYQ18M	ø 15.9
REYQ26,28,30,38,40,42,44M	ø 19.1

2 Capacity correction ratio

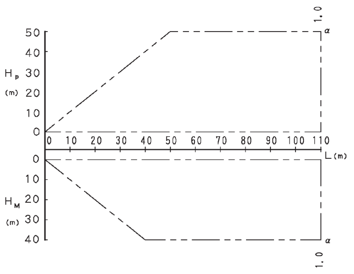
2-3 VRVII heat recovery

2-3-6 REYQ20,32,34,46M

- Rate of change in cooling capacity



- Rate of change in heating capacity



3D042146

NOTES

1 These figures illustrate the rate of change in capacity of a standard indoor unit system at maximum load (with the thermostat set to maximum) under standard conditions.
Moreover, under partial load conditions there is only a minor deviation from the rate of change in capacity shown in the above figures.

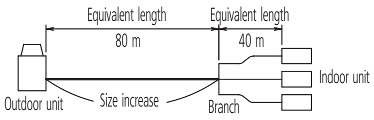
2 With this outdoor unit, evaporating pressure constant control when cooling, and condensing pressure constant control when heating is carried out.

3 Method of calculating cooling / heating capacity (max. capacity for combination with standard indoor unit)
cooling / heating capacity = cooling / heating capacity obtained from performance characteristics table x each capacity rate of change
When piping length differs depending on the indoor unit, maximum capacity of each unit during simultaneous operation is:
cooling / heating capacity = cooling / heating capacity of each unit x capacity rate of change for each piping length

4 When overall equivalent pipe length is 90m or more, the diameter of the main gas and liquid pipes (outdoor unit-branch sections) must be increased .
Diameter of above case

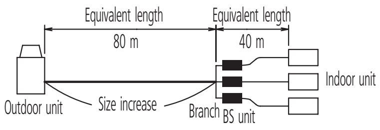
Model	liquid
REYQ20M	ø 19.1
REYQ32,34,46M	ø 22.2

5 When the main sections of the interunit gas pipe diameters are increased the overall equivalent length should be calculated as follows. (Heating only)
Overall equivalent length = Equivalent length to main pipe x 0.5 + Equivalent length after branching
Example



In the above case (Heating)
Overall equivalent length = 80m x 0.5 + 40m = 80m
The correction factor in capacity when H_p = 0m is thus approximately 1.0

6 In the combination which does not include cooling only indoor unit, calculate the equivalent length pipe by the following when you calculate cooling capacity.
Overall equivalent length = Equivalent length to main pipe x 0.5 + Equivalent length after branching
Example



In the above case (Cooling)
Overall equivalent length = 80m x 0.5 + 40m = 80m
The correction factor in capacity when H_p = 0m is thus approximately 0.87

EXPLANATION OF SYMBOLS

H_p : Level difference (m) between indoor and outdoor units with indoor unit in inferior position
H_M : Level difference (m) between indoor and outdoor units with indoor unit in superior position
L : Equivalent pipe length (m)
α : Capacity correction factor

Diameter of gas pipes

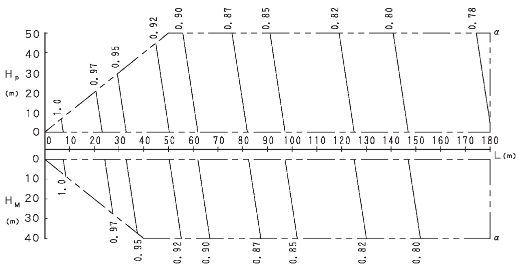
Model	liquid
REYQ20M	ø 15.9
REYQ32,34,46M	ø 19.1

2 Capacity correction ratio

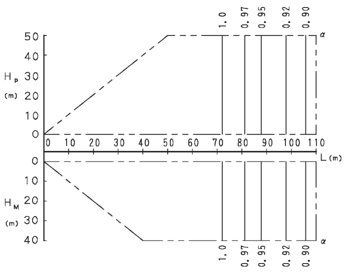
2-3 VRVII heat recovery

2-3-7 REYQ48M

- Rate of change in cooling capacity



- Rate of change in heating capacity



3D042147

NOTES

1 These figures illustrate the rate of change in capacity of a standard indoor unit system at maximum load (with the thermostat set to maximum) under standard conditions.
Moreover, under partial load conditions there is only a minor deviation from the rate of change in capacity shown in the above figures.

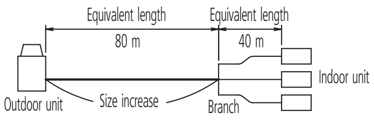
2 With this outdoor unit, evaporating pressure constant control when cooling, and condensing pressure constant control when heating is carried out.

3 Method of calculating cooling / heating capacity (max. capacity for combination with standard indoor unit)
cooling / heating capacity = cooling / heating capacity obtained from performance characteristics table x each capacity rate of change
When piping length differs depending on the indoor unit, maximum capacity of each unit during simultaneous operation is:
cooling / heating capacity = cooling / heating capacity of each unit x capacity rate of change for each piping length

4 When overall equivalent pipe length is 90m or more, the diameter of the main gas and liquid pipes (outdoor unit-branch sections) must be increased except for the gas pipe of RX(Y)Q46M.
Diameter of above case

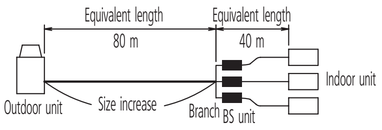
Model	liquid
REYQ48M	ø 22.2

5 When the main sections of the interunit gas pipe diameters are increased the overall equivalent length should be calculated as follows. (Heating only)
Overall equivalent length = Equivalent length to main pipe x 0.5 + Equivalent length after branching
Example



In the above case (Heating)
Overall equivalent length = 80m x 0.5 + 40m = 80m
The correction factor in capacity when H_p = 0m is thus approximately 0.97

6 In the combination which does not include cooling only indoor unit, calculate the equivalent length pipe by the following when you calculate cooling capacity.
Overall equivalent length = Equivalent length to main pipe x 0.5 + Equivalent length after branching
Example



In the above case (Cooling)
Overall equivalent length = 80m x 0.5 + 40m = 80m
The correction factor in capacity when H_p = 0m is thus approximately 0.87

EXPLANATION OF SYMBOLS

H_p : Level difference (m) between indoor and outdoor units with indoor unit in inferior position
H_M : Level difference (m) between indoor and outdoor units with indoor unit in superior position
L : Equivalent pipe length (m)
α : Capacity correction factor
Diameter of gas pipes

Model	liquid
REYQ48M	ø 19.1

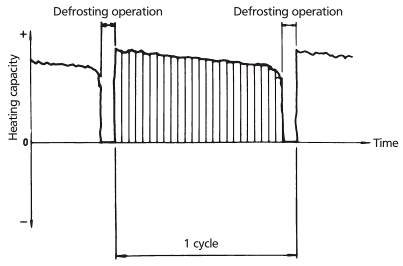
3 Integrated heating capacity coefficient

1 The tables do not take account of the reduction in capacity when frost has accumulated or while the defrosting operation is in progress.
The capacity values which take these factors into account, in other words the integrated heating capacity values, can be calculated as follows:

Formula: Integrated heating capacity = A
Value given in table of capacity characteristics = B
Integrating correction factor for frost accumulation (kW) = C
A = B x C

2 Correction factor for finding integrated heating capacity

Inlet port temperature of heat exchanger (°C/RH 85%)	-7	-5	-3	0	3	5	7
Integrating correction factor for frost accumulation	0.96	0.93	0.87	0.81	0.83	0.89	1.0



NOTE

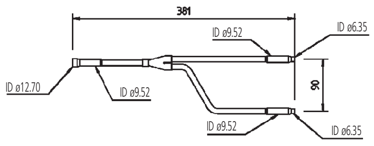
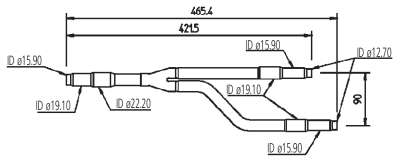
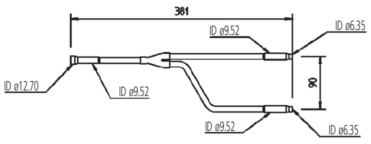
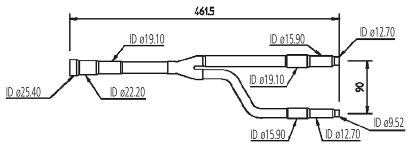
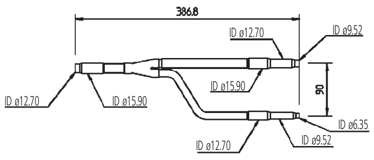
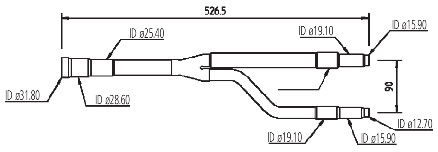
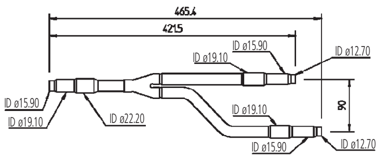
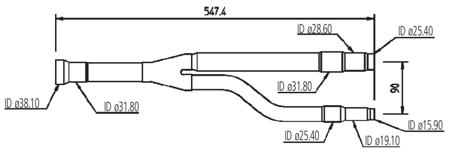
- The figure shows that the integrated heating capacity expresses the integrated heating capacity for a single cycle (from defrost operation to defrost operation) in terms of time.

3 Please note that when there is an accumulation of snow against the outside surface of the outdoor unit heat exchanger, there will always be a temporary reduction in capacity although this will, of course, vary in degree in accordance with a number of other factors such as the outdoor temperature (°CDB), relative humidity (RH) and the amount of frosting which occurs.

4 Refnet pipe system

4-1 Refnet joints

4-1-1 VRVII heat pump

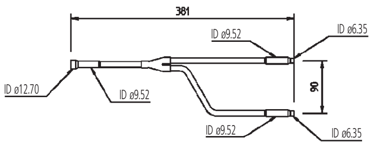
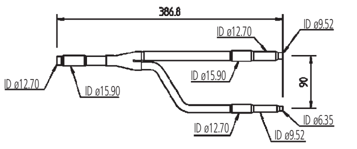
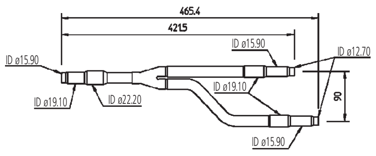
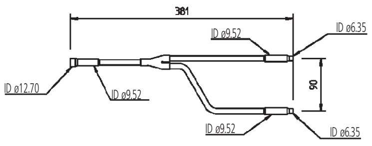
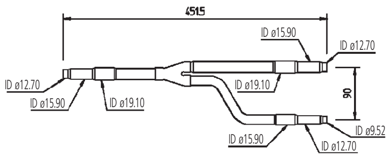
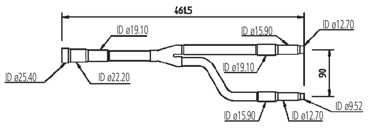
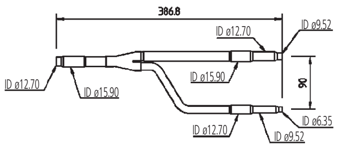
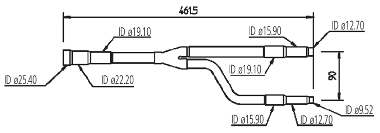
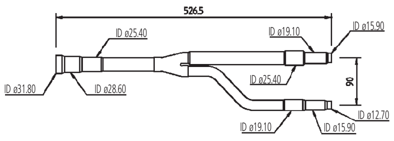
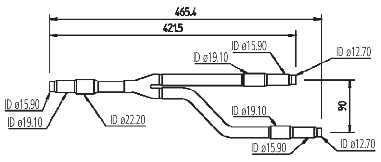
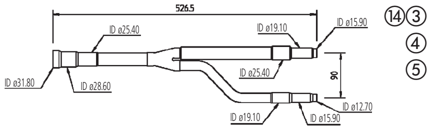
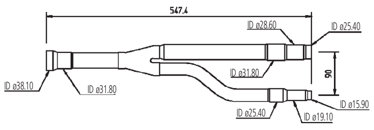
	Liquid side junction	Suction gas side junction
KHRQ22M20TA7	 ⑦	 2 x ⑧ ⑩
KHRQ22M29T7	 ⑯	 ③ 2 x ④
KHRQ22M64T7	 2 x ⑬	 ③ ④ ② ⑤
KHRQ22M75T7	 ⑨	 ⑤ ② ⑥ ⑩ 2 x ⑭

1TW25799-1D

4 Refnet pipe system

4-1 Refnet joints

4-1-2 VRVII heat recovery

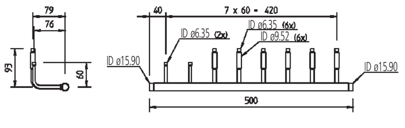
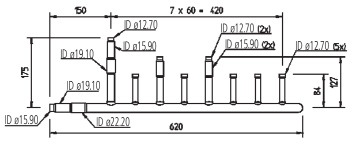
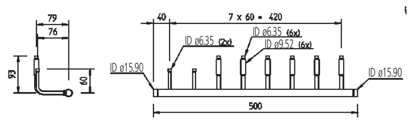
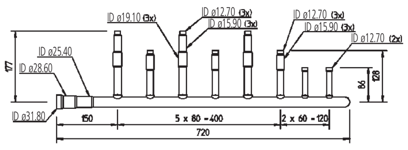
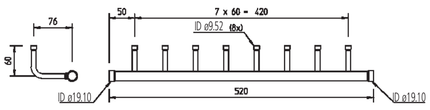
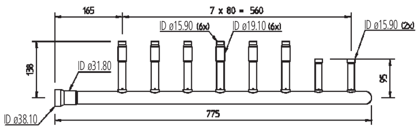
	Liquid side junction	Discharge gas side junction	Suction gas side junction
KHRQ23M20T7			 ⑩ ⑧
KHRQ23M29T7	 ⑯		 ③ 2 x ④
KHRQ23M64T7	 2 x ⑬	 ③ 2 x ④ ⑬	 ⑤ ②
KHRQ23M75T7	 ⑨	 ⑧② ⑭③ ④ ⑤	 ⑤② ⑥ ⑩ 2 x ⑭

1TW25799-1D

4 Refnet pipe system

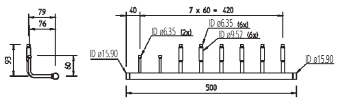
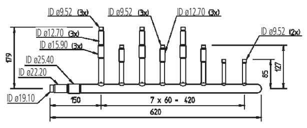
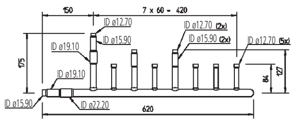
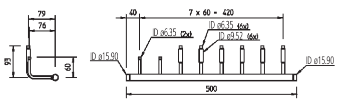
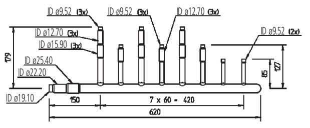
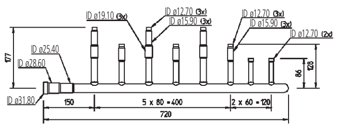
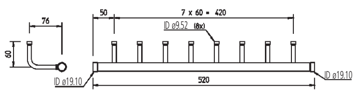
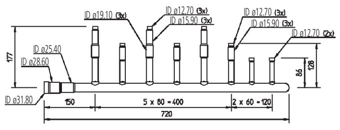
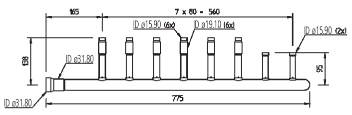
4-2 Refnet headers

4-2-1 VRVII heat pump

	Liquid side header	Suction gas side header
KHRQ22M29H7	 ① 6 x Ⓐ Ⓓ	 6 x Ⓒ ⑰ ⑱
KHRQ22M64H7	 ①Ⓓ 6 x Ⓐ 2 x ⑲ ⑬	 6 x Ⓒ 2 x ⑱
KHRQ22M75H7	 ① 6 x Ⓐ Ⓓ	 ⑭ 6 x Ⓓ 4 x ⑩

1TW25799-1D

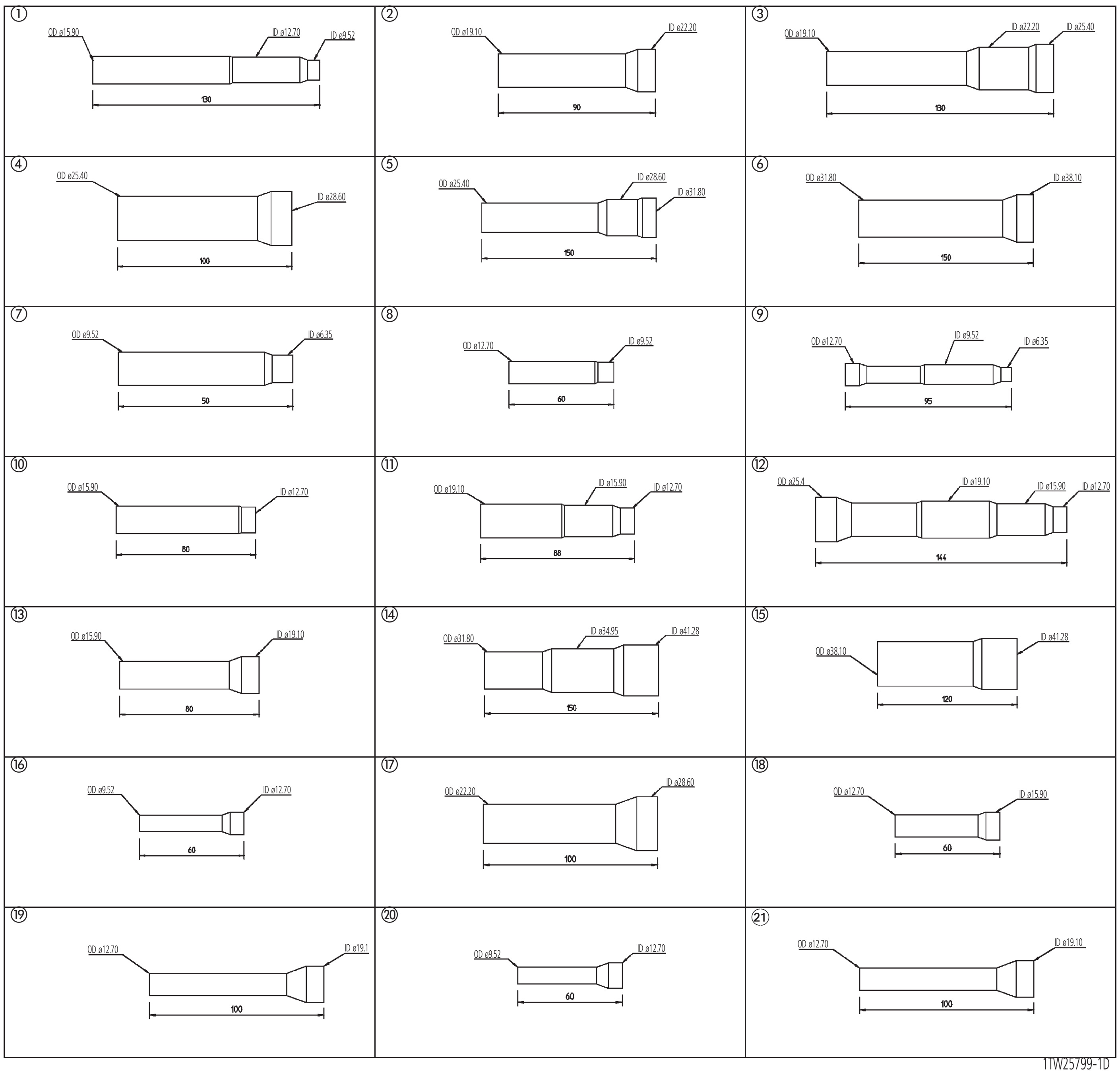
4-2-2 VRVII heat recovery

	Liquid side header	Discharge gas side header	Suction gas side header
KHRQ23M29H7	 ① 6 x Ⓐ Ⓓ	 ⑪ 6 x Ⓑ ⑬	 6 x Ⓒ ⑰ ⑱
KHRQ23M64H7	 ①Ⓓ 6 x Ⓐ 2 x ⑲ ⑬	 ④ 6 x Ⓑ 3 x ⑬ 2 x ⑳	 6 x Ⓒ 2 x ⑱
KHRQ23M75H7	 ②⑨ ⑪Ⓔ 6 x Ⓑ 4 x ⑦	 5 x ⑧ 6 x Ⓒ 6 x ⑬ ㉑	 5 x ⑩ ⑫ ⑭ 6 x Ⓓ

1TW25799-1D

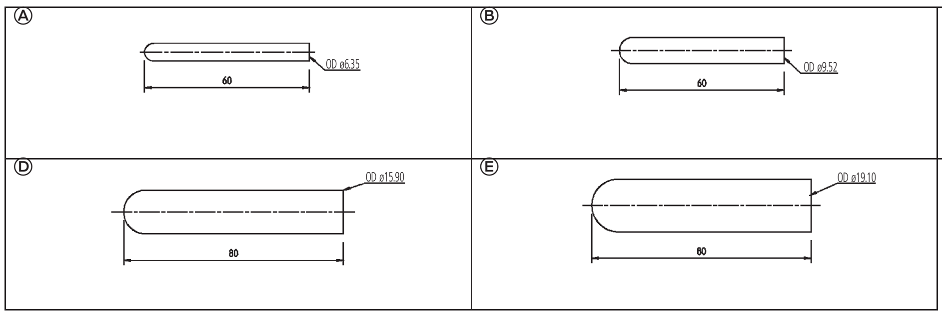
4 Refnet pipe system

4-3 Reducers, Expanders



1TW25799-1D

4-4 Closed pipes



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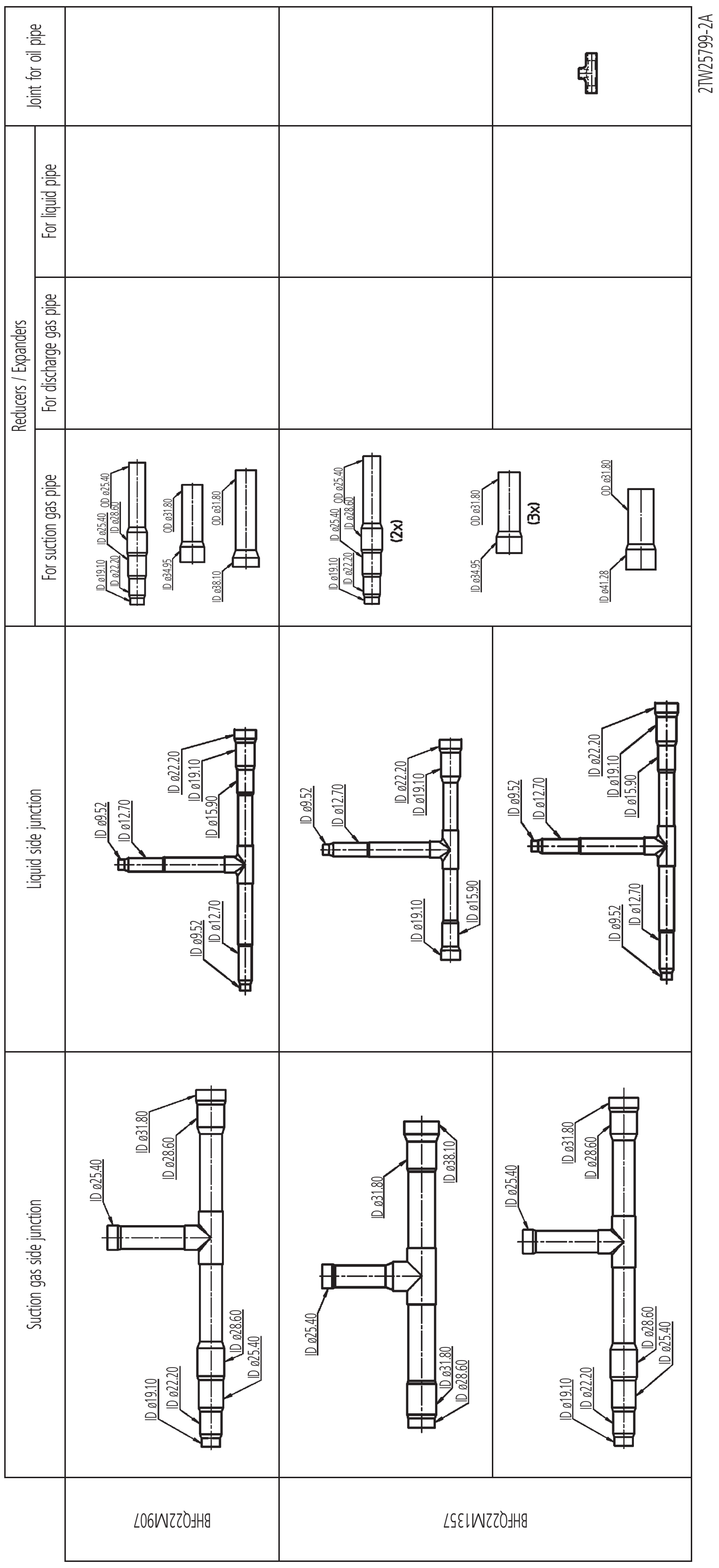
4 Refnet pipe system

4-5 Outdoor unit multi piping connection kit

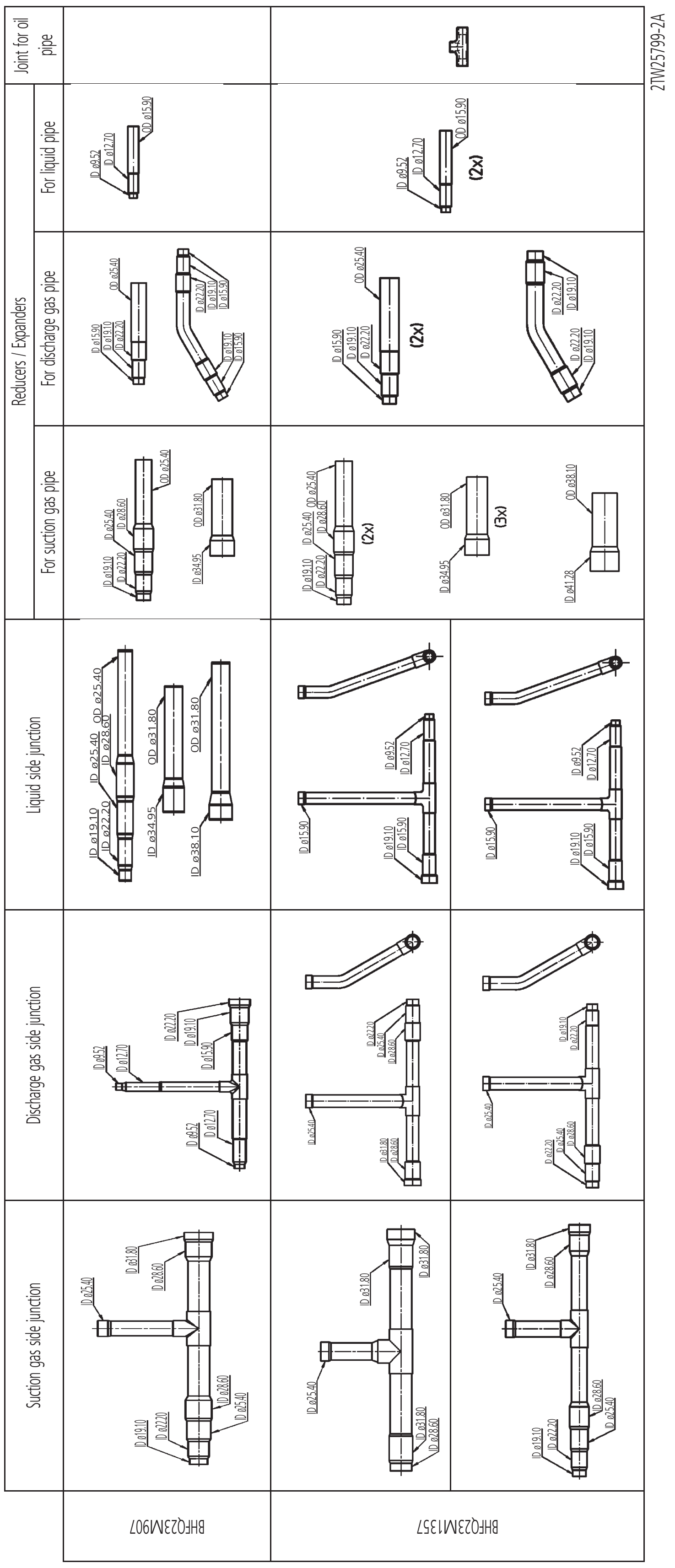
4-5-1 VRVII heat pump



4 Refnet pipe system

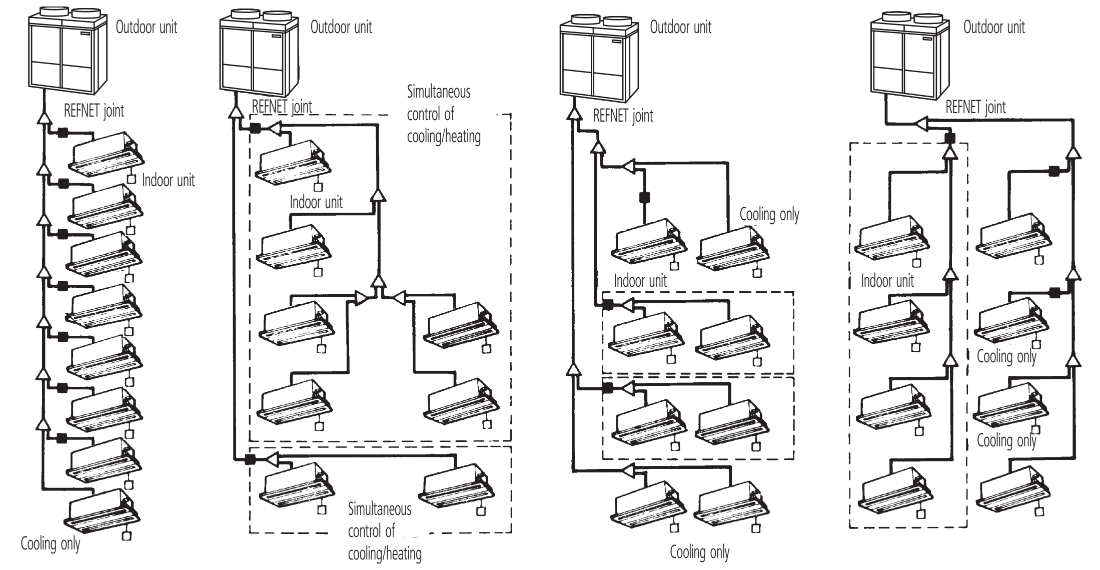
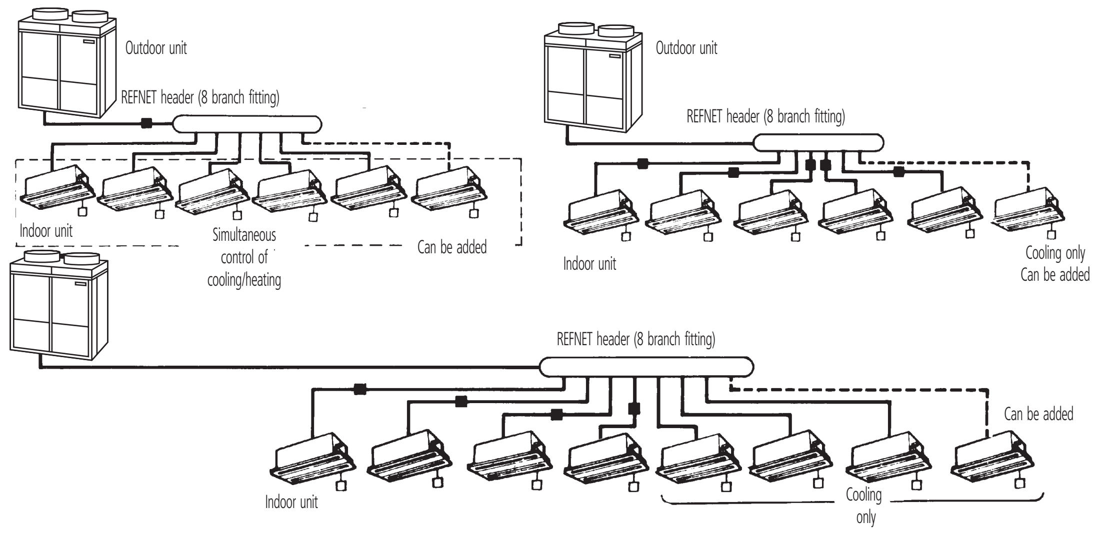
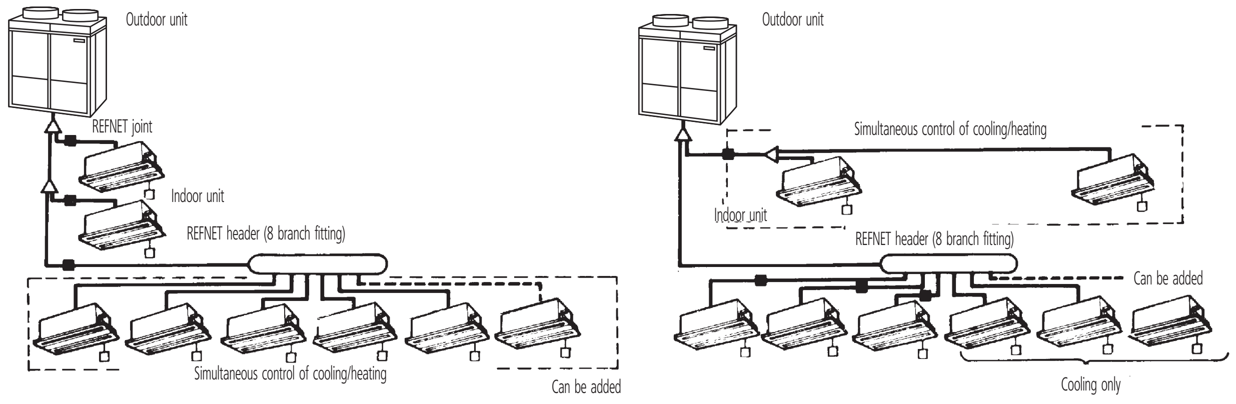
4-5 Outdoor unit multi piping connection kit

4-5-2 VRVII heat recovery



4 Refnet pipe system

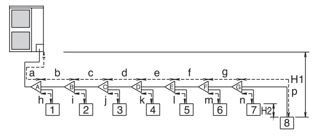
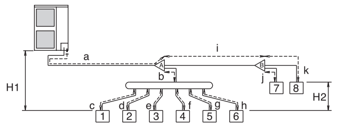
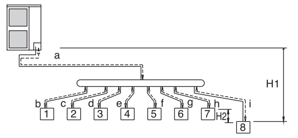
4-6 Example of Refnet piping layouts

Type of fitting	Sample systems
Distribution by REFNET joints	
Distribution by REFNET header	
Distribution by REFNET joints and headers	

5 REFNET pipe selection

5-1 VRVII-S

RXYSQ-M7V3B

			Branch with refnet joint	Branch with refnet joint and refnet header	Branch with refnet header
Example of connection (Connection of 8 indoor units Heat pump system) 1 indoor unit ◁A refnet joint ⬭ refnet header					
Maximum allowable length	Between outdoor and indoor units	Actual pipe length	Pipe length between outdoor and indoor units ≤ 150m		
			[Example] unit 8: a+b+c+d+e+f+g+p ≤ 150m	[Example] unit 6: a+b+h 150m, unit 8: a+i+k ≤ 150m	[Example] unit 8: a+i ≤ 150m
		Equivalent length	Equivalent pipe length between outdoor and indoor units ≤ 175m (Assume equivalent pipe length of refnet joint to be 0.5m and ot the refent header to be 1.0m. (for calculation purposes))		
		Total extension length	Total piping length from outdoor unit to all indoor units between 10m and 300m		
Allowable height	Between outdoor and indoor units	Difference in height	Difference in height between outdoor and indoor units (H1) ≤ 50m (≤ 40m if outdoor unit is located in a lower position).		
	Between indoor and indoor units	Difference in height	Difference in height between adjacent indoor units (H2) ≤ 15m		
Allowable length after the branch		Actual pipe length	Pipe length from first refrigerant branch kit (either refnet joint or refnet header) ot indoor unit ≤ 40m		
			[Example] unit 8: a+b+c+d+e+f+g+p ≤ 40m	[Example] unit 6: a+b+h 40m, unit 8: i+k ≤ 40m	[Example] unit 8: i ≤ 40m

Refrigerant branch kit selection

Refrigerant branch kits can only be used with R-410A.

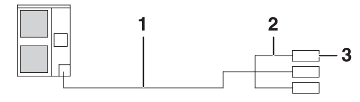
Use the following refnet joint

Outdoor unit capacity type	Refrigerant branch kit name
RXYSQ4~6	KHRQ22M20T

Use the following refnet header

Outdoor unit capacity type	Refrigerant branch kit name
RXYSQ4~6	KHRQ22M29H

Pipe size selection
Caution on selecting connection pipes
If the overall equivalent piping lenth is ≥ 90m, be sure to enlarge the pipe diameter of the gas-side main piping. If the recommended pipe size is not available, stick to the original pipe diameter (which may result in a small capacity decrease).
[Gas side]
RXYSQ4+5: Ø15.9 Ø19.1 ⚠
RXYSQ6: Ø19.1 Ø22.2 ⚠



1 Main pipe (enlarge)
2 First refrigerant branch kit
3 Indoor unit

A. Piping between outdoor unit and refrigerant branch kit
- Match to the size of the connection piping on the outdoor unit.

Outdoor unit connection piping size

Outdoor unit capacity type	Piping size (outer diameter x minimum thickness)	
	Gas pipe	Liquid pipe
RXYSQ4~6	Ø15.9x1.0	Ø9.5x0.8
	Ø19.1x1.0	
	Ø22.2x1.0	

B. Piping between refrigerant branch kits
- Use the pipe size from the following table.

Piping size (outer diameter x minimum thickness	
Gas pipe	Liquid pipe
Ø15.9x1.0	Ø9.5x0.8

C. Piping between refrigerant branch kit and indoor unit
- Pipe size for direct connection to indoor unit must be the same as the connection size of indoor unit.

Indoor capacity index	Piping size (outer diameter x minimum thickness)	
	Gas pipe	Liquid pipe
20+25+32+40+50	Ø12.7x0.8	Ø6.4x0.8
63+80+100+125	Ø15.9x1.0	Ø9.5x0.8

How to calculate the additional regrigerant to be charged
Additional refrigerant to be charged R (kg)
R should be rounded off in units of 0.1 kg

$$R=\left(\begin{array}{c}\text{Total length (m) of liquid}\\ \text{piping size at Ø9.5}\end{array}\right)\text{x0.054+}\left(\begin{array}{c}\text{Total length (m) of liquid}\\ \text{piping size at Ø6.4}\end{array}\right)\text{x0.022}$$

Example for refrigerant branch using refnet joint and refnet header

a: Ø9.5x30 m	d: Ø9.5x13 m	g: Ø6.4x10 m	j: Ø6.4x10 m
b: Ø9.5x10 m	e: Ø6.4x10 m	h: Ø6.4x20 m	k: Ø6.4x9 m
c: Ø9.5x10 m	f: Ø6.4x10 m	i: Ø9.5x10 m	

R=[73 x 0.054] + [69 x 0.022] = 5.46 ⇒ 5.5 kg

5 REFNET pipe selection

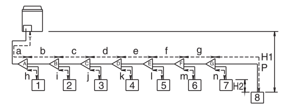
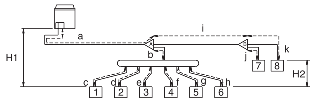
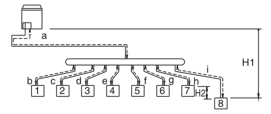
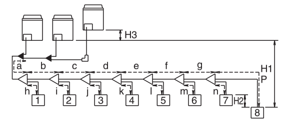
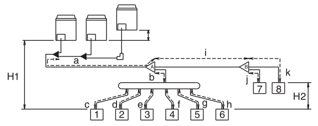
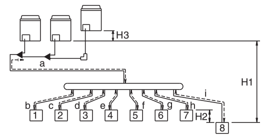
5-2 VRVII cooling only/heat pump

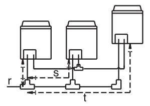
Example of connection
(Connection of 8 indoor units Heat pump system)

⚠
- Use the outdoor unit multi connection piping kit that is sold separately as an option (BHFQ22M909+1359) for the multi installation of outdoor units. Selection method is as shown in the right table.
- Never use the outdoor unit multi connection piping kit (BHFQ22M909+1359) that are sold separately as an option of M-type or T-joint.

1 indoor unit
◁ refnet joint
▭ refnet header
◄ outdoor multi connection piping kit

Install the joint part (◄ part in the figure) of the outdoor unit multi connection piping kit horizontally with attention to the installation restrictions described in “connecting the refrigerant piping”.
(*) If the system capacity is RXYQ18 or more, re-read to the first outdoor branch as seen from the indoor unit.

	Branch with refnet joint	Branch with refnet joint and refnet header	Branch with refnet header
One outdoor unit installed (RX(Y)Q5~16)			
When multiple outdoor units installed (RXYQ18~...)			

			Branch with refnet joint	Branch with refnet joint and refnet header	Branch with refnet header
Maximum allowable length	Between outdoor and indoor units	Actual pipe length	Pipe length between outdoor(*) and indoor units ≤150 m		
			[Example] unit 8: a+b+c+d+e+f+g+p≤150 m	[Example] unit 6: a+b+h≤150 m, unit 8: a+i+k≤150 m	[Example] unit 8: a+i≤150 m
		Equivalent length	Equivalent pipe length between outdoor(*) and indoor units ≤175 m (Assume equivalent pipe length of refnet joint to be 0.5 m and of the refnet header to be 1.0 m. (for calculation purposes))		
		Total extension length	Total piping length from outdoor unit* to all indoor units ≤300 m		
	Between outdoor branch and outdoor unit (Only for RXYQ18 or more)	Actual pipe length	Piping length from outdoor branch to outdoor unit ≤10 m. Approximate length: max. 13 m		
Allowable height	Between outdoor and indoor units	Difference in height	Difference in height between outdoor and indoor units (H1)≤50 m (≤40 m if outdoor unit is located in a lower position).		 r≤10 m (Approximate length: max. 13 m) s≤10 m (Approximate length: max: 13 m) t≤10 m (Approximate length: max 13 m)
	Between indoor and indoor units	Difference in height	Difference in height between adjacent indoor units (H2)≤15 m		
	Between outdoor and outdoor units	Difference in height	Difference in height between outdoor unit (main) and outdoor unit (sub) (H3)≤5 m		
Allowable length after the branch		Actual pipe length	Pipe length from first refrigerant branch kit (either refnet joint or refnet header) to indoor unit ≤40 m		
			[Example] unit 8: b+c+d+e+f+g+p≤40 m	[Example] unit 6: b+h≤40 m, unit 8: i+k≤40 m	[Example] unit 8: i≤40 m

Refrigerant branch kit selection

Refrigerant branch kits can only be used with R-410A.

How to select the refnet joint
- When using refnet joints at the first branch counted from the outdoor unit side. Choose from the following table in accordance with the capacity of the outdoor unit.

Outdoor unit capacity type	Refrigerant branch kit name
RXYQ5	KHRQ22M20T7
RXYQ8+10	KHRQ22M29T7
RXYQ12~22	KHRQ22M64T7
RXYQ24	KHRQ22M75T7

- For refnet joints other than the first branch, select the proper branch kit model based on the total capacity index.

Indoor capacity type	Refrigerant branch kit name
<200	KHRQ22M20T7
200≤x<290	KHRQ22M29T7
290≤x<640	KHRQ22M64T7
>640	KHRQ22M75T7

How to select the refnet header
- Choose from the following table in accordance with the total capacity of all the indoor units connected below the refnet header.
- Note: 250 type cannot be connected below the refnet header.

Indoor capacity type	Refrigerant branch kit name
<290	KHRQ22M29H7 (Max. 8 kit)
290≤x<640	KHRQ22M64H7 (Max. 8 kit)
>640	KHRQ22M75H7 (Max. 8 kit)

How to choose an outdoor branch kit (needed if the outdoor unit capacity type is RXYQ18 or more.)
- Choose from the following table in accordance with the number of outdoor units.

Number of outdoor units	Branch kit name
2	BHFQ22M909 (Max. 4 kit)
3	BHFQ22M1359 (Max. 8 kit)

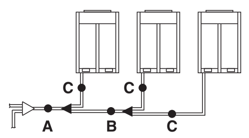
	Branch with refnet joint	Branch with refnet joint and refnet header	Branch with refnet header
Example of downstream indoor units	[Example] in case of refnet joint C; indoor units 3+4+5+6+7+8	[Example] in case of refnet joint B; indoor units 7+8, in case of refnet header; indoor units 1+2+3+4+5+6	[Example] in case of refnet header; indoor units 1+2+3+4+5+6+7+8

5 REFNET pipe selection

5-2 VRVII cooling only/heat pump

Pipe size selection

For an outdoor unit multi installation (RXYQ18~48M9W1B), make the settings in accordance with the following figure.



A. Piping between outdoor unit and refrigerant branch kit

- Match to the size of the connection piping on the outdoor unit.

Outdoor unit connection piping size

Outdoor unit capacity type	Piping size (outer diameter) Gas pipe	Liquid pipe
RXYQ5	Ø15.9	Ø9.5
RXYQ8	Ø19.1	
RXYQ10	Ø22.2	
RXYQ12~16	Ø28.6	Ø12.7
RXYQ18~22		Ø15.9
RXYQ24	Ø34.9	
RXYQ26~34		Ø19.1
RXYQ36~48	Ø41.3	

Piping between refrigerant branch kits

- Choose from the following table in accordance with the total capacity of all the indoor units connected below this.
- Do not let the connection piping exceed the refrigerant piping size chosen by general system model name.

Indoor capacity index	Piping size (outer diameter) Gas pipe	Liquid pipe
<200	Ø15.9	Ø9.5
200≤x<290	Ø22.2	
290≤x<420	Ø28.6	Ø12.7
420≤x<640		Ø15.9
640≤x<920	Ø34.9	Ø19.1
>920	Ø41.3	

B. Piping between outdoor branches

- Choose from the following table in accordance with the total capacity of all the oudoor units connected above this.

Outdoor capacity index	Piping size (outer diameter) Gas pipe	Liquid pipe
<22 HP	Ø28.6	Ø15.9
24 HP	Ø34.9	
>26 HP		Ø19.1

Piping between refrigerant branch kit and indoor unit

- Pipe size for direct connection to indoor unit must be the same as the connection size of indoor unit.

Indoor capacity type	Piping size (outer diameter) Gas pipe	
20~50	Ø12.7	Ø6.4
63~125	Ø15.9	Ø9.5
200	Ø19.1	
250	Ø22.2	

C. Piping between outdoor branch and outdoor unit

Outdoor capacity type	Piping size (outer diameter) Gas pipe	
RX(Y)Q8	Ø19.1	Ø9.5
RX(Y)Q10	Ø22.2	
RXYQ12~16	Ø28.6	Ø12.7

How to calculate the additional refrigerant to be charged

Additional refrigerant to be charged R (kg)
R should be rounded off in units of 0.1 kg

NOTE If a negative result is gotten for R from the formula at right, no refrigerant needs to be added nor removed.

$$R= \left(\begin{array}{c} \text{Total length (m) of liquid} \\ \text{piping size at Ø22.2} \end{array} \right) \text{x0.35+} \left(\begin{array}{c} \text{Total length (m) of liquid} \\ \text{piping size at Ø19.1} \end{array} \right) \text{x0.25+} \left(\begin{array}{c} \text{Total length (m) of liquid} \\ \text{piping size at Ø15.9} \end{array} \right) \text{x0.17+} \left(\begin{array}{c} \text{Total length (m) of liquid} \\ \text{piping size at Ø12.7} \end{array} \right) \text{x0.11}$$

$$+ \left(\begin{array}{c} \text{Total length (m) of liquid} \\ \text{piping size at Ø9.5} \end{array} \right) \text{x0.054+} \left(\begin{array}{c} \text{Total length (m) of liquid} \\ \text{piping size at Ø6.4} \end{array} \right) \text{x0.022+}$$

Model	Amount of refrigerant
RXYQ8~32	1 kg
RXYQ5, 34~48	0 kg

Example for refrigerant branch using refnet joint and refnet header for RXYQ34M9W1B

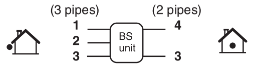
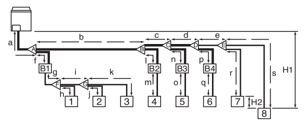
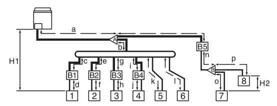
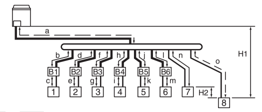
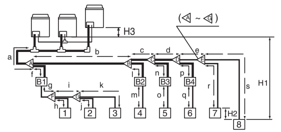
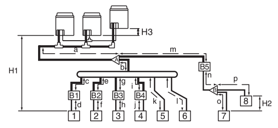
If the outdoor unit is RXYQ34M9W1B and the piping lengths are as below

a: Ø19.1x30 m	d: Ø9.5x10 m	g: Ø6.4x10 m	j: Ø6.4x10 m
b: Ø15.9x10 m	e: Ø9.5x10 m	h: Ø6.4x20 m	k: Ø6.4x9 m
c: Ø9.5x10 m	f: Ø9.5x10 m	i: Ø12.7x10 m	

R = [30x0.25]+[10x0.17]+[10x0.11]+[40x0.054]+[49x0.022]+0 = 13.538 ≤R = 13.5 kg

5 REFNET pipe selection

5-3 VRVII heat recovery

<table>
<tr>
<td colspan="2" rowspan="2">1 indoor unit
B1 BS box
◁A refnet joint
⬭ refnet header

1 Discharge gas side
2 Suction gas side
3 Liquid pipe
4 Gas pipe
Piping from BS unit to indoor unit and piping from refrigerant branch kit to indoor unit used as cooling only must be composed by 2 pipes (suction gas pipe and liquid pipe).
* If the system capacity is REYQ18 or more, measure to the first outdoor branch as seen from the indoor unit.</td>
<td>One outdoor unit installed (REYQ8~16)</td>
<th>Branch with refnet joint</th>
<th>Branch with refnet joint and refnet header</th>
<th>Branch with refnet header</th>
</tr>
<tr>
<td></td>
<td>
1 ~ 6 Cool/heat selection possible
7 + 8 Cooling only</td>
<td>
1 ~ 4 , 7 + 8 Cool/heat selection possible
5 + 6 Cooling only</td>
<td>
1 ~ 6 Cool/heat selection possible
7 + 8 Cooling only</td>
</tr>
<tr>
<td colspan="2"></td>
<td>When multiple outdoor units installed (REYQ18~...)</td>
<td>
1 ~ 6 Cool/heat selection possible
7 + 8 Cooling only</td>
<td>
1 ~ 4 , 7 + 8 Cool/heat selection possible
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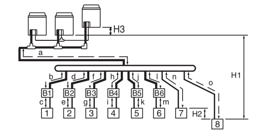
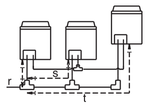
<td>
1 ~ 6 Cool/heat selection possible
7 + 8 Cooling only</td>
</tr>
<tr>
<td rowspan="5">Maximum allowable length</td>
<td rowspan="4">Between outdoor and indoor units</td>
<td rowspan="2">Actual pipe length</td>
<td colspan="3">Pipe length between outdoor and indoor units ≤150 m</td>
</tr>
<tr>
<td>[Example] unit 8: a+b+c+d+e+s≤150 m</td>
<td>[Example] unit 6: a+b+l ≤150 m, unit 8: a+m+n+p≤150 m</td>
<td>[Example] unit 8: a+o≤150 m</td>
</tr>
<tr>
<td>Equivalent length</td>
<td colspan="3">Equivalent pipe length between outdoor and indoor units ≤175 m (Assume equivalent pipe length of refnet joint to be 0.5 m and of the refnet header to be 1.0 m, that of BSVQ100 and BSVQ160 to be 4 m and that of BSVQ250 to be 6 m (for calculation purposes)).</td>
</tr>
<tr>
<td>Total extension length</td>
<td colspan="3">Total piping length from outdoor unit* to all indoor units ≤300 m</td>
</tr>
<tr>
<td>Between outdoor branch and outdoor unit (Only for REYQ18 or more)</td>
<td>Actual pipe length</td>
<td colspan="3">Piping length from outdoor branch to outdoor unit ≤10 m. Approximately length: max. 13 m</td>
</tr>
<tr>
<td rowspan="3">Allowable height</td>
<td>Between outdoor and indoor units</td>
<td>Difference in height</td>
<td colspan="2">Difference in height between outdoor and indoor units (H1)≤50 m (≤40 m if outdoor unit is located in a lower position).</td>
<td rowspan="3">
r≤10 m (Approximately length: max. 13 m)
s≤10 m (Approximately length: max: 13 m)
t≤10 m (Approximately length: max 13 m)</td>
</tr>
<tr>
<td>Between indoor and indoor units</td>
<td>Difference in height</td>
<td colspan="2">Difference in height between adjacent indoor units (H2)≤15 m</td>
</tr>
<tr>
<td>Between outdoor and outdoor units</td>
<td>Difference in height</td>
<td colspan="2">Difference in height between outdoor unit (main) and outdoor unit (sub) (H3)≤5 m</td>
</tr>
<tr>
<td colspan="2" rowspan="2">Allowable length after the branch</td>
<td rowspan="2">Actual pipe length</td>
<td colspan="3">Pipe length from first refrigerant branch kit (either refnet joint or refnet header) to indoor unit ≤40 m</td>
</tr>
<tr>
<td>[Example] unit 8: b+c+d+e+s≤40 m</td>
<td>[Example] unit 6: b+l≤40 m, unit 8: m+n+p≤40 m</td>
<td>[Example] unit 8: o≤40 m</td>
</tr>
</table>

Refrigerant branch kit selection

Refrigerant branch kits can only be used with R-410A.

How to select the refnet joint

- When using refnet joints at the first branch counted from the outdoor unit side. Choose from the following table in accordance with the capacity of the outdoor unit.

Outdoor unit capacity type	Refrigerant branch kit name
REYQ8+10	KHRQ23M29T7
REYQ12~22	KHRQ23M64T7
REYQ24	KHRQ23M75T7

- For refnet joints other than the first branch, select the proper branch kit model based on the total capacity index.

Indoor capacity type	Refrigerant branch kit name	
<200	KHRQ23M20T7	KHRQ22M20T7
200≤x<290	KHRQ23M29T7	KHRQ22M29T7
290≤x<640	KHRQ23M64T7	KHRQ22M64T7
>640	KHRQ23M75T7	—

How to select the refnet header

- Choose from the following table in accordance with the total capacity of all the indoor units connected below the refnet header.
- Note: 250 type cannot be connected below the refnet header.

Indoor capacity type	Refrigerant branch kit name	
	In case of 3 pipes	In case of 2 pipes
<200	KHRQ23M29T7	KHRQ22M29H7
200≤x<290		
290≤x<640	KHRQ23M64H7	KHRQ22M64H7
>640	KHRQ23M75H7	—

How to choose an outdoor branch kit (needed if the outdoor unit capacity type is REYQ18 or more.)

- Choose from the following table in accordance with the number of outdoor units.

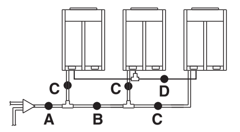
Number of outdoor units	Branch kit name
2	BHFQ23M907
3	BHFQ23M1357

Example of downstream indoor units	[Example] in case of refnet joint C; indoor units 5+6+7+8	[Example] in case of refnet joint B; indoor units 7+8, in case of refnet header; indoor units 1+2+3+4+5+6	[Example] in case of refnet header; indoor units 1+2+3+4+5+6+7+8

5 REFNET pipe selection

5-3 VRVII heat recovery

Pipe size selection
For an outdoor unit multi installation (REYQ18~48), make the settings in accordance with the following figure.



A. Piping between outdoor unit and refrigerant branch kit

- Match to the size of the connection piping on the outdoor unit.

Outdoor unit connection piping size

Outdoor unit capacity type	Piping size (outer diameter)		
	Liquid pipe	Gas pipe	
		Suction	Discharge
REYQ8	Ø9.5	Ø19.1	Ø15.9
REYQ10		Ø22.2	Ø19.1
REYQ12	Ø12.7	Ø28.6	
REYQ14+16			Ø22.2
REYQ18	Ø15.9		Ø28.6
REYQ20+22			
REYQ24		Ø34.9	
REYQ26~34	Ø19.1		
REYQ36		Ø41.3	
REYQ38~48			Ø34.9

Pipe size when overall equivalent pipe length is 90 m or more

- When overall equivalent pipe length is 90 m or more, the size of the main liquid pipe (outdoor unit branch sections) must be increased. (Only main liquid pipe!)

Main liquid pipe size

Outdoor capacity type	Piping size (outer diameter)	
	Normal size	Size up
REYQ8+10	Ø9.5	Ø12.7
REYQ12~16	Ø12.7	Ø15.9
REYQ18~24	Ø15.9	Ø19.1
REYQ26~48	Ø19.1	Ø22.2

B. Piping between outdoor branches

- Choose from the following table in accordance with the total capacity of all the outdoor units connected above this.

Outdoor capacity index	Piping size (outer diameter)		
	Liquid pipe	Gas pipe	
		Suction	Discharge
REYQ18	Ø15.9	Ø28.6	Ø22.2
REYQ20+22			Ø28.6
REYQ24		Ø34.9	
REYQ26	Ø19.1		

Between two immediately adjacent refrigerant branch kits and BS unit

- Choose from the following table in accordance with the total capacity of all the indoor units connected below this.
- Do not let the connection piping exceed the refrigerant piping size chosen by general system model name.

Indoor capacity index	Piping size (outer diameter)		
	Liquid pipe	Gas pipe	
		Suction	Discharge
<62.5(*)	Ø6.4	Ø12.7	Ø9.5
62.5≤x≤200	Ø9.5	Ø15.9	Ø12.7
200≤x<290		Ø22.2	Ø19.1
290≤x<420	Ø12.7	Ø28.6	
420≤x<640	Ø15.9		Ø28.6
640≤x<920	Ø19.1	Ø34.9	
Š920		Ø41.3	

(*) The BS unit (BSVQ100MV1) port and connection pipe are different sizes. Use the reducing joints included with the BS unit.

- When two pipes are connected between two adjacent refrigerant branch kits, select the proper gas pipe size based on data mentioned under "suction gas pipe" column in the table above.

C. Piping between outdoor branch and outdoor unit

Outdoor unit capacity type	Piping size (outer diameter)		
	Liquid pipe	Gas pipe	
		Suction	Discharge
REYQ8	Ø9.5	Ø19.1	Ø15.9
REYQ10		Ø22.2	Ø19.1
REYQ12	Ø12.7	Ø28.6	
REYQ14+16			Ø22.2

D. Oil-equalizing line (Only for REYQ18 or greater)

Piping size	Ø6.4

Between BS unit (refrigerant branch kit) and indoor unit

- Pipe size for direct connection to indoor unit must be the same as the connection size of indoor unit.

Indoor capacity index	Piping size (outer diameter)	
	Gas pipe	Liquid pipe
20, 25, 32,40, 50(*)	Ø12.7	Ø6.4
63, 80, 100, 125	Ø15.9	Ø9.5
200	Ø19.1	
250	Ø22.2	

(*) The BS unit (BSVQ100MV1) port and connection pipe are different sizes. Use the reducing joints included with the BS unit.

How to calculate the additional refrigerant to be charged
Additional refrigerant to be charged R (kg)
R should be rounded off in units of 0.1 kg

NOTE If a negative result is gotten for R from the formula at right, no refrigerant needs to be added nor removed.

$$R=\left\{\left(\begin{matrix}\text{Total length (m) of liquid}\\ \text{piping size at Ø22.2}\end{matrix}\right)\text{x}0.35+\left(\begin{matrix}\text{Total length (m) of liquid}\\ \text{piping size at Ø19.1}\end{matrix}\right)\text{x}0.25+\left(\begin{matrix}\text{Total length (m) of liquid}\\ \text{piping size at Ø15.9}\end{matrix}\right)\text{x}0.17+\left(\begin{matrix}\text{Total length (m) of}\\ \text{liquid}\\ \text{piping size at Ø12.7}\end{matrix}\right)\text{x}0.11\right.$$

$$\left.+\left(\begin{matrix}\text{Total length (m) of liquid}\\ \text{piping size at Ø9.5}\end{matrix}\right)\text{x}0.054+\left(\begin{matrix}\text{Total length (m) of liquid}\\ \text{piping size at Ø6.4}\end{matrix}\right)\text{x}0.022\right\}\text{x }1.15-$$

Model	Amount of refrigerant
REYQ8~16	0 kg
REYQ18~32	3 kg
REYQ34~48	6 kg

Example for refrigerant branch using refnet joint and refnet header for REYQ34
If the outdoor unit is REYQ34 and the piping lengths are as below

a: Ø19.1x30 m	d: Ø9.5x10 m	g: Ø6.4x10 m	j: Ø6.4x10 m
b: Ø15.9x10 m	e: Ø9.5x10 m	h: Ø6.4x20 m	k: Ø6.4x9 m
c: Ø9.5x10 m	f: Ø9.5x10 m	i: Ø12.7x10 m	

R = [30x0.25]+[10x0.17]+[10x0.11]+[40x0.054]+[49x0.022]x1.15–6 = 9.569 ⇒ R = 9.6 kg

5 REFNET pipe selection

5-4 Piping thickness

Piping diameter	Material	Minimum thickness [mm]
Ø 6.4	O	0.8
Ø 9.5	O	0.8
Ø 12.7	O	0.8
Ø 15.9	O	0.99
Ø 19.1	1/2H	0.8
Ø 22.2	1/2H	0.8
Ø 28.6	1/2H	0.99
Ø 34.9	1/2H	1.21
Ø 41.3	1/2H	1.43

:O : annealed

1/2H : half-hard

For half hard pipes the maximum allowed tensile stress is 61 N/mm^2. For this reason the 0.2% proof strength of the half hard pipe shall be minimum 61 N/mm^2.

The bending radius is more than or equal to 3 times the diameter of the pipe.

TABLE OF CONTENTS

VRV-WII heat pump and heat recovery

"Please note that this material is for reference only. In practice, construction methods may vary with projects and local legislation. Therefore, please consult your design office for design and construction of the system"

1 Introduction

The Daikin water cooled VRV (VRV-WII) combines all the well known benefits of VRV with those of water systems:

The VRV component of the system - condensing and indoor units, refrigerant piping and controls - delivers high efficiency combined with exceptional control flexibility. Heat is exhausted or absorbed via the condensing units to and from the 2-pipe water circuit as required, during cooling and heating cycles respectively.

On the water side of the system the heat source (water) is supplied to VRV condensing units throughout the building via the water circuit, which incorporates ancillary items such as - pumps, valves, strainer, expansion tank, heat transfer equipment, air vents and water treatment equipment etc.

The operating range of VRV-WII depends on the temperature of the water circuit, which should be maintained between 15°C and 45°C.

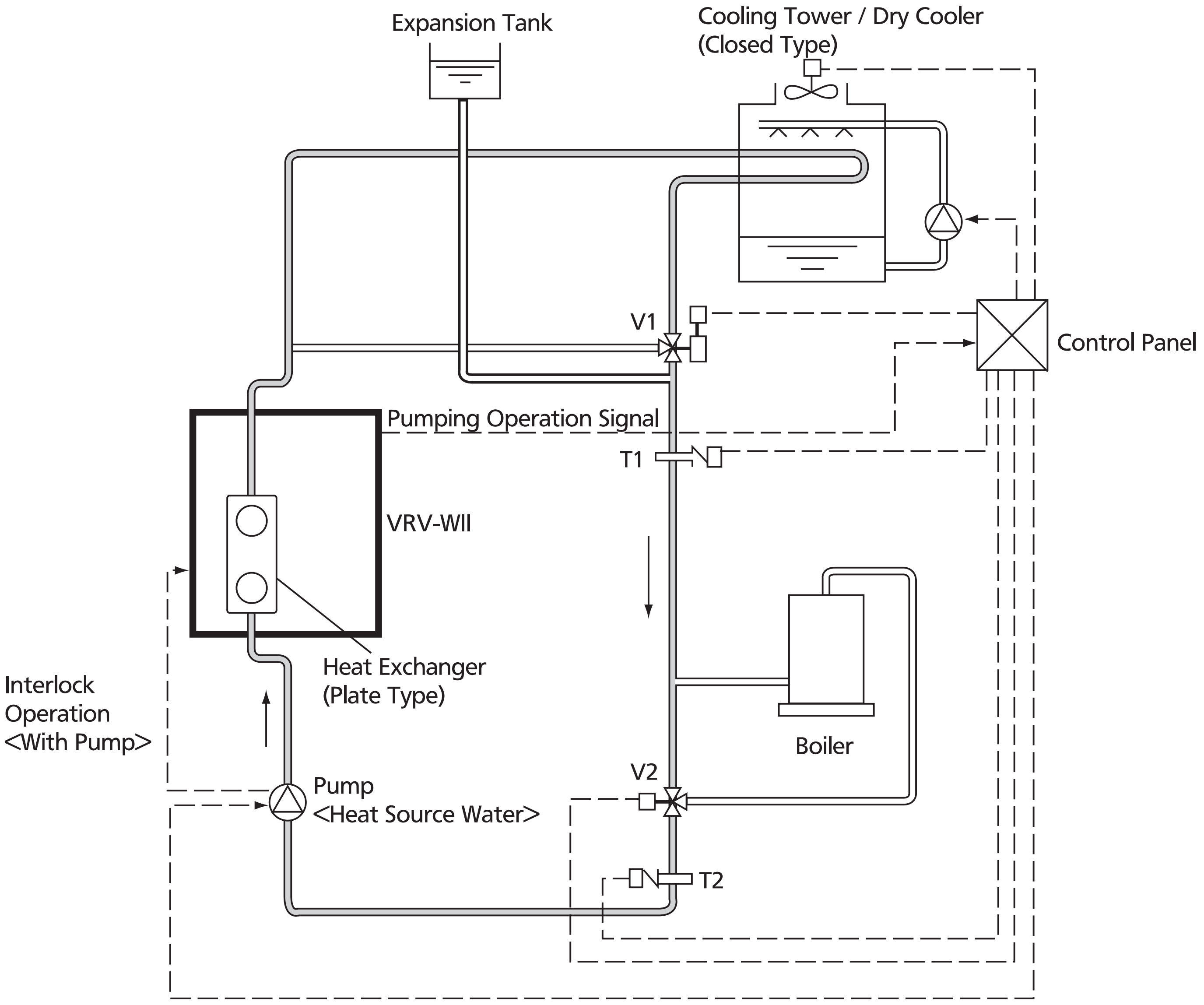
Application potential for VRV-WII:

- tall or wide multi storey buildings not subject to limitations on length of water piping
- applications in which the amount of refrigerant in the building is limited
- refurbishment projects in which it is possible to link VRV-WII into existing water piping and use the existing heat source
- sites where suitable alternative heat transfer sources such as district water, underground water, sea water, solar energy etc. exist
- sites where low external noise is critical. NB! Models of heat rejection equipment (cooling towers) are available for low noise applications.
- cold climate applications with no defrost cycle due to use of water circuit.

2 Basic configurations of VRV-WII

2 - 1 Basic configuration for cooling operation

In temperate climatic regions, excess heat within the water circuit can usually be exhausted via a dry cooler or cooling tower. However, alternative heat sinks can also be used, including natural water sources such as rivers, lakes and bore holes - existing process or chilled water circuits can also be utilized if fitted with heat transfer facilities.

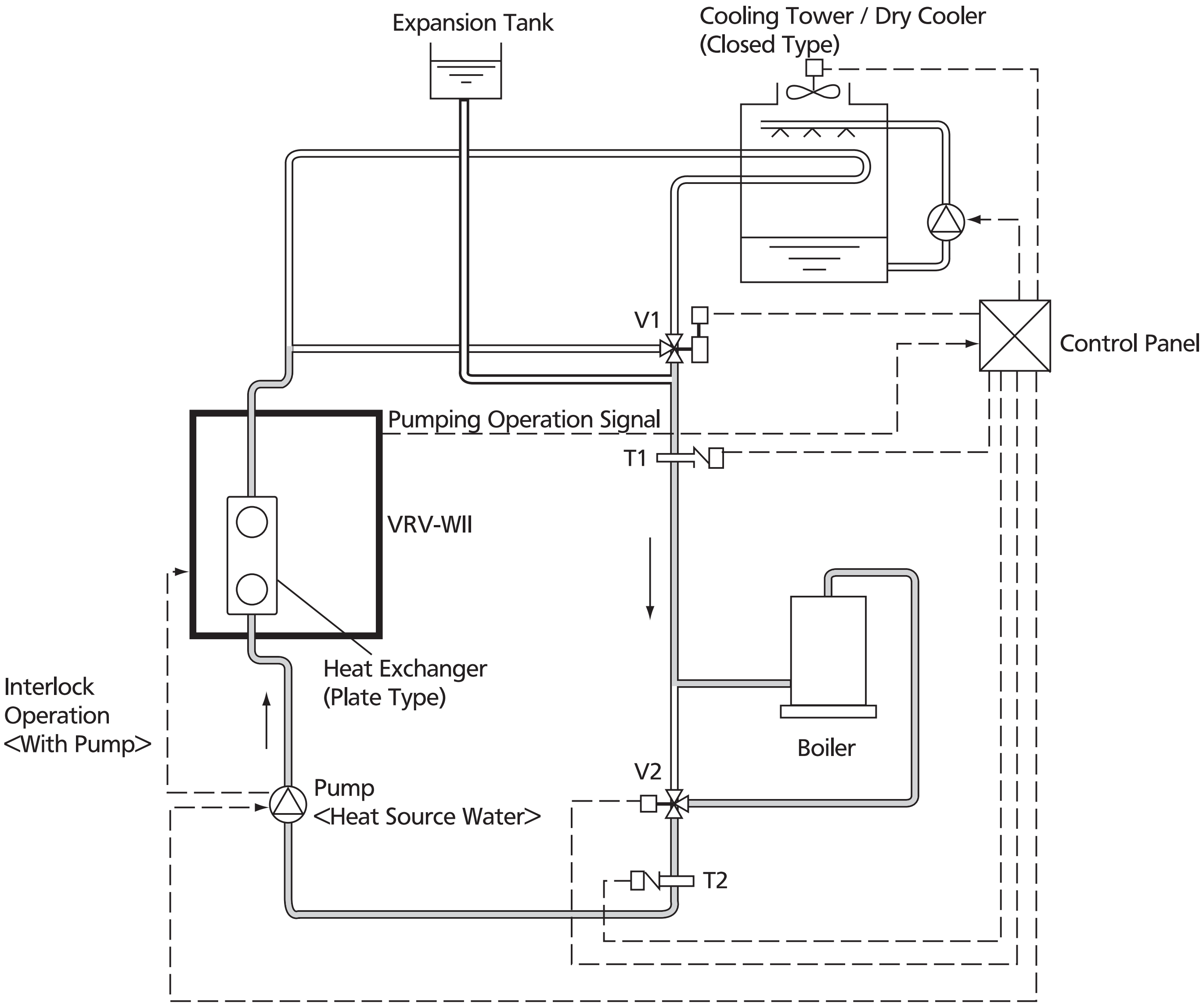


The diagram shows that during summer operating cycles, a drop in cooling water temperature below pre set temperature level T1 causes 3-way valve bypass V1 to open. This bypass closes once more when T1 is exceeded, reducing the temperature by allowing an increased flow of water to the cooling tower. On/off control of pump and fan in closed cooling tower circuits is also provided by 3-way valve, V1.

2 Basic configurations of VRV-WII

2 - 2 Basic configuration for heating operation

Low pressure hot water from a boiler is generally utilized to maintain the required temperature levels within the water circuit - but steam, district/process/industrial heating systems or even solar energy can also act as the heat source.



During winter operation, water circuit temperature T2 is maintained by circulating water through the boiler (or similar) via valve V2, which shuts off immediately the pre set temperature is achieved.

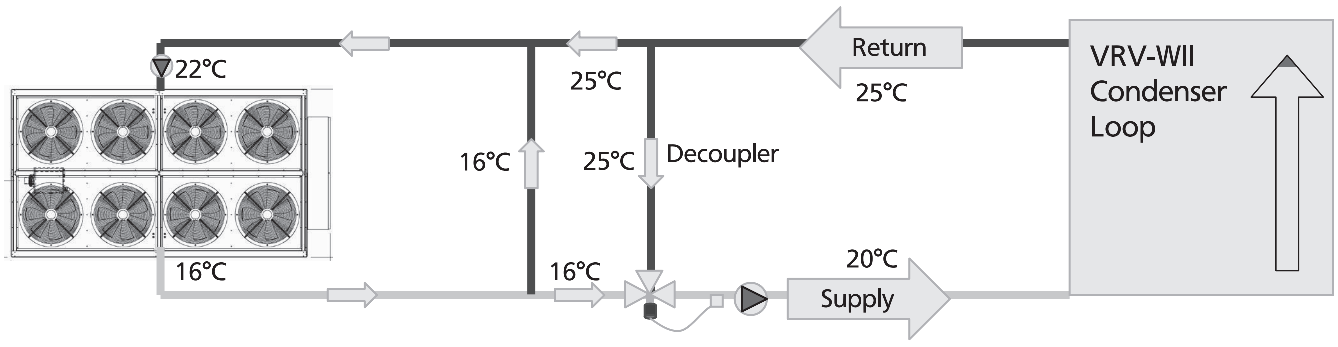
2 Basic configurations of VRV-WII

2 - 3 Alternative solution

Cooling tower and boiler replaced by heat pump chiller

The use of a boiler and cooling tower to maintain condenser circuit temperature can be replaced by a heat pump chiller in most Southern European regions, resulting in good control options via a single package, which can be supplied by Daikin.

The water circuit temperature on VRV-WII is outside the standard operating range of a standard heat pump chiller, hence the **piping configuration is important**. All engineering data books for Daikin chillers publish the operating range and specify the max and min ∆**T across the evaporator (Usually 3~8°C)**.



To ensure maximum operating efficiency of the heat pump chiller, the following data represents the optimum selection point when using the above configuration: -

Cooling Mode: Leaving chilled water temperature

= Highest possible leaving water temperature (16°C)

Heating Mode: Leaving hot water temperature =

= Lowest possible leaving water temperature (25°C)

3 Water piping elements

Water at the pre set temperature is supplied to all VRV-WII condensing units via a 2-pipe closed circuit..

Water temperatures within the circuit must be maintained at 15 to 45°C and pumps should be of sufficient duty to match the requirements of all VRV-WII condensing units. Air purging should be carried out in closed circuit systems and a strainer installed to prevent impurities from entering the water flow. Expansion tanks are also important since they allow for temperature changes within the circuit. System start up should be provided by a controller, which also regulates circuit water temperature and protects the system.

Steel, stainless steel, copper and plastic but not galvanised, piping can be used.

NOTE

1 When designing a water piping system, the following should be considered:
- water must be supplied to the required locations according to the needs of each VRV-WII
- head and friction losses should be kept at a minimum
- water velocity should be properly controlled to avoid water streaming noise, pipe vibration or pipe expansion/contraction due to temperature differences.
- attention should be paid to water management: impact of the water quality, corrosion prevention…
- enough arrangements should be provided for easy service and maintenance.

3 - 1 Heat rejection equipment

In cooling mode, the purpose of the water cooled VRV plant is to reject unwanted heat outdoors.

In an **air cooled VRVII**, cooler ambient air is usually drawn across the condenser coil by means of propeller fans. High pressure refrigerant heat is transferred to the cooler ambient air and exhausted outdoors.

By comparison, in a **water cooled VRV-WII**, cooling water is pumped through the plate type condenser. High pressure refrigerant heat is transferred to the cooler condenser water and exhausted outdoors.

3 - 1 - 1 Cooling towers types

The cooling tower is still the most common equipment used for water heat rejection. With the current drive towards energy efficiency, ground water, lakes, rivers and sea have been used as an alternative heat rejection medium. Environmental concerns and restrictions however, may limit this potential source.

The cooling tower relies on the process of evaporation, enabling the condenser water circuit to be cooled to a temperature below the ambient wet bulb.

NOTE

1 Cooling tower performance is dependent on the ambient wet bulb, whilst dry bulb temperature has little effect on performance.

Over sizing cooling towers will lead to lower condenser water temperatures at part load operation, increasing plant efficiency.

Cooling towers are either of the **"open"** or **"closed"** type.

In an **open tower**, the condenser water / fluid circuit comes into direct contact with the outside air.

In a **closed tower**, the condenser water is circulated in the heat exchanger tubes, while an evaporating water film falls on the fins of the tube exchanger.

3 Water piping elements

3 - 1 Heat rejection equipment

3 - 1 - 1 Cooling towers types

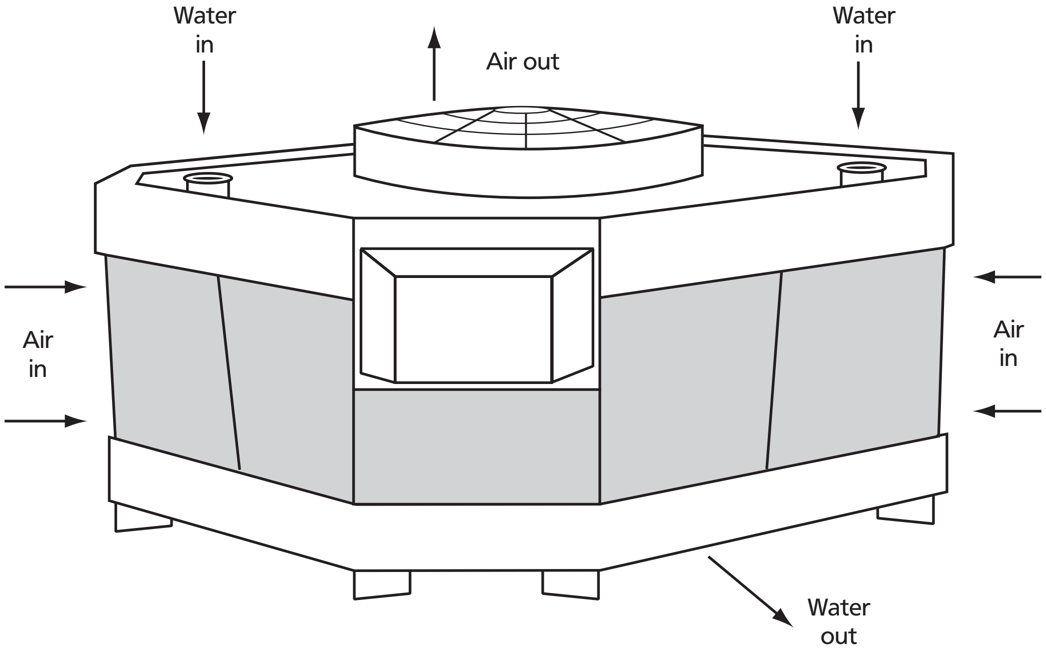
3 - 1 - 1 - 1 Open cooling towers

Open cooling towers are classified in terms of the airflow configuration. **"Forced draught"** and **"induced draught"** towers are the most common types found in the HVAC industry. The forced draught tower is driven by a fan, which blows air through the tower. Induced draught towers **pull** the air through the tower.

Depending on whether the air is drawn against the flow of the water or across the flow of water in the tower, the systems can be further classified as **"counter flow"** or **"cross flow"** configurations.

① **Induced draught tower**

This type of unit utilizes axial flow fans and is generally thought to be the most efficient and therefore the most popular, in use today.



Large propeller fans on the air discharge or the top of the tower **draw air counter flow or cross flow** to the condenser water. Due to the higher discharge velocities they are less susceptible to short air circuits or recirculation. Noise levels are higher due to the low frequency noise associated with propeller and axial fans.

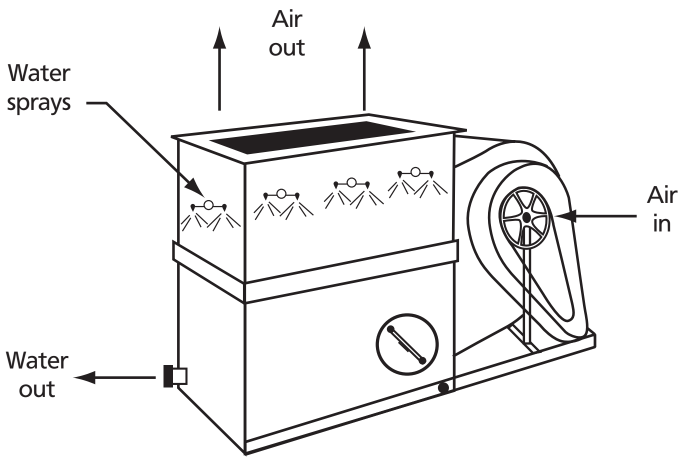
3 Water piping elements

3 - 1 Heat rejection equipment

3 - 1 - 1 Cooling towers types

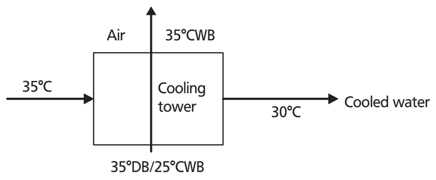
3 - 1 - 1 - 1 Open cooling towers

② **Forced Draught Tower**



Forward curved centrifugal fans on the air inlet will **force/push** the air in either a counter flow or cross flow pattern. **Centrifugal fans use more power but generate enough static pressure to overcome any problems associated with internally located cooling towers or those fitted with sound dampers.** These towers are quieter than others and are particularly useful for low noise applications. The cross flow tower offers the benefit of a lower profile unit where aesthetics or plant room height may be restricted. On the other hand, the power input is approximately double that of an induced draught tower.

Typical air/water temperatures for an open cooling tower operating in a temperate climatic region:



3 Water piping elements

3 - 1 Heat rejection equipment

3 - 1 - 1 Cooling towers types

3 - 1 - 1 - 2 Closed cooling towers

The water being cooled is contained within a heat exchanger or coil.

Numerous advantages are associated with this arrangement, particularly if the water is pressurized or mixed with chilled water from an external source or if the primary pump is sited away from the cooling tower.

Closed cooling towers tend to be larger than open models and consequently, more expensive.

On the other hand, since fouling is negligible, closed type systems have lower maintenance costs

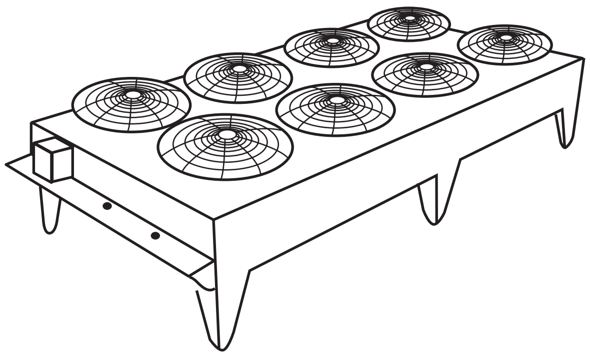
There are 2 types:

① **Evaporative cooling tower:**

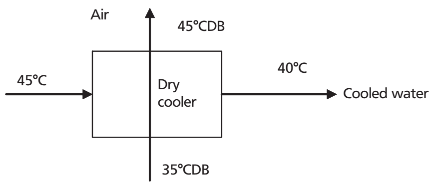
A secondary open water spray system is used to distribute a film of water to the fins to provide the benefit of evaporative cooling.

② **Dry cooler:**

The concept is similar to that of an air cooled condenser with condenser water circulating through the tubes and is therefore classed as a closed type system. Due to the higher condenser water temperatures of dry coolers, performance is similar or lower than an equivalent air cooled package.



Typical air/water temperatures for a dry cooler tower operating in a temperate climatic region:



RECOMMENDATION

1 It is recommended that closed cooling towers should be used as much as possible in order to prevent the cooling water from becoming contaminated.

2 When open cooling towers are used it is essential to install a water treatment system.

3 Water piping elements

3 - 1 Heat rejection equipment

3 - 1 - 2 Cooling tower selection

Cooling tower selection is based on the amount of heat to be rejected (the actual cooling capacity + compressor power) and the optimum method of rejecting this heat depending on the most important design criteria, ie. initial cost, efficiency, footprint and noise.

Example of selection of a dry cooler:

Qr = total rejected heat = Total (cooling capacity + PI) of VRV-WII units (kW)

m = VRV-WII total condenser flow rate (l/s)

ΔT = range = LWC-EWC (°C)

LWC = Condenser leaving water temperature

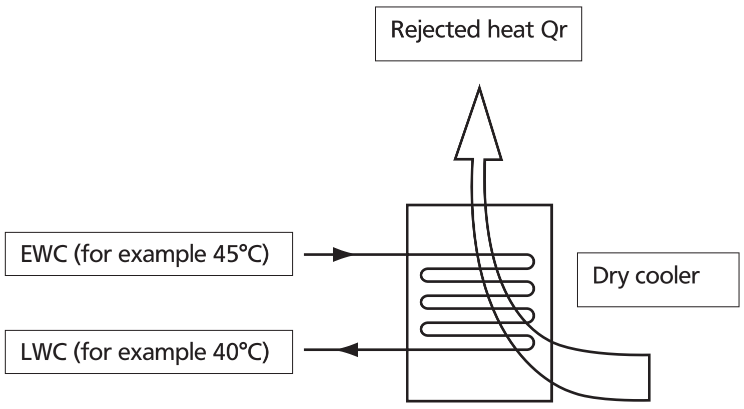
EWC= Condenser entering water temperature

$\boxed{\Delta T = Qr/(4.2 \times m)}$

where 4.2 = specific heat capacity, kJ/kg/°C

LWC is pre-selected within the limits of the VRV-WII operation range (15°-45°C), EWC is calculated.

With these values, the dry cooler can be selected by using different manufacturers' selection catalogues or software.



3 Water piping elements

3 - 2 Heat transfer equipment

An external heat source, usually in the form of a LPHW boiler and associated heat exchanger is necessary in applications in which the operating temperature of the water circuit cannot be maintained due to insufficient heat recovery within the system. The operating temperature of the boiler should be in the region of 90/70°C.

Example of boiler selection:

Boiler selection is carried out similarly to cooler selection, except the kW of power input (PI) is subtracted from instead of added to the VRV-WII heating capacity.

Qi = total injected heat = total (heating capacity - PI) of VRV-WII units (kW)

m = VRV-WII total condenser flow rate (l/s)

ΔT = EWC-LWC (°C)

LWH = heat exchanger leaving water temperature

EWH= heat exchanger entering water temperature

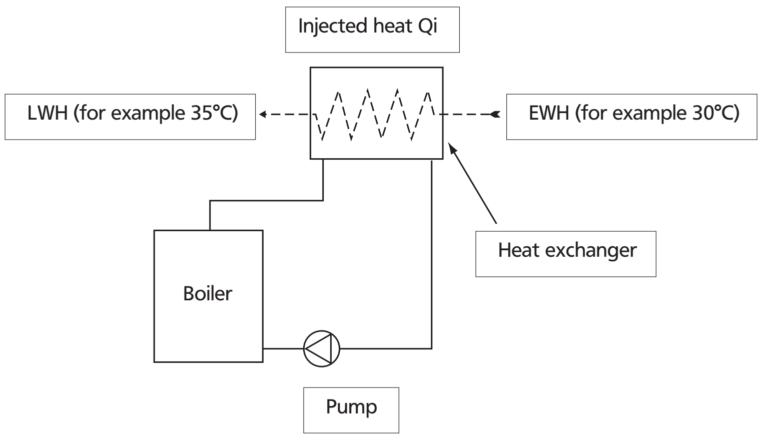
$\boxed{\Delta T = Qi/(4.2 \times m)}$

where 4.2 = specific heat capacity, kJ/kg/°C

LWH is pre-selected within the limits of the VRV-WII operation range (15°-45°C), EWH is calculated.

Based on total injected heat (Qi), the boiler can be selected.

With these values, the heat exchanger can also be selected by using different manufacturers' selection catalogues or software.



3 Water piping elements

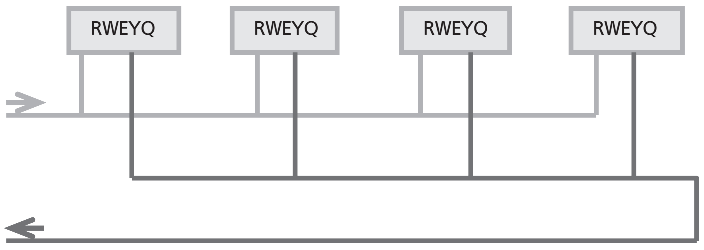
3 - 3 Water pipes

The 2-pipe layout is commonly used and consists out of one pipe to and one from the terminal (fan coil unit or VRV-WII). Both chilled or hot water can be supplied to the terminal.

3 - 3 - 1 Reverse return method for dimensioning the water pipes:

According to this method, the length of the water piping return and supply is almost equal for all VRV-WII condensing units in the system. The friction loss is almost the same, resulting in a balanced water flow to each condensing unit. Adversely, the piping length is longer. Since the water circuits are equal for each unit, the major advantage of the reverse return method is that it seldom requires balancing. Due to the more balanced flow, the test run and maintenance work becomes easier.

It is often the most economical design for new build projects.



3 - 3 - 2 Friction losses

In order to force a fluid through a pipe, pressure is required to overcome the viscous friction forces. Friction loss occurs when water flow through a pipe.

NOTE

1 The Darcy equation is the basis of all fluid flow equations and relates the pipe pressure drop required to overcome the fluid viscous friction forces: $\partial P = (\rho * f * l * v^2) / (2 * d)$

Where: ∂P= friction losses (Pa)
ρ = fluid density (kg/m³)
f = friction factor, depending on the roughness of the internal surface of the pipe (dimensionless)
l = pipe length (m)
v = fluid velocity (m/s)
d = internal pipe diameter (m)

Most air conditioning systems use steel pipe or copper tubing .

Based on the Darcy equation, the pipe friction / flow tables are made (e.g. **fig.1**).

3 - 3 - 3 Water velocity

The recommended water velocity through the piping is depending on two conditions:

- pipe diameter
- effect of erosion.

The table below lists the recommended velocity ranges for the different piping diameters. The higher the water velocity, the higher the noise level of the moving water and the entrained air and the erosion will be.

Recommended water velocity	
Diameter (mm)	Velocity range (m/s)
> 125	2.1 ~ 2.7
50~100	1.2 ~ 2.1
about 25	0.6 ~ 1.2

Since erosion is a function of time, water velocity and quality of water, the design water velocity is subject to the judgment of the design engineer.

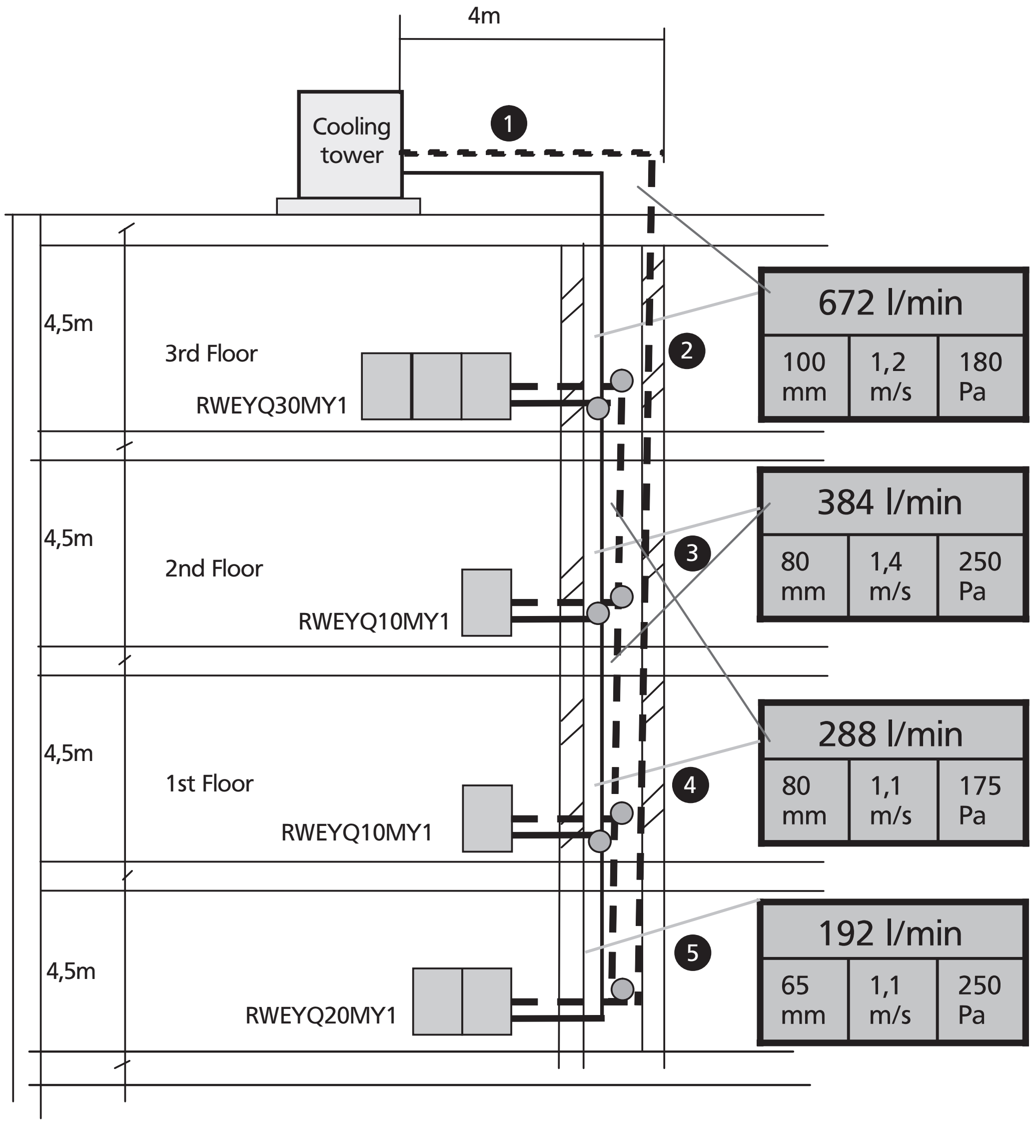
3 Water piping elements

3 - 3 Water pipes

3 - 3 - 4 Example of dimensioning the water pipes:

Preliminary information on the VRV-WII systems, according with capacity tables:

- **system 3rd floor: 30 HP**
  - 130% connection ratio
  - water flow: 96x3 = 288 l/min
  - water temp inlet/outlet: 30°C/34,3°C
- **system 2nd floor: 10 HP**
  - 120% connection ratio
  - 96 l/min
  - 30°C/34°C
- **system 1st floor: 10 HP**
  - 120% connection ratio
  - 96 l/min
  - 30°C/34°C
- **basement: 20 HP**
  - 120% connection ratio
  - 96x2= 192 l/min
  - 30°C/34°C



3 Water piping elements

3 - 3 Water pipes

3 - 3 - 4 Example of dimensioning the water pipes:

RECOMMENDATION

1. in VRV-WII capacity tables 4 water flows are mentioned for each model/connection ratio: 50, 60, 96, 120 l/min
2. **water flows of either 60 or 96 l/min are advisable in order to maintain a balance between pipe diameter and pressure losses. As water flow increases, pipe diameter reduces whereas pressure losses increase with increased water flow.**

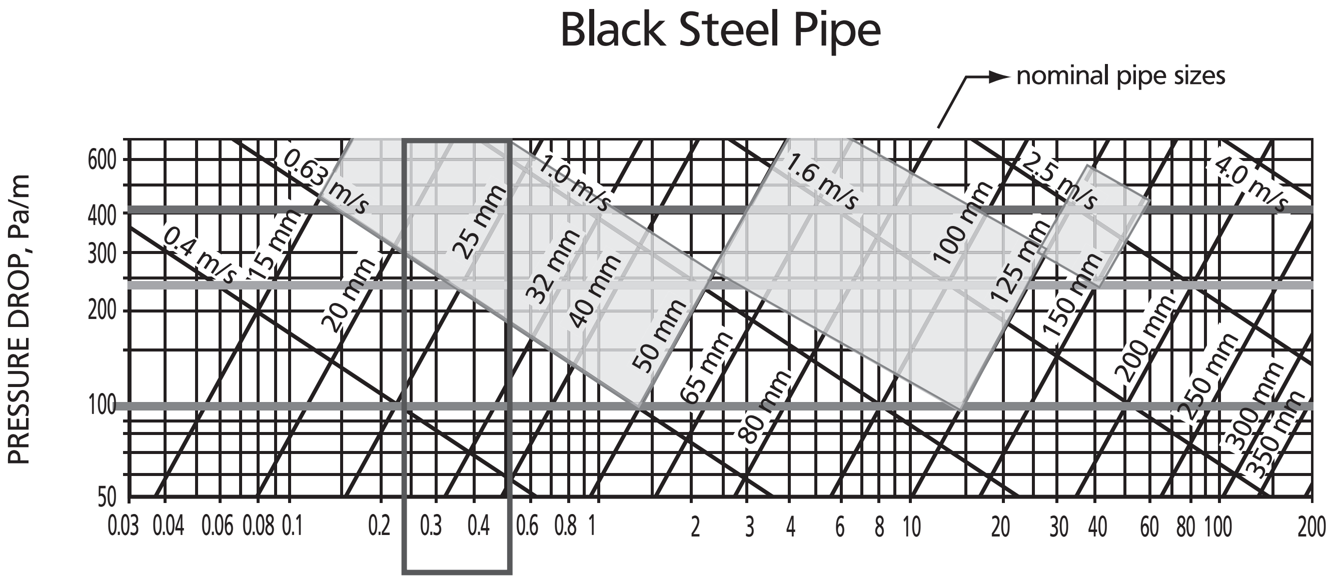


Fig. 1 VOLUMETRIC FLOW RATE, L/s

Friction Loss for Water in Commercial Steel Pipe

Procedure for pipe selection:

- reverse return piping was chosen
- the water flow should be determined for each section of the water circuit
- by means of the using the friction loss diagram (fig.1), the diameter should be determined based on following input:
  - water flow
  - recommended domain of water velocities
  - recommended domain of linear pressure losses (100-400 Pa/m)
- the total linear friction losses should be determined by multiplying the pressure drop (Pa/m) obtained from the diagram, with the pipe length.
- local pressure losses should be calculated for special fittings like elbows, T-connections, reducers, etc. The values can be obtained from pipe manufacturers' catalogues. The following table can be also used: the equivalent length should be multiplied with the pressure drop (Pa/m) determined before.

Equivalent length of local friction loss (m)

Nominal pipe size	mm	15	20	25	32	40	50	65	80
	in	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3
Elbow		0.5	0.6	0.9	1.1	1.3	1.6	2.1	2.6
T-connection straight through		0.3	0.4	0.6	0.8	0.9	1.1	1.4	1.7
T-connection through branch		1.0	1.3	1.8	2.3	2.8	3.5	4.2	5.7
Gate valve		0.1	0.15	0.2	0.3	0.35	0.4	0.5	0.6
Reducer (3/4)		0.1	0.15	0.2	0.3	0.35	0.4	0.5	0.6
Globe valve		4.5	6.5	9.0	11	16	21	26	30

- total friction loss **in pipes** should be calculated by adding the linear and local friction losses.

The total friction loss in pipes will serve further when selecting the circulating pump.

3 Water piping elements

3 - 4 Expansion tank

The purpose of the expansion tank is to maintain system pressure by allowing the water to expand when the water temperature increases in order to prevent pipes from bursting. It also provides the means for adding water to the system

An expansion tank is required in a closed system. In an open system, the reservoir acts as the expansion tank.

The expansion tank can be of the open or closed type.

The **open expansion tank** (reservoir) is located at the suction side of the pump, above the highest point in the system. At this location, the tank provides atmospheric pressure equal to or higher than the pump suction, preventing air from leaking into the system.

The **closed expansion tank** is used in small systems and work at atmospheric pressure. The tank is located at the suction side of the pump.

The capacity of a closed expansion tank is greater than that of an open expansion tank operating under the same conditions.

When sizing the expansion tank, the engineering supplied by the tank manufacturer should be consulted.

3 - 5 Pumps

Centrifugal pumps are the most commonly used types in chilled water (CW) and low pressure hot water circuits (LPHW).

An electric motor usually powers the impeller (the rotating specially shaped "heart" of the pump) rotation.

System design requires a duty and a standby pump to be selected for the sum of all water flow rates of the VRV-WII system.

Pump performance can be given in terms of discharge capacity, head, shaft, power and efficiency

- **The discharge capacity** is the required water flow rate (m³/min or l/min). The correlation between the pump suction size and the water flow is listed in table.

Correlation between pump suction size and water flow rate	
Suction size (mm)	**Discharge capacity (m³/min)**
40	0.10~ 0.20
50	0.16~ 0.32
65	0.25~ 0.50
80	0.40~ 0.80
100	0.63~ 1.25
125	1.00~ 2.00
150	1.60~ 2.15
200	2.50~ 5.00
250	4.00~ 8.00
300	3.30~12.50

- **The head is the pressure produced by the pump** in metres of water column. The higher the discharge capacity of the pump, the lower the head **(Fig. 2)**.
- **The required pump power** is roughly proportional to the delivered capacity.
- **The pump efficiency (%)** is defined as the ratio between the delivered work and the shaft power: e**fficiency % = (power output / power input) x 100%**
- **The pump efficiency may be obtained from manufacturer data.**

The pump performance chart is the summary of the head, efficiency and discharge capacity.

The pump is operated at the intersection between the head and the system resistance curve. This intersection is called the pump operating point.

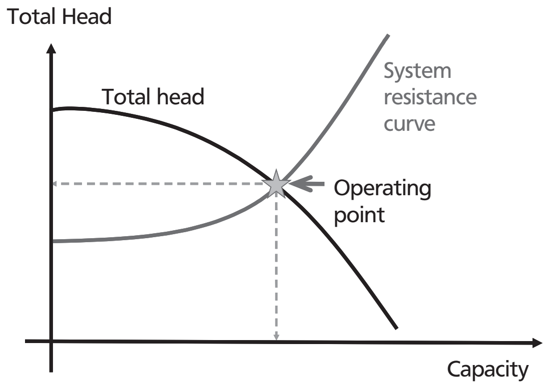


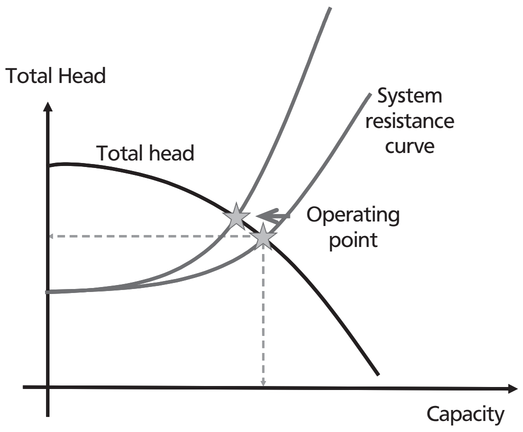
Fig. 2

3 Water piping elements

3 - 5 Pumps

NOTE

1 When the gate valve is throttled, the resistance increases and the water flow rate decreases. In doing this, the operating point can be changed. The same phenomena, a decrease in water flow rate and an increase in the head loss, can be caused when rust and / or scale is deposited on the internal surface of the water piping system.



The pump selection can be carried out through calculation or by use of the pump selection chart:

- The input valves are:
  - design flow rate (discharge capacity)
  - total friction loss (system resistance)
  - the pump efficiency
- The type of pump and required power of the pump are resulting.

In both cases the maximum friction loss (usually the longest pipe branch in the piping system) should be calculated:

H = Ha + Hf + Ht + Hk

Where: **H** = total friction loss

Ha = actual head (mH2O) = difference between the discharge and suction level

Hf = **linear** friction loss in straight pipes (mH2O) = from friction loss diagram

Ht = **local** friction loss (mH2O) caused by fittings = equivalent piping length * basic friction loss

Hk = internal friction loss (mH2O) of evaporator/condenser (of the cooling tower and VRV-WII) may be obtained from the manufacturer's data.

3 - 6 Temperature and pressure measurement points

Temperature and pressure measurement points should be located at each VRV-WII condensing unit

3 Water piping elements

3 - 7 Water quality

Be sure the water quality is in accordance with the specifications below:

Water quality standards for chilled water, hot water and make-up water

ITEM (5)	Cooling water system (3)		Hot water system (2)		Tendency (1)	
	Circulation system		Circulation water (20°C ~ 60°C)	Make-up water	Corrosion	Scale
	Circulation water	Make-up water				
Standard items						
pH (25°C)	6.8 to 8.2	6.0 to 8.0	7.0 to 8.0	7.0 to 8.0	○	○
Electrical conductivity (mS/m) (25°C)	Less than 80	Less than 30	Less than 30	Less than 30	○	○
Chloride ions (mg Cl^-/l)	Less than 200	Less than 50	Less than 50	Less than 50	○	
Sulfate ions (mg SO_4^{2-}/l)	Less than 200	Less than 50	Less than 50	Less than 50	○	
Acid consumption (pH 4.8) (mg $CaCO_3$/l)	Less than 100	Less than 50	Less than 50	Less than 50		○
Total hardness (mg $CaCO_3$/l)	Less than 200	Less than 70	Less than 70	Less than 70		○
Calcium hardness (mg $CaCO_3$/l)	Less than 150	Less than 50	Less than 50	Less than 50		○
Ionic-state silica (mg SiO_2/l)	Less than 50	Less than 30	Less than 30	Less than 30		○
Reference items						
Iron (mg Fe/l)	Less than 1.0	Less than 0.3	Less than 1.0	Less than 0.3	○	○
Copper (mg Cu/l)	Less than 0.3	Less than 0.1	Less than 1.0	Less than 0.1	○	
Sulfite ion (mg S^2/l)	Shall not be	Shall not be	Shall not be	Shall not be	○	
Ammonium ion (mg NH_4^+/l)	Less than 1.0	Less than 0.1	Less than 0.3	Less than 0.1	○	
Residual chlorine (mg CL/l)	Less than 0.3	Less than 0.3	Less than 0.25	Less than 0.3	○	
Free carbon dioxide (mg CO_2/l)	Less than 4.0	Less than 4.0	Less than 0.4	Less than 4.0	○	
Stability index	6.0 to 7.0	-	-	-	○	○

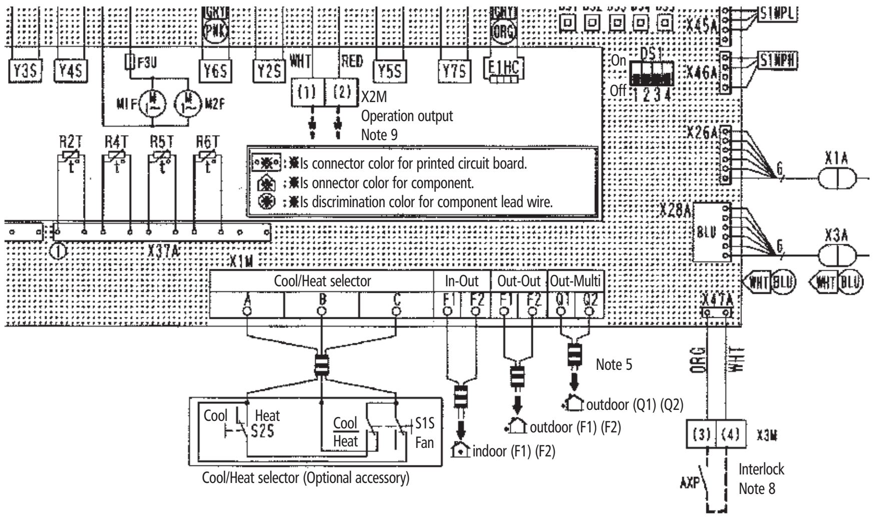
4 System safety requirements

4 - 1 Pump interlock

Problems can arise if the VRV-WII condensing units are allowed to operate without sufficient water within the circuit.

When interlocking a water pump with a VRV-WII system, terminals 1 and 2 of the X2M terminal strip should be used.

The PCB of the VRV-WII condensing unit:



NOTE

In most cases in large buildings (20,000 m²) the pumps run continuously. Therefore the interlock function is not used.

4 - 2 Flow switch

A flow switch per VRV-WII module is recommended to ensure that each module receives its required flow rate. If one flow switch is open, the module stops. In case of a multi arrangement (20 and 30 HP units), all units in the same system will remain in 'off' condition, which will continue as long as any VRV-WII module detects an 'open' status for a flow switch.

A flow switch can be interlocked between the terminal 3 and 4 of the terminal strip X3M

4 System safety requirements

4 - 3 Anti freezing protection

Anti freezing protection should be provided for the cooling tower and the external water piping during winter

Typical measures:

- if the temperature drops, **the pump** should be started to re-circulate the water
- electric heater tape should be used
- a forced boiler start up program activated
- water should be drained from the cooling tower

4 - 3 - 1 Glycol application

The use of a certain % ethylene glycol instead of normal water will affect the COP and water flow rate of the system, together with pressure drop on total system.

Glycol should be limited in use, however when necessary a primary and secondary water loop is recommended (Fig 3)

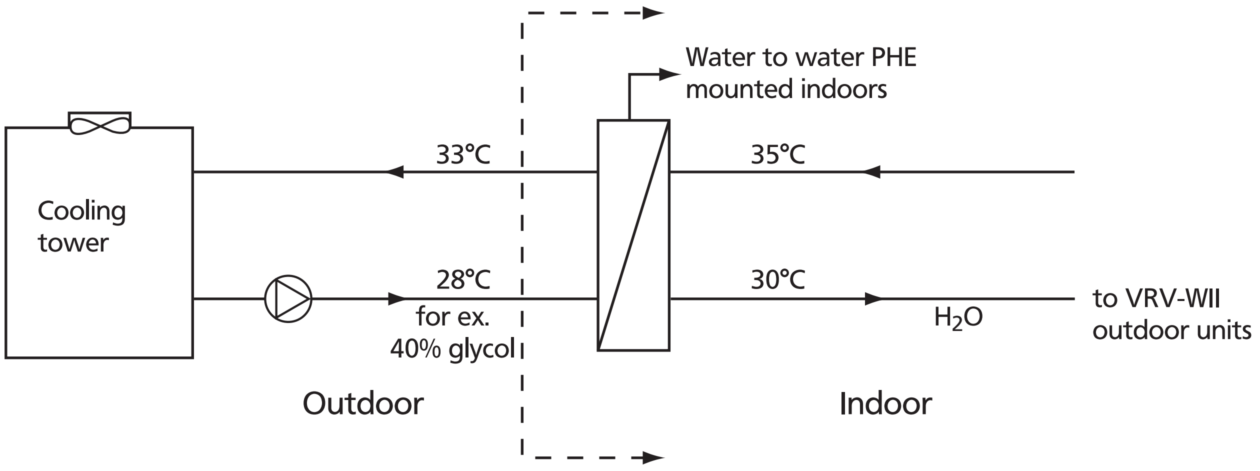


Fig. 3

Example

① **Influence on COP:**

- When normal water is used -
  Cooling operation: capacity 26.7kW, power input: 6.07kW
  Heating operation: capacity 31.5kW, power input: 6.05kW
- When ethylene glycol 40% is used
  Cooling operation: capacity 26.1kW, power input: 6.35kW
  Heating operation: capacity 31.5 kW, power input: 6.30kW

② **Water flow range:**

- When using normal water: from 50 l/min to 120 l/min
- When using water with 40/% glycol: from 80 l/min to 150 l/min
  Larger piping diameters are required.

③ **Water temperature range: between 15°C and 45°C, the same as for normal water.**

④ **Corrosiveness:**

Since the heat exchanger is made of SUS304, anti-freezing fluid non corrosive to SUS304 must be used.

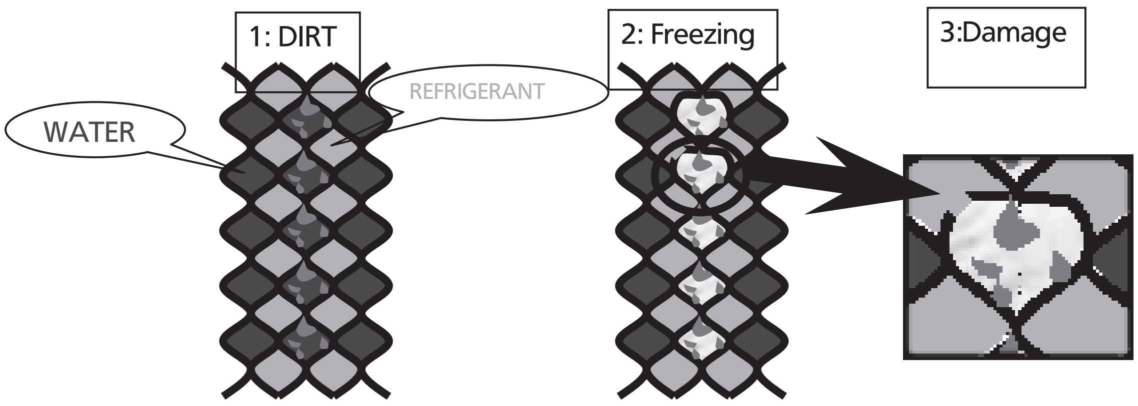
4 System safety requirements

4 - 4 Water piping strainer

A strainer kit 50 mesh should be provided for each outdoor unit in order to filter the water and protect the VRV-WII heat exchanger against dirt.

Why the strainer a must

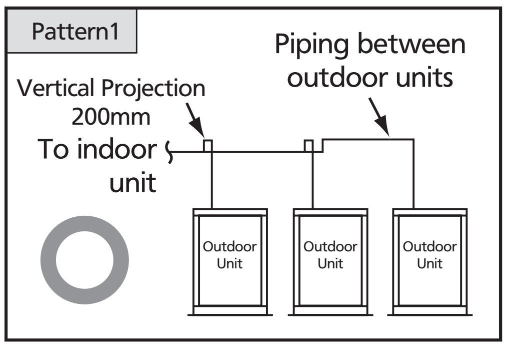
1 A plate heat exchanger consists of several water passages in parallel.
2 If no water filter is used, some of these passages can get blocked by dirt.
3 Evaporating temperature drops but the mix of water temperatures of the non blocked passages remains above freezing point.
4 The water in the blocked passages starts to freeze and the PHE breaks.
5 The result is a leak between the water circuit and the refrigerant circuit.

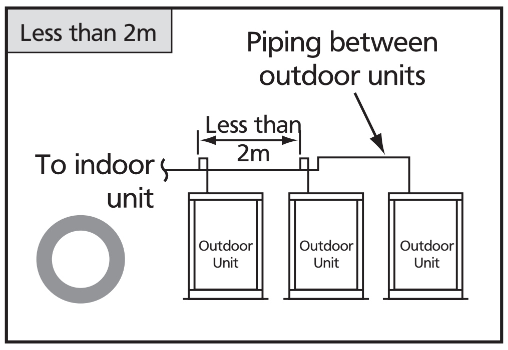


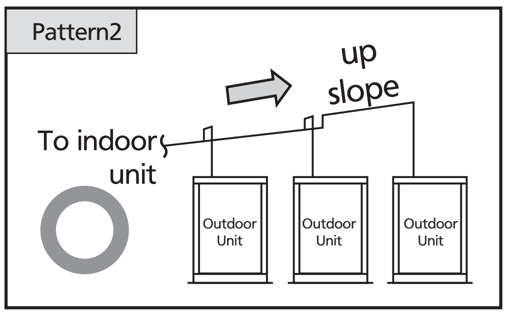
4 - 5 Recommendations for multi outdoor unit installations

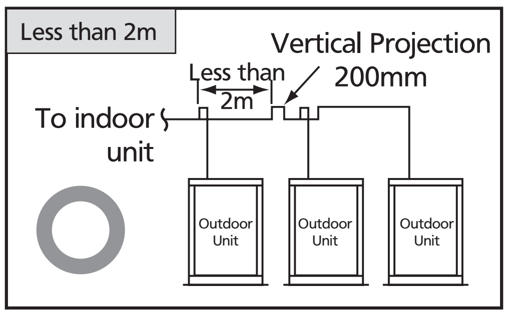
Recommendations for multi outdoor unit installations, in order to prevent oil and refrigerant flow back to a stopped outdoor unit:

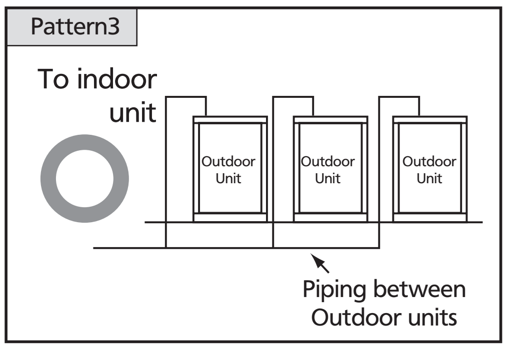
- An oil trap of 200 mm or more should be located on the gas pipe
- At every 2m of piping between outdoor units, an oil trap of 200mm should be fitted on the gas pipe.
- Piping between outdoor units should be horizontal or upwards inclined.

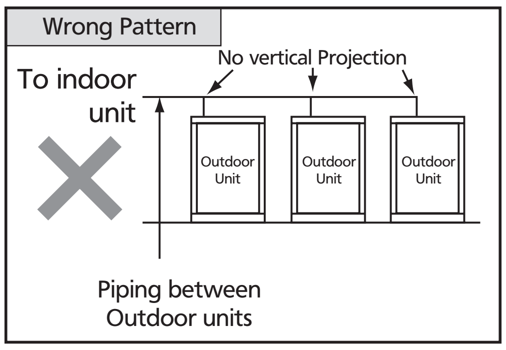








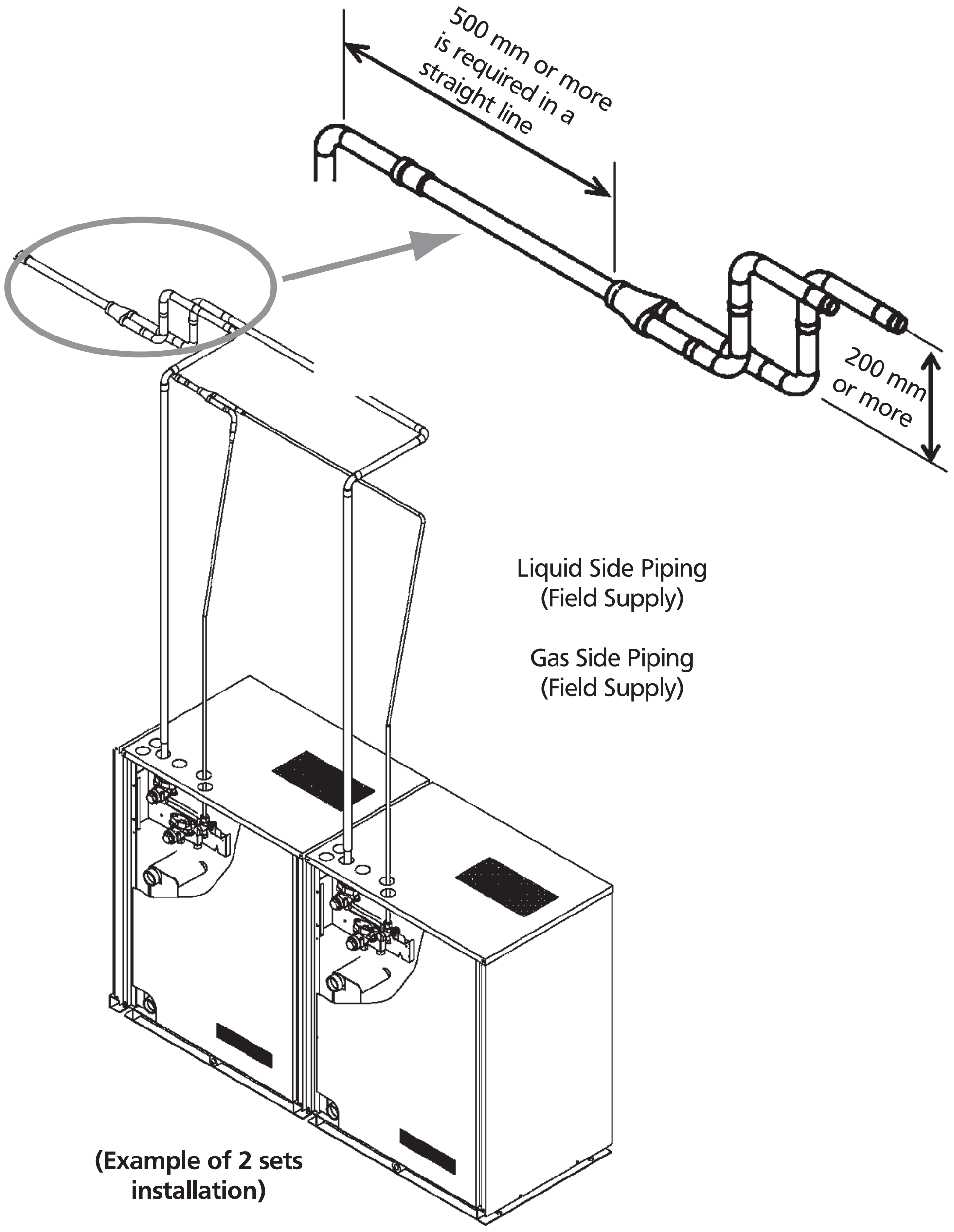




4 System safety requirements

4 - 5 Recommendations for multi outdoor unit installations

- A straight refrigerant pipe of 500mm should be positioned in front of the Y branch kit which couples outdoor unit piping.



(Example of 2 sets installation)

4 - 6 The total heat rejection of a 10 HP unit is 710W.

The majority of heat produced will be from the inverter board and compressor, which is why the machine room must be ventilated, especially if the ambient temperature is over 40°C. A space of 300 mm must be allowed above the unit for heat rejection.

5 System control

5 - 1 Complete control of a VRV-WII

- The control for the refrigerant side is identical to that of an air cooled VRVII -- by the use of the DIII communication line

Complete control of a VRV-WII system (including pumps and cooling tower) can be achieved by using Intelligent Controller and Intelligent Manager:

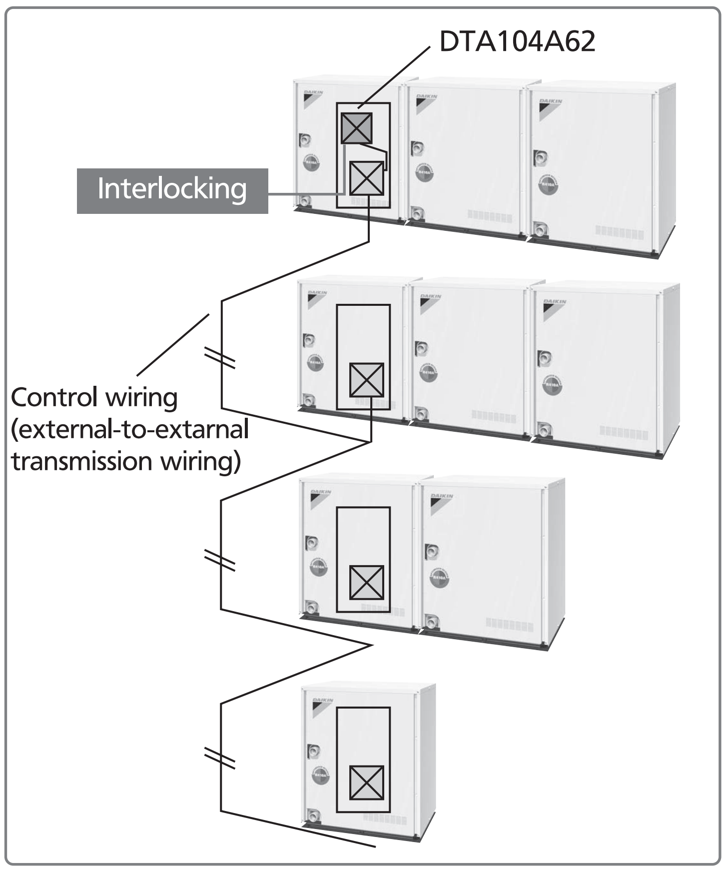
For ex.:

The on/off control of water pumps, cooling water fan and pumps can be controlled via the DEC101A51 (digital input) or DEC102A51 (digital input/ output) electronic boards.

More details can be found in the chapters on the different control systems of the VRVII data book

5 - 2 Interlocking VRV-WII outdoor units

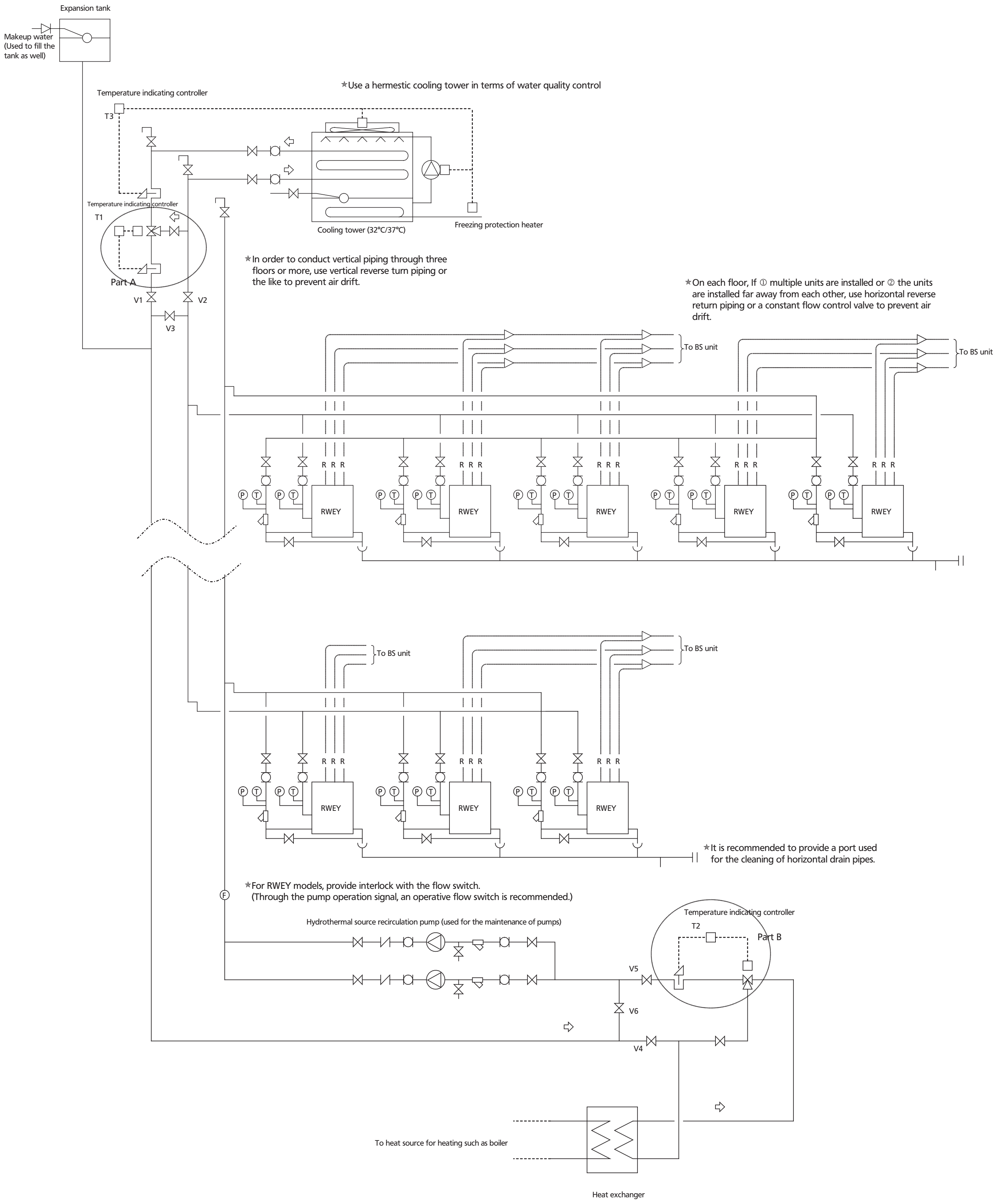
Centralized interlocking input to multiple condensing units is possible by using an external control adaptor (DTA104162)



6 Typical VRV-WII installations

6 - 1 Example Installation

Typical Installation



*Use a hermestic cooling tower in terms of water quality control

*In order to conduct vertical piping through three floors or more, use vertical reverse turn piping or the like to prevent air drift.

*On each floor, If ① multiple units are installed or ② the units are installed far away from each other, use horizontal reverse return piping or a constant flow control valve to prevent air drift.

*It is recommended to provide a port used for the cleaning of horizontal drain pipes.

*For RWEY models, provide interlock with the flow switch. (Through the pump operation signal, an operative flow switch is recommended.)

*Considering the maintenance of the boiler, it is recommended to break off the line concerned using the heat exchanger.

6 Typical VRV-WII installations

6 - 1 Example Installation

Note:
Pleased be noted that this Schematic Diagram is absolutely for reference only.
Practically, construction methods may vary with projects. Therefore, consult with the architect office for the design and construction of the system.

The following section shows precautions for the design of systems, which should be thoroughly observed.

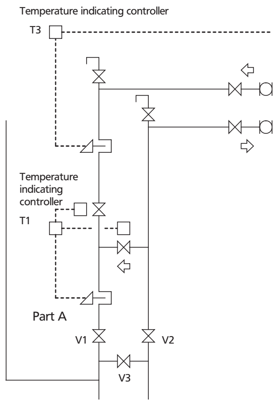
1. Temperature
   The operating range of hydrothermal cooling/heating free VRV (RWEY) is 10°C to 45°C.
   Keep the water temperature in the system within the said range through the ON/OFF operation of 2-way control valve, three-way control valve, cooling tower, or boiler.

2. Water quality
   The hydrothermal cooling/heating free VRV (RWEY) requires quality stability of water to be used.
   Be sure to install the hermestic cooling water or, in order to install the open type cooling water, install the heat exchanger to break off the line concerned.

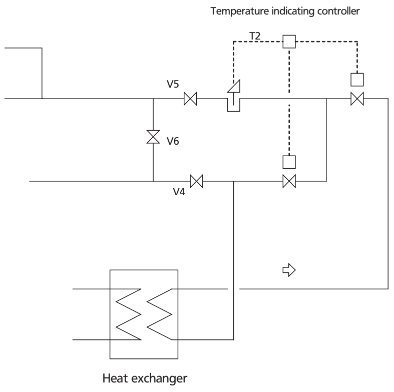
3. Freezing
   Freezing protection should be provided for the cooling tower water during wintertime.
   Take some sort of measures shown below so that water on the primary and secondary side of the cooling water will not freeze up during wintertime.
   Typical measure: If the water temperature drops,
   Start the pump to recirculate water.
   Provide freezing protection using freezing protection heater.
   Provide water temperature drop protection through the forced startup of the boiler.
   Drain water from the cooling tower.
   Particularly, if the unit should stop for an extended period of time, it may freeze up. Consequently, attention should be paid for this point.

4. Air drift
   Provide constant amount of feed water through the installation of reverse return piping system and constant flow control valve.

Typical modification to Part A (Three-way valve → Two-way valve)



Typical modification to Part B (Three-way valve → Two-way valve)

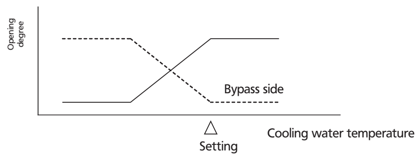


◬	Pump
◿⊐	Temperature controller
⋈◁	Three-way valve (mixed type)
◁▯	Y strainer
▯	Flexible joint
Ⓟ	Pressure gauge
Ⓣ	Thermometer
Ⓕ	Flow switch

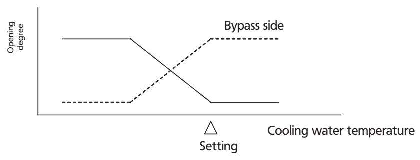
Typical set values (reference values)

Operation mode		Cooling (mainly for cooling)	Heating (mainly for cooling)	In-between seasons (cooling/heating combination)
T1 set value		15°C		25°C
T2 set value			40°C	20°C
T3 set value		33°C, 31°C		33°C, 31°C
Open/Closed of valve Open: ○ Closed: ×	V1	○	×	○
	V2	○	×	○
	V3	×	○	×
	V4	×	○	○
	V5	×	○	○
	V6	○	×	×

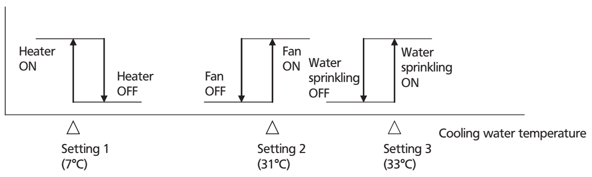
T1 Control



T2 control



T3 control



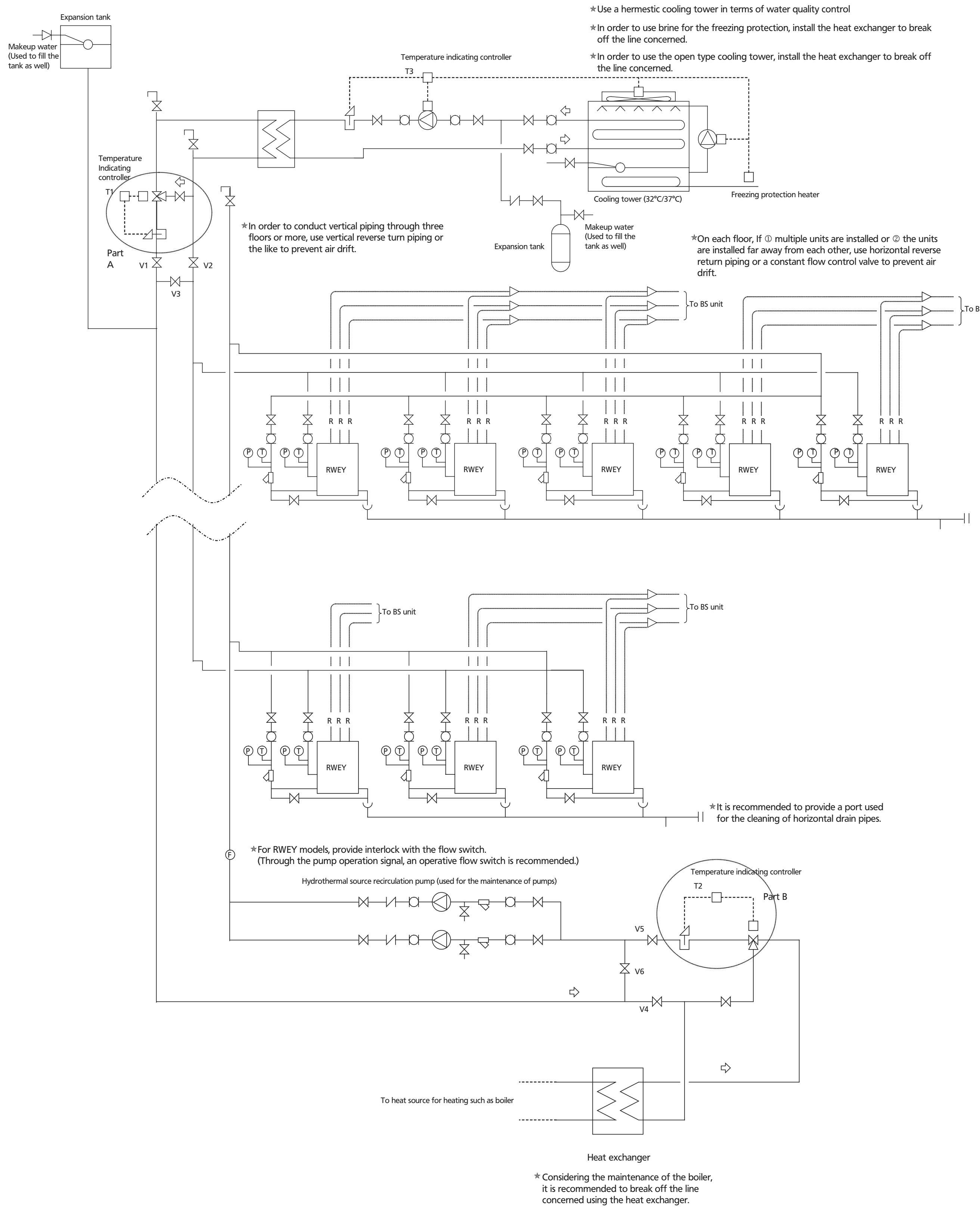
* If freezing is expected to occur, install the freezing protection heater or drain water from the water sprinkling side.
(If water is drained from the water sprinkling side, pay attention so that loads will never be applied to cooling mainly.)

6 Typical VRV-WII installations

6 - 2 Example Installation

(Use of open type cooling tower for low ambient climates)

Typical Installation (Installed in cold district, with open type cooling tower used)



✭Use a hermestic cooling tower in terms of water quality control

✭In order to use brine for the freezing protection, install the heat exchanger to break off the line concerned.

✭In order to use the open type cooling tower, install the heat exchanger to break off the line concerned.

✭In order to conduct vertical piping through three floors or more, use vertical reverse turn piping or the like to prevent air drift.

✭On each floor, If ① multiple units are installed or ② the units are installed far away from each other, use horizontal reverse return piping or a constant flow control valve to prevent air drift.

✭It is recommended to provide a port used for the cleaning of horizontal drain pipes.

✭For RWEY models, provide interlock with the flow switch.
(Through the pump operation signal, an operative flow switch is recommended.)

✭Considering the maintenance of the boiler, it is recommended to break off the line concerned using the heat exchanger.

6 Typical VRV-WII installations

6 - 2 Example Installation

(Use of open type cooling tower for low ambient climates)

Note:
Pleased be noted that this Schematic Diagram is absolutely for reference only.
Practically, construction methods may vary with projects. Therefore, consult with the architect office for the design and construction of the system.

The following section shows precautions for the design of systems, which should be thoroughly observed.

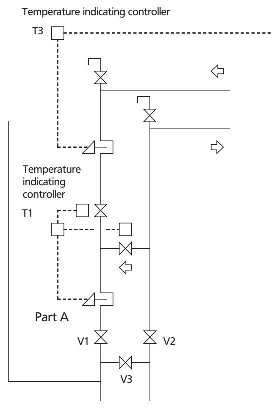
1. Temperature
   The operating range of hydrothermal cooling/heating free VRV (RWEY) is 10°C to 45°C.
   Keep the water temperature in the system within the said range through the ON/OFF operation of 2-way control valve, three-way control valve, cooling tower, or boiler.

2. Water quality
   The hydrothermal cooling/heating free VRV (RWEY) requires quality stability of water to be used.
   Be sure to install the hermestic cooling water or, in order to install the open type cooling water, install the heat exchanger to break off the line concerned.

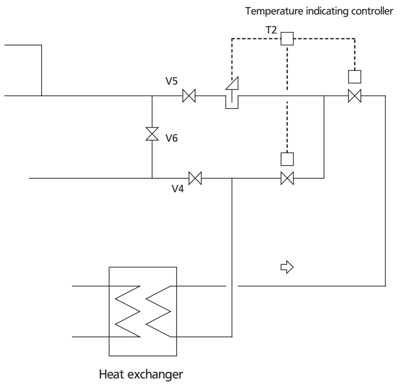
3. Freezing
   Freezing protection should be provided for the cooling tower water during wintertime.
   Take some sort of measures shown below so that water on the primary and secondary side of the cooling water will not freeze up during wintertime.
   Typical measure: If the water temperature drops,
   Start the pump to recirculate water.
   Provide freezing protection using freezing protection heater.
   Provide water temperature drop protection through the forced startup of the boiler.
   Drain water from the cooling tower.
   Particularly, if the unit should stop for an extended period of time, it may freeze up. Consequently, attention should be paid for this point.

4. Air drift
   Provide constant amount of feed water through the installation of reverse return piping system and constant flow control valve.

Typical modification to Part A (Three-way valve → Two-way valve)



Typical modification to Part B (Three-way valve → Two-way valve)

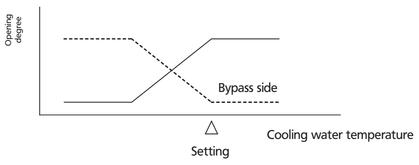


△	Pump
⊿	Temperature controller
⋈	Three-way valve (mixed type)
◁	Y strainer
()	Flexible joint
Ⓟ	Pressure gauge
Ⓣ	Thermometer
Ⓕ	Flow switch

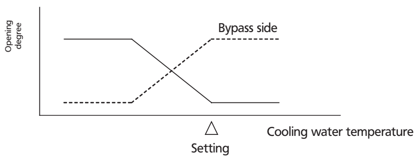
Typical set values (reference values)

Operation mode		Cooling (mainly for cooling)	Heating (mainly for cooling)	In-between seasons (cooling/heating combination)
T1 set value		15°C		25°C
T2 set value			40°C	20°C
T3 set value		33°C, 31°C		33°C, 31°C
Open/Closed of valve Open: ○ Closed: ×	V1	○	×	○
	V2	○	×	○
	V3	×	○	×
	V4	×	○	○
	V5	×	○	○
	V6	○	×	×

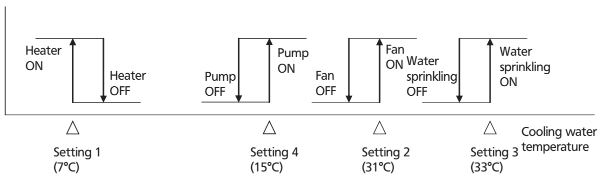
T1 Control



T2 Control



T3 Control

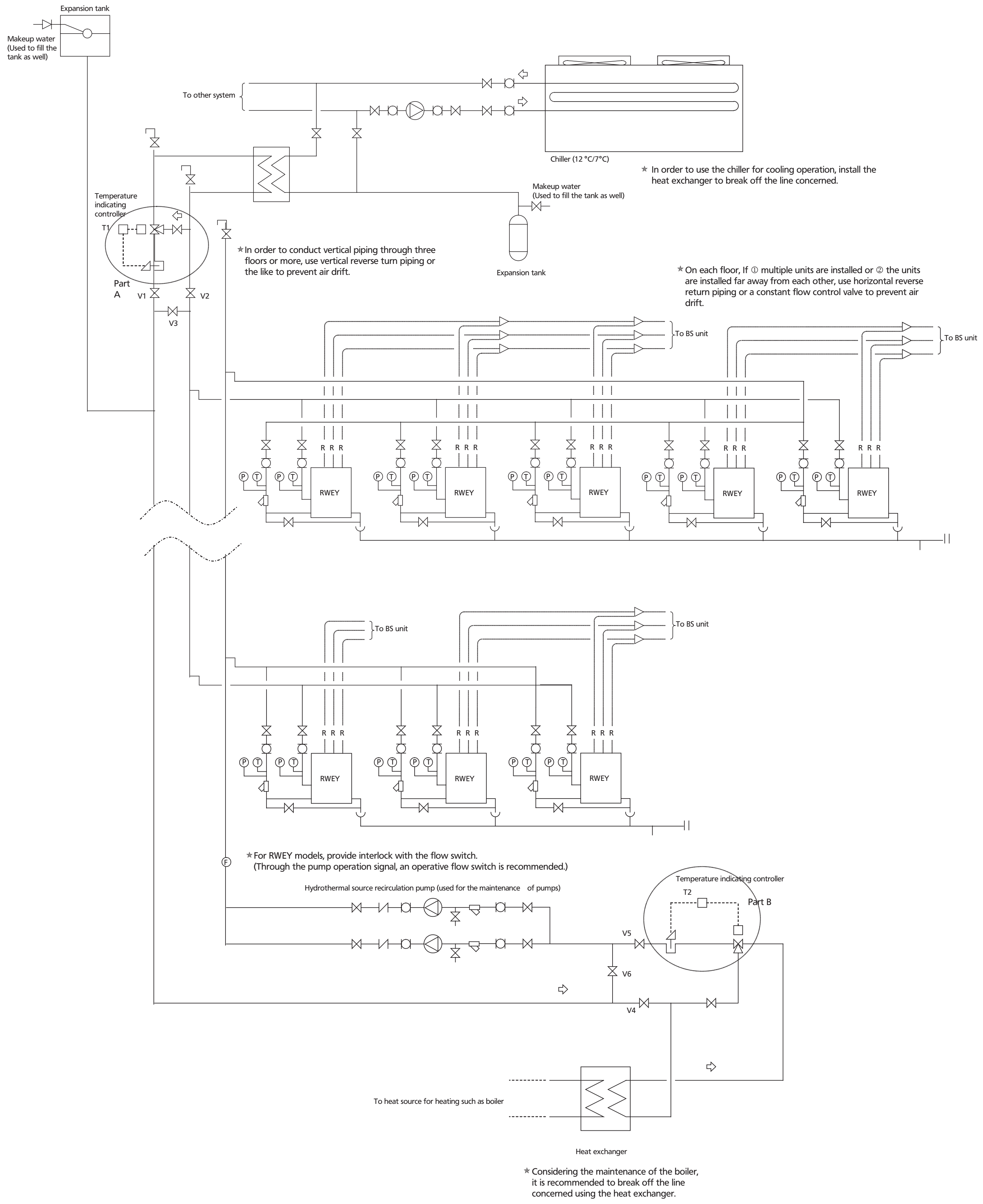


*If freezing is expected to occur, install the freezing protection heater or drain water from the water sprinkling side.
(If water is drained from the water sprinkling side, pay attention so that loads will never be applied to cooling mainly.)

6 Typical VRV-WII installations

6 - 3 Example Installation

(with part of central heating equipment used for this installation)



* In order to use the chiller for cooling operation, install the heat exchanger to break off the line concerned.

* In order to conduct vertical piping through three floors or more, use vertical reverse turn piping or the like to prevent air drift.

* On each floor, If ① multiple units are installed or ② the units are installed far away from each other, use horizontal reverse return piping or a constant flow control valve to prevent air drift.

* For RWEY models, provide interlock with the flow switch.
(Through the pump operation signal, an operative flow switch is recommended.)

* Considering the maintenance of the boiler, it is recommended to break off the line concerned using the heat exchanger.

6 Typical VRV-WII installations

6 - 3 Example Installation

(with part of central heating equipment used for this installation)

Note:
Pleased be noted that this Schematic Diagram is absolutely for reference only.
Practically, construction methods may vary with projects. Therefore, consult with the architect office for the design and construction of the system.

The following section shows precautions for the design of systems, which should be thoroughly observed.

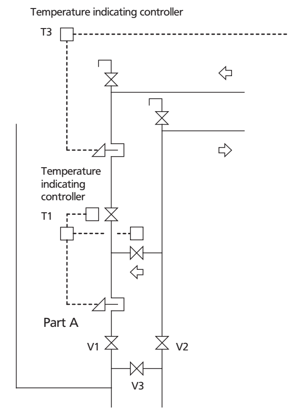
1. Temperature
   The operating range of hydrothermal cooling/heating free VRV (RWEY) is 10°C to 45°C.
   Keep the water temperature in the system within the said range through the ON/OFF operation of 2-way control valve, three-way control valve, cooling tower, or boiler.

2. Water quality
   The hydrothermal cooling/heating free VRV (RWEY) requires quality stability of water to be used.
   Be sure to install the hermestic cooling water or, in order to install the open type cooling water, install the heat exchanger to break off the line concerned.

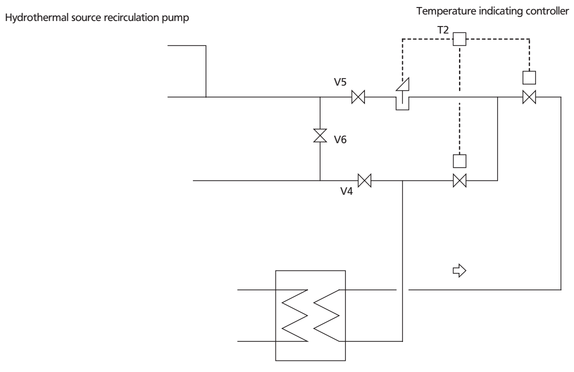
3. Freezing
   Freezing protection should be provided for the cooling tower water during wintertime.
   Take some sort of measures shown below so that water on the primary and secondary side of the cooling water will not freeze up during wintertime.
   Typical measure: If the water temperature drops,
   Start the pump to recirculate water.
   Provide freezing protection using freezing protection heater.
   Provide water temperature drop protection through the forced startup of the boiler.
   Drain water from the cooling tower.
   Particularly, if the unit should stop for an extended period of time, it may freeze up. Consequently, attention should be paid for this point.

4. Air drift
   Provide constant amount of feed water through the installation of reverse return piping system and constant flow control valve.

Typical modification to Part A (Three-way valve → Two-way valve)

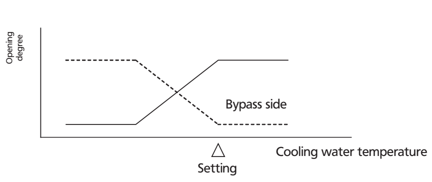


Typical modification to Part B (Three-way valve → Two-way valve)

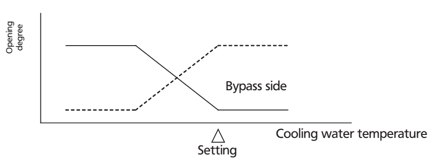


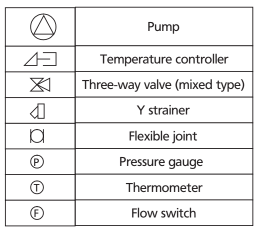
Heat exchanger

T1 Control



T2 Control





	Pump
	Temperature controller
	Three-way valve (mixed type)
	Y strainer
	Flexible joint
Ⓟ	Pressure gauge
Ⓣ	Thermometer
Ⓕ	Flow switch

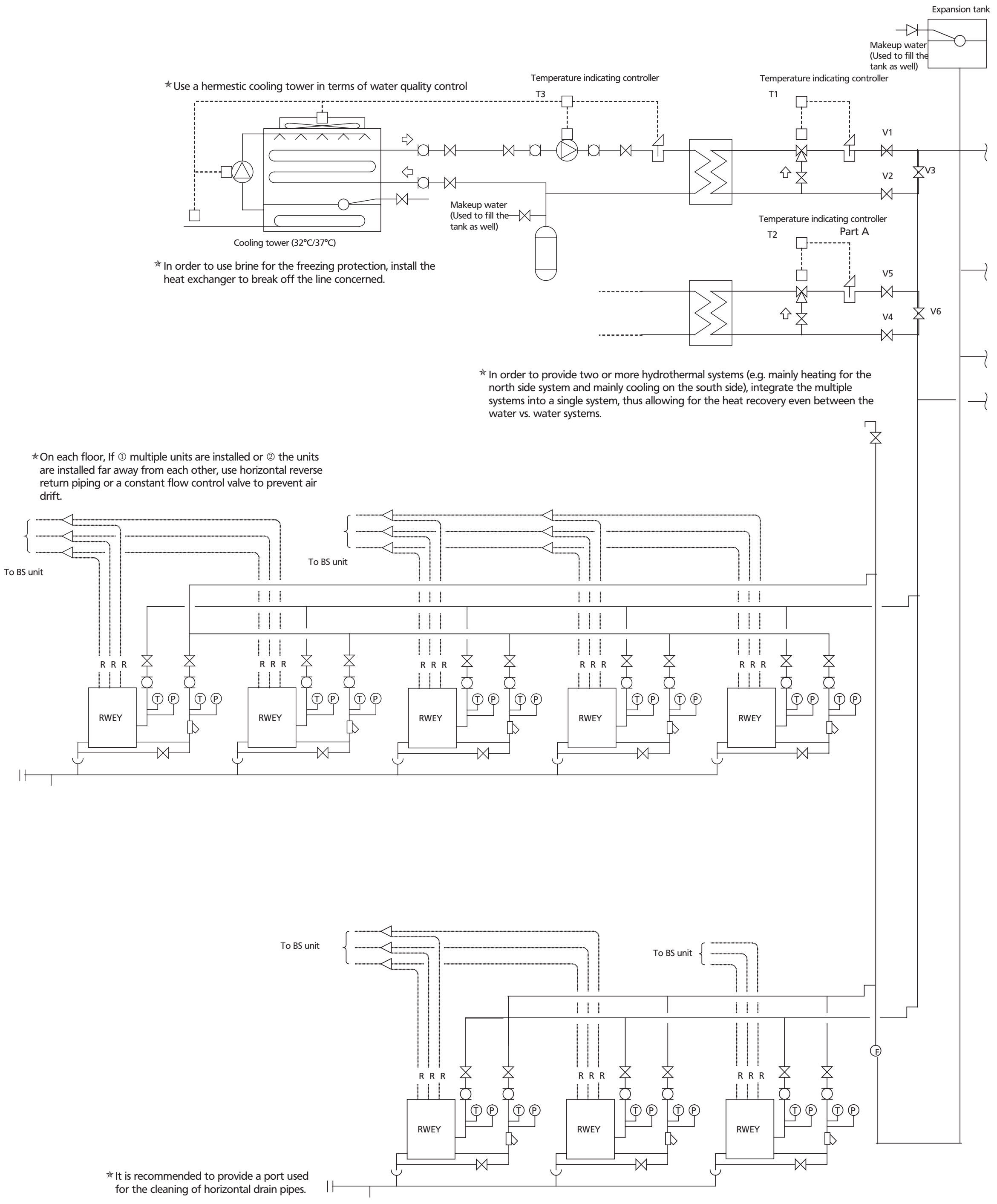
Typical set values (reference values)

Operation mode		Cooling (mainly for cooling)	Heating (mainly for cooling)	In-between seasons (cooling/heating combination)
T1 set value		15°C		25°C
T2 set value			40°C	20°C
Open/Closed of valve Open: ○ Closed: ×	V1	○	×	○
	V2	○	×	○
	V3	×	○	×
	V4	×	○	○
	V5	×	○	○
	V6	○	×	×

6 Typical VRV-WII installations

6 - 4 Example Installation

(With heat recovery from multiple systems through water circuit)



* Use a hermestic cooling tower in terms of water quality control

* In order to use brine for the freezing protection, install the heat exchanger to break off the line concerned.

* In order to provide two or more hydrothermal systems (e.g. mainly heating for the north side system and mainly cooling on the south side), integrate the multiple systems into a single system, thus allowing for the heat recovery even between the water vs. water systems.

* On each floor, If ① multiple units are installed or ② the units are installed far away from each other, use horizontal reverse return piping or a constant flow control valve to prevent air drift.

* It is recommended to provide a port used for the cleaning of horizontal drain pipes.

* For RWEY models, provide interlock with the flow switch. (Through the pump operation signal, an operative flow switch is recommended.)

Operation mode		Cooling (mainly for cooling)	Heating (mainly for cooling)	In-between seasons (cooling/heating combination)
T1 set value		15°C		25°C
T2 set value			40°C	20°C
T3 set value		33°C, 31°C		33°C, 31°C
Open/Closed of valve Open: ○ Closed: ×	V1	○	×	○
	V2	○	×	○
	V3	×	○	×
	V4	×	○	○
	V5	×	○	○
	V6	○	×	×

△	Pump
⊿⊐	Temperature controller
⋈	Three-way valve (mixed type)
◁	Y strainer
○	Flexible joint
Ⓟ	Pressure gauge
Ⓣ	Thermometer
Ⓕ	Flow switch

6 Typical VRV-WII installations

6 - 4 Example Installation

(With heat recovery from multiple systems through water circuit)

Note:
Pleased be noted that this Schematic Diagram is absolutely for reference only.
Practically, construction methods may vary with projects. Therefore, consult with the architect office for the design and construction of the system.

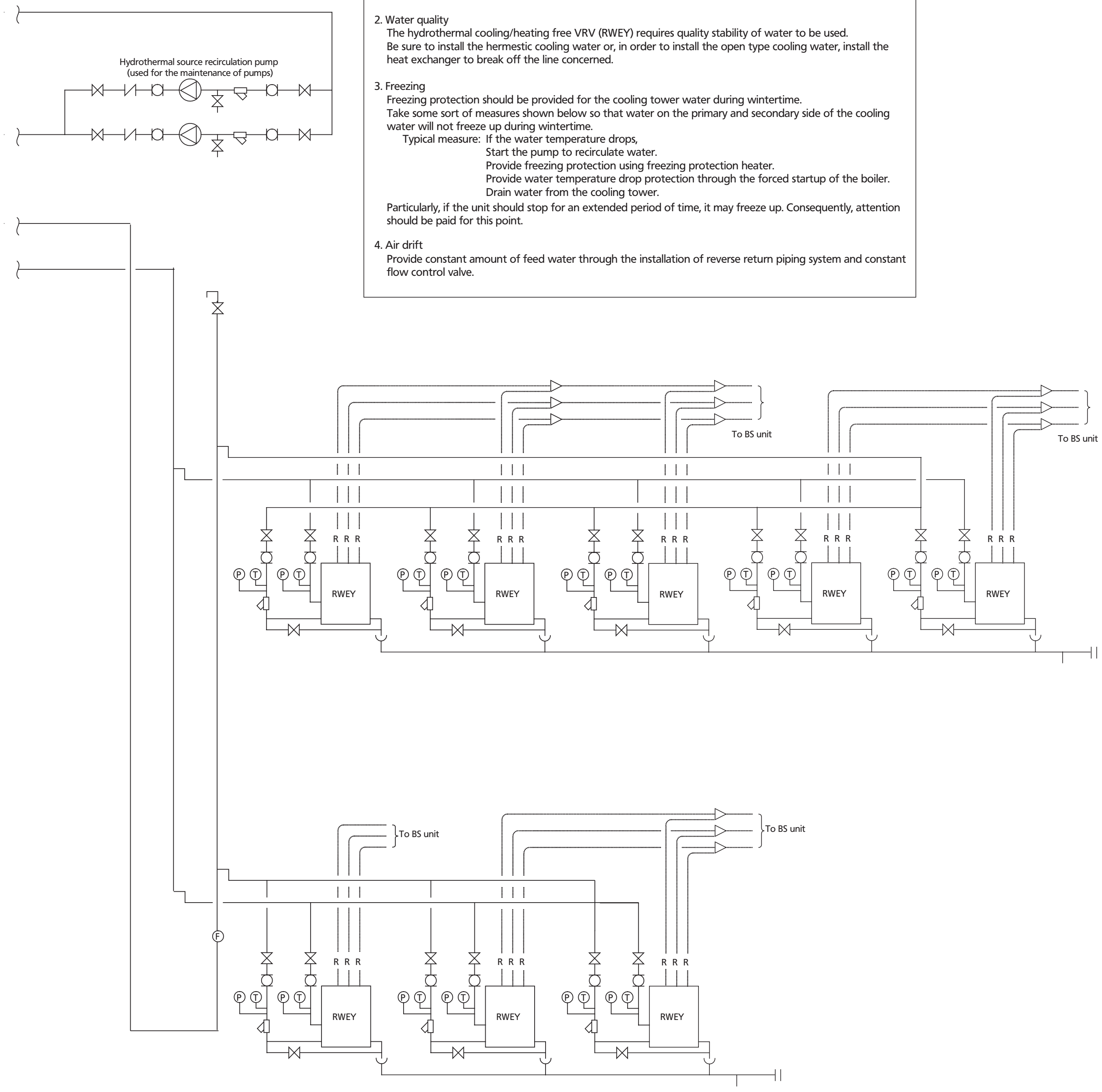
The following section shows precautions for the design of systems, which should be thoroughly observed.

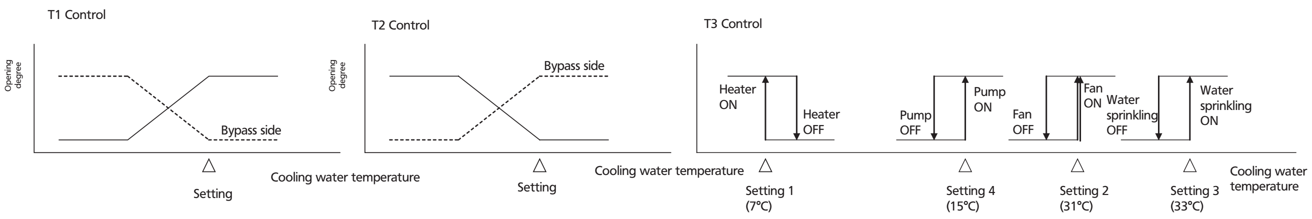
1. Temperature
   The operating range of hydrothermal cooling/heating free VRV (RWEY) is 10°C to 45°C.
   Keep the water temperature in the system within the said range through the ON/OFF operation of 2-way control valve, three-way control valve, cooling tower, or boiler.

2. Water quality
   The hydrothermal cooling/heating free VRV (RWEY) requires quality stability of water to be used.
   Be sure to install the hermestic cooling water or, in order to install the open type cooling water, install the heat exchanger to break off the line concerned.

3. Freezing
   Freezing protection should be provided for the cooling tower water during wintertime.
   Take some sort of measures shown below so that water on the primary and secondary side of the cooling water will not freeze up during wintertime.
   Typical measure: If the water temperature drops,
   Start the pump to recirculate water.
   Provide freezing protection using freezing protection heater.
   Provide water temperature drop protection through the forced startup of the boiler.
   Drain water from the cooling tower.
   Particularly, if the unit should stop for an extended period of time, it may freeze up. Consequently, attention should be paid for this point.

4. Air drift
   Provide constant amount of feed water through the installation of reverse return piping system and constant flow control valve.





*If freezing is expected to occur, install the freezing protection heater or drain water from the water sprinkling side.
(If water is drained from the water sprinkling side, pay attention so that loads will never be applied to cooling mainly.)