

HOT WATER HEAT PUMP

DATA BOOK

MODEL

CAHV-R450YA-HPB (-BS)

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1. Product Specifications

1-1. Specifications

CAHV-R-YA-HPB

Model		CAHV-R450YA-HPB (-BS)	
Power source		3-phase 4-wire 380-400-415V 50/60 Hz	
Capacity(EN14511) *1		kW	40.0
		BTU/h	136,480
	Power input	kW	14.03
	Current input	A	23.7-22.5-21.7
	COP (kW/kW)		2.85
	SCOP Low/Medium		3.57/3.24
Capacity(EN14511) *2		kW	35.0
		BTU/h	119,420
	Power input	kW	20.13
	Current input	A	34.0-32.3-31.1
	COP (kW/kW)		1.74
Maximum current input	A	44.0-41.8-40.3	
Water pressure drop *1			10.2 kPa (1.47 psi)
Temperature range *5	Outlet water temperature	24-70°C 75.2-158°F	
	Outdoor temperature	D.B.	-25-43°C -13-109.4°F
Circulating water volume range *6		1.5 m ³ /h-15.0 m ³ /h	
Sound pressure level (measured 1 m below the unit in an anechoic room) *1 *4		dB (A)	64
Sound pressure level (measured 1 m below the unit in an anechoic room) *3 *4		dB (A)	72
Water pipe diameter and type	Inlet	mm (in)	38.1 (1 1/2"), housing type joint
	Outlet	mm (in)	38.1 (1 1/2"), housing type joint
External finish		Acrylic painted steel sheet <Munsell 5Y 8/1 or similar>	
External dimensions H × W × D		mm	1710 × 1750 × 740
Net weight		kg (lbs)	359 (791)
Design pressure	R454C	MPa	3.85
	Water	MPa	1.0
Drawing number	Wiring	KW94C870	
	External appearance	KW94C397	
Heat exchanger	Water-side	Copper brazed stainless steel sheet	
	Air-side	Plate fins and copper tubes	
Compressor	Type	Inverter scroll hermetic compressor	
	Manufacturer	MITSUBISHI ELECTRIC CORPORATION	
	Starting method	Inverter	
	Motor output	kW	12.1
	Lubricant	FVC32EA	
Fan	Air flow rate	m ³ /min	150 × 2
		L/s	2500 × 2
		cfm	5297 × 2
	External static pressure	10 Pa (1 mm H ₂ O)	
	Type and quantity	Propeller fan × 2	
	Control and driving mechanism	Inverter control, direct driven by motor	
Motor output	kW	0.92 × 2	
HIC (Heat inter-changer) circuit		Copper pipe	
Protection devices	High pressure	High-pressure sensor and switch set at 3.85 MPa (643 psi)	
	Inverter circuit	Overheat and overcurrent protection	
	Compressor	Overheat protection	
	Fan motor	Thermal switch	
Defrosting method		Auto-defrost mode (Reversed refrigerant cycle)	
Refrigerant	Type and factory charge	kg	R454C, 9.0 kg
	Flow and temperature control	LEV and HIC circuit	

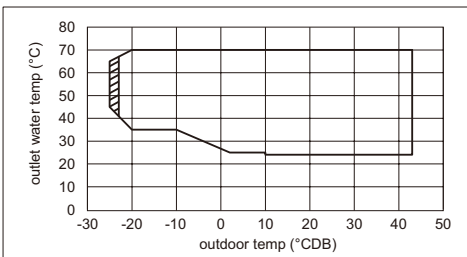
*1 Under normal heating conditions at the outdoor temperature of 7°CDB/6°CWB (44.6°FDB/42.8°FWB), the outlet water temperature of 45°C (113°F), and the inlet water temperature of 40°C (104°F)

*2 Under normal heating conditions at the outdoor temperature of 7°CDB/6°CWB (44.6°FDB/42.8°FWB) and the outlet water temperature of 70°C (158°F)

*3 Under normal heating conditions at the outdoor temperature of 7°CDB/6°CWB (44.6°FDB/42.8°FWB) when the unit is set to the "Capacity Priority" mode through the dry NC-contact

*4 The sound pressure level is a value measured in an anechoic room in accordance with the conventional method in JRA4060.

*5



Outdoor temp. -25°CDB/Outlet water temp. 45~65°C
(Outdoor temp. -13°FDB/Outlet water temp. 113~149°F)
Outdoor temp. -20°CDB/Outlet water temp. 35~70°C
(Outdoor temp. -4°FDB/Outlet water temp. 95~158°F)
Outdoor temp. 43°CDB/Outlet water temp. 24~70°C
(Outdoor temp. -109°FDB/Outlet water temp. 75.2~158°F)

*Do not start up the unit at or below the outdoor temperature of -23°C

*6 4.0 - 15.0 m³/h under the following conditions:

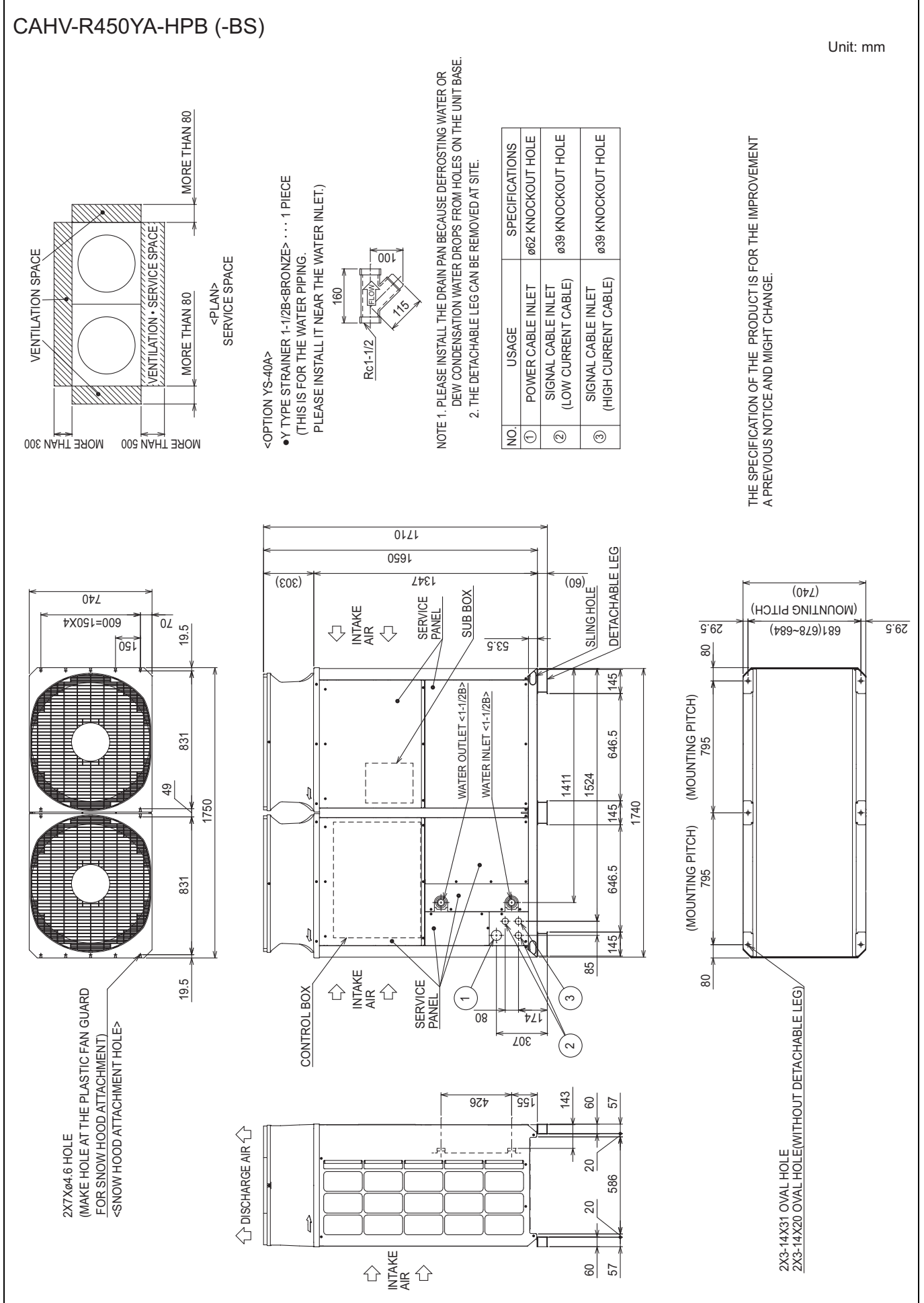
- When the outdoor temperature is below 0°C,
- When the outlet water temperature is 30°C or below AND the outdoor temperature is 6°C or below.

Unit converter

BTU/h= kW × 3,412
cfm= m³/min × 35.31
lbs= kg/0.4536

1. Product Specifications

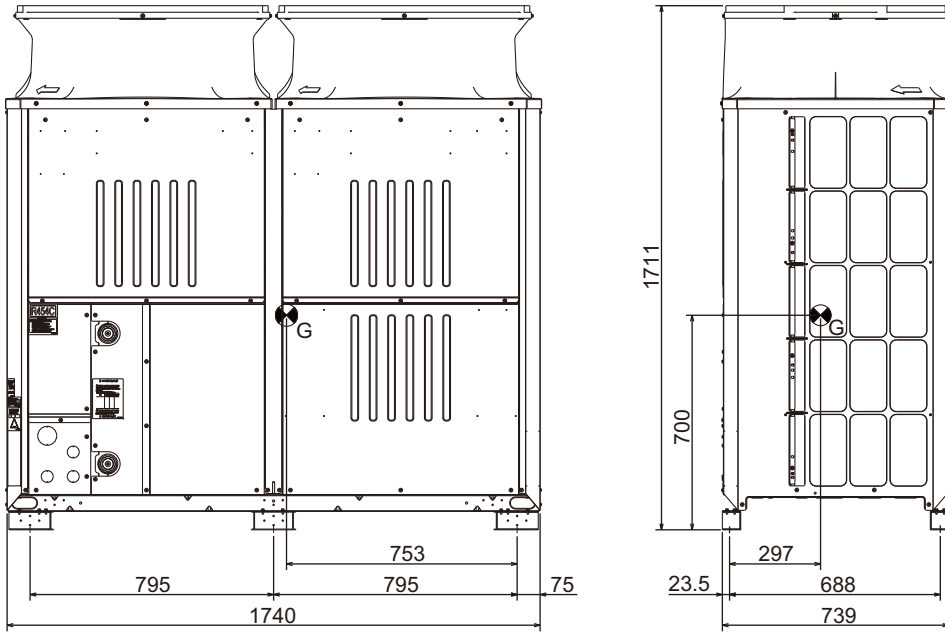
1-2. External Dimensions



1. Product Specifications

1-3. Center of Gravity

Unit: mm

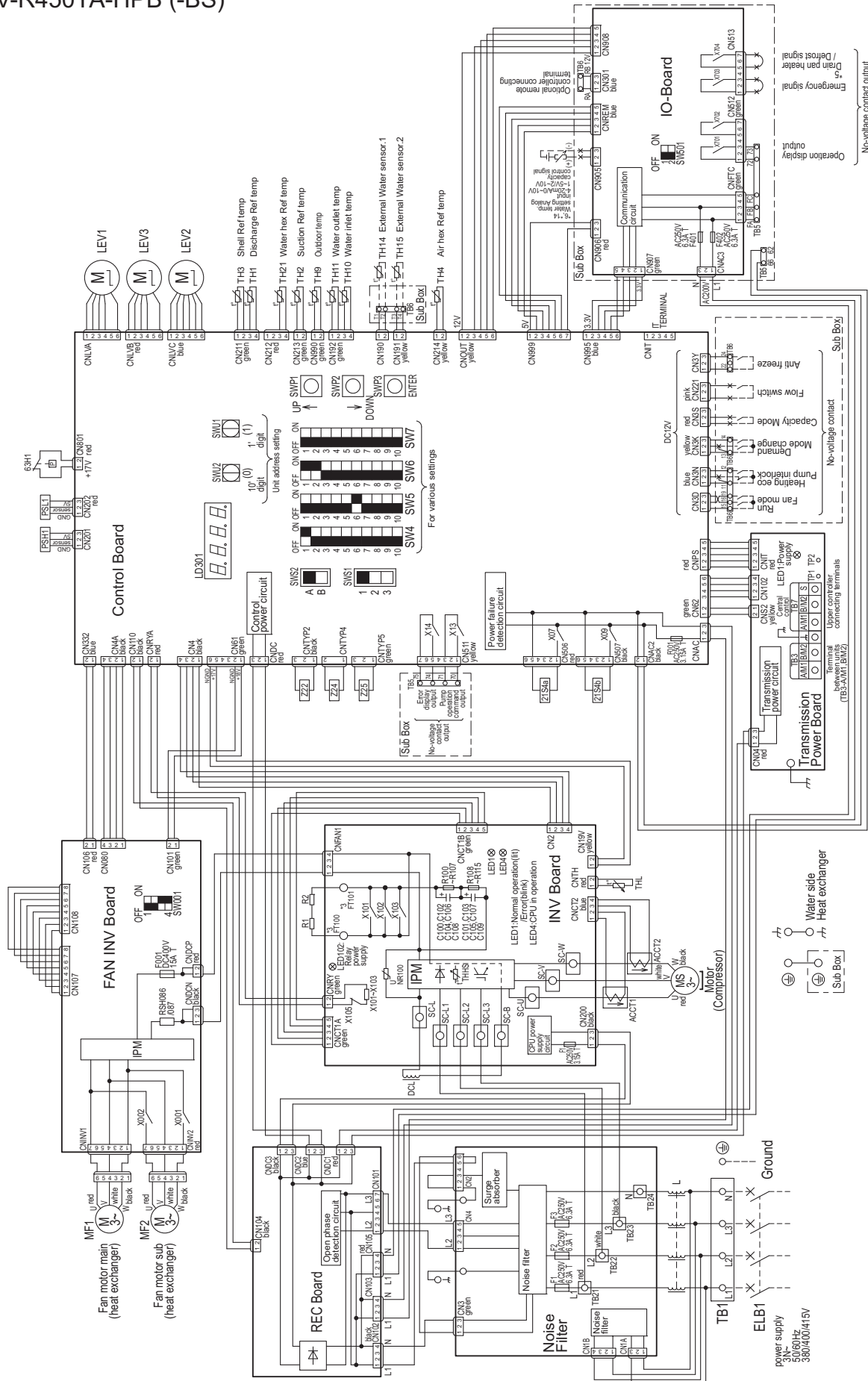


CAHV-R-YA-HPB

1. Product Specifications

1-4. Electrical Wiring Diagrams

CAHV-R450YA-HPB (-BS)



The specification of the product is for the improvement a previous notice and might change.

CAHV-R450YA-HPB (-BS)

CAHV-R-YA-HPB

- Note 1. The broken lines indicate the optional parts, field-supplied parts, and field work.
2. Dashed lines indicate Sub box.
 3. Faston terminals have a locking function.
Press the tab in the middle of the terminals to remove them.
Check that the terminals are securely locked in place after insertion.
 4. The symbols of the field connecting terminals are as follows.
○ : Terminal block × : Connection by cutting the short circuit wire
 5. Selects either Drain pan signal or Defrost signal by SW5 and SW6 settings.
(Item code 1056)
 6. Selects either Water temperature setting input signal or Capacity control input signal by SW5 and SW6 settings. (Item code 1051)
 7. Make sure to connect a pump interlock contact.
A short-circuit may cause abnormal stop or malfunctions.
 8. The preset temperature setting can be switched from the no-voltage contact or by setting time ranges.
 9. The method of input signal of operation can choose one of optional remote controller or no-voltage input.
 10. Leave a space of at least 5 cm between the low voltage external wiring (no-voltage contact input and remote controller wiring) and wiring of 100V or greater. Do not place them in the same conduit tube or cable as this will damage the circuit board.
 11. When cable is used for the control cable wiring, use a separate cable for the following wiring.
Using the same cable may cause malfunctions and damage to the unit.
(a) Optional remote controller wiring
(b) No-voltage contact input wiring
(c) No-voltage contact output wiring
(d) Remote water temperature setting
 12. Use a contact that takes 12VDC 1mA for no-voltage contact input.
 13. Need to select either Water temperature setting input signal.
Set the SW501 as shown in the table below.
- | | | |
|--------|---------|---------|
| | SW501-1 | SW501-2 |
| 4~20mA | ON | ON |
| 0~10V | OFF | OFF |
| 1~5V | OFF | ON |
| 2~10V | OFF | OFF |
14. Use a 4-20mA signal output device with insulation.
Feeding 30mA or more current may damage the circuit board.

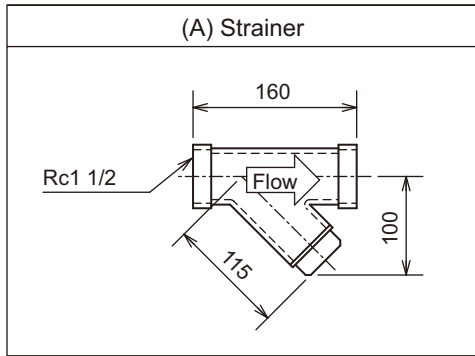
Symbol explanation	Symbol	Explanation
	ACCT1	AC current sensor
	ACCT2	DC reactor
	DCL	
	F1(Noise Filter)	
	F2(Noise Filter)	
	F3(Noise Filter)	
	F1(INV Board)	Fuse
	F001(FAN INV Board)	
	F001(Control Board)	
	F401	
	F402	
	LEV1.3	Electronic expansion valve (Main circuit)
	LEV2	Electronic expansion valve (Injection)
	MF1.2	Fan motor
	MS	Compressor motor
	PSH1	High pressure sensor
	PSL1	Low pressure sensor
	R1,R2	Electrical resistance
	21S4a	4-way valve Cooling/Heating switching
	21S4b	
	THL	DC reactor temperature
	TH1~4,9~11,21	Thermistor
	Z22,24,25	Function setting connector
	63H1	High pressure switch
	72C	Electromagnetic relay (Inverter main circuit)
	*TH14,15	Thermistor
	<ELB1>	Earth leakage breaker

* of symbol item is the optional parts, <> is field-supplied parts.

1. Product Specifications

1-5. Optional parts

CAHV-R450YA-HPB (-BS)



(A) Install the strainer at the water pipe inlet.

1-6. External-water temperature sensor TW-TH16

- Required parts for installing an external-water temperature sensor
 - External-water temperature sensor
 - Cable for connecting between the sensor and the unit*
 - Cable terminal for connecting to the sensor and the unit terminal block*
(Terminals for M4 screws × 4)** A) and B) are field-supplied.

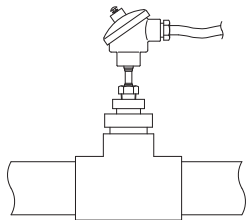
Cable specifications

Size	2-core, 1.25 mm ² or larger
Type	CVVS or CPEVS
Length	20 m

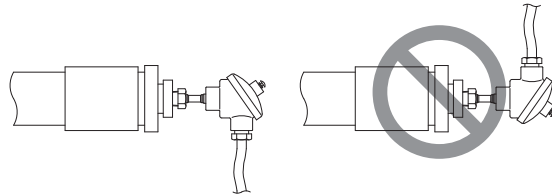
- Installing an external-water temperature sensor

As shown in the figures below, install the sensor at the merged part of water pipes or the load-side tank.

The sensor can be installed in either the vertical or the horizontal position. When installing the sensor in the horizontal position, make sure to place the cable-access-hole side down.



Vertical installation

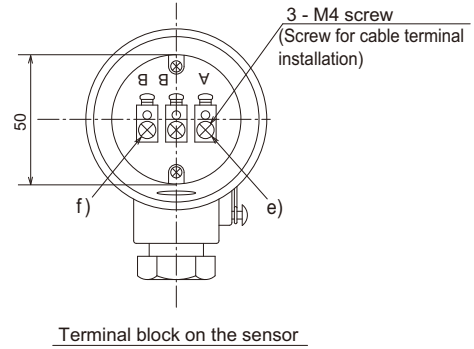
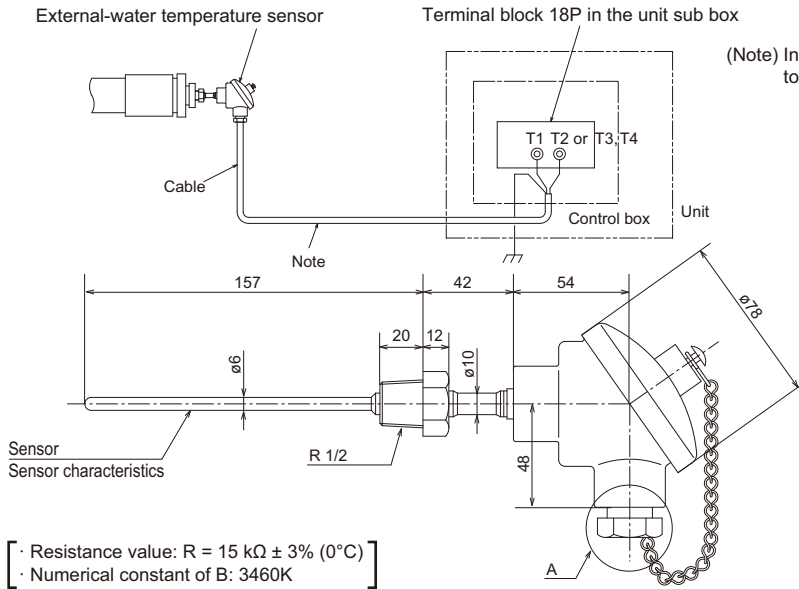


Horizontal installation

1. Product Specifications

3. Wiring for an external-water temperature sensor

As shown in the figures below, connect the cable to the external-water temperature sensor and the terminal block in the unit control box.



- Resistance value: $R = 15 \text{ k}\Omega \pm 3\% (0^\circ\text{C})$
- Numerical constant of B: 3460K

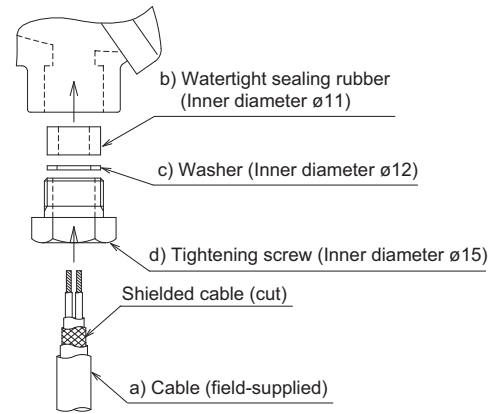
On the unit side, connect the sensor cable to the terminals T1 and T2 in the terminal block 18P in the unit sub box. Connect the shielded cable to the ground terminal.

On the sensor side, as shown in the figure at right, run the cable through d), c), and b), attach the field-supplied terminals for M4 screws to the cable, and then connect the terminals to the screws e) and f) (terminal A and B).

Cut the shielded cable and leave it unconnected.

(On the unit side, the shielded cable should be connected to the ground terminal already.)

Tighten the tightening screw d), and caulk the gap between the tightening screw d) and cable a) to prevent water leakage.



Enlarged view of area A: Cable installation

*1 In a multiple module connection system, install the temperature sensor where the cold/hot water from each module is sufficiently mixed to provide a representative temperature.

*2 The temperature sensor must be installed on a pipe between the outlet of the unit and the entrance to the load-side system.

2. Product Data

2-1. Capacity tables

2-1-1. Correction by temperature

CAHV-R450YA-HPB (-BS)

(1)-1 Efficiency Priority Mode (Operating capacity: 100% = 40.0 kW)

Capacity

		Intake air temperature °C																	
		-25	-20	-15	-10	-7	-5	0	2	5	7	10	16	20	25	30	35	40	43
Outlet water temperature °C	25	–	–	–	–	–	–	–	36.1	38.1	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
	35	–	21.3	24.9	29.7	32.5	34.3	35.6	36.1	36.9	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
	45	6.7	21.5	24.2	29.5	31.8	33.3	35.6	36.2	36.9	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
	55	6.8	21.9	25.3	29.5	31.8	33.4	35.6	36.2	37.2	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
	60	7.4	22.5	25.7	29.5	31.9	33.5	35.7	36.6	38.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
	65	8.0	23.5	26.3	30.5	32.8	34.2	36.1	36.8	37.9	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
	70	–	24.4	27.3	31.5	33.6	35.0	36.4	36.9	37.8	35.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0

This table shows the capacity when the relative humidity is 85%.

The intake wet-bulb temperature is fixed to 32°C when the intake dry-bulb temperature is 35°C or higher.

The difference between the outlet water temperature and the inlet water temperature is 5°C.

However, if a difference of 5°C cannot be secured, the lower limit flow rate shall be used.

Power input

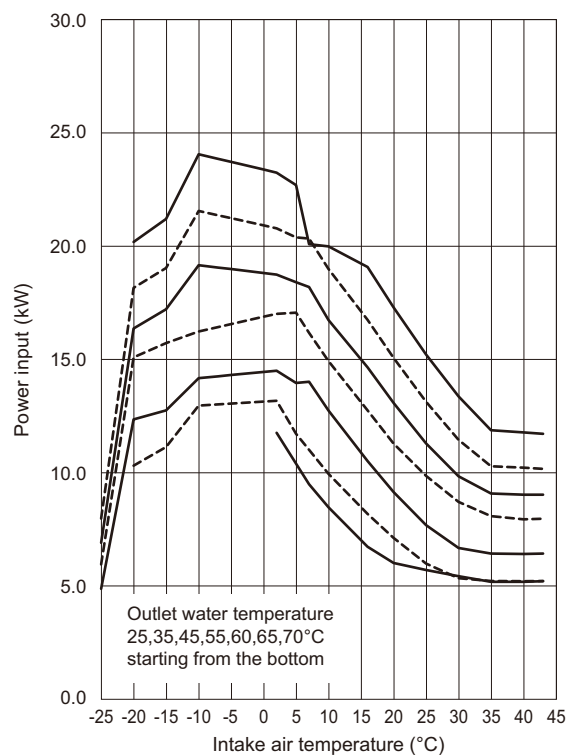
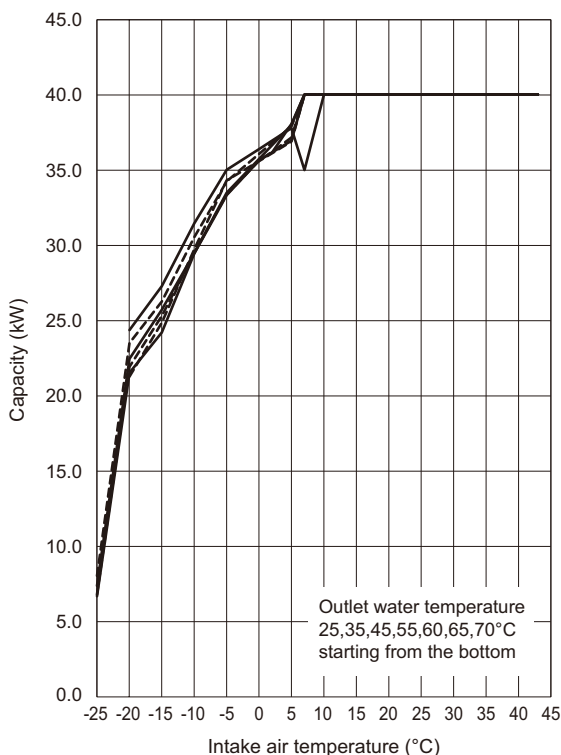
		Intake air temperature °C																	
		-25	-20	-15	-10	-7	-5	0	2	5	7	10	16	20	25	30	35	40	43
Outlet water temperature °C	25	–	–	–	–	–	–	–	11.8	10.4	9.5	8.5	6.8	6.0	5.7	5.5	5.2	5.2	5.2
	35	–	10.3	11.2	13.0	13.0	13.1	13.2	13.2	11.7	11.0	10.0	8.2	7.1	6.0	5.4	5.2	5.2	5.2
	45	4.9	12.4	12.8	14.2	14.3	14.3	14.5	14.5	14.0	14.0	12.8	10.5	9.2	7.7	6.7	6.5	6.4	6.4
	55	6.0	15.1	15.7	16.2	16.4	16.6	16.9	17.0	17.1	16.2	14.9	12.8	11.3	9.9	8.7	8.1	8.0	8.0
	60	6.9	16.4	17.2	19.2	19.1	19.0	18.8	18.8	18.4	18.2	16.7	14.7	13.1	11.3	9.9	9.1	9.0	9.0
	65	8.0	18.2	19.0	21.6	21.4	21.2	20.9	20.8	20.4	20.3	19.0	16.8	15.1	13.1	11.5	10.3	10.2	10.2
	70	–	20.2	21.2	24.1	23.9	23.7	23.4	23.3	22.7	20.1	20.0	19.1	17.3	15.2	13.4	11.9	11.8	11.7

This table shows the power input when the relative humidity is 85%.

The intake wet-bulb temperature is fixed to 32°C when the intake dry-bulb temperature is 35°C or higher.

The difference between the outlet water temperature and the inlet water temperature is 5°C.

However, if a difference of 5°C cannot be secured, the lower limit flow rate shall be used.



2. Product Data

(1)-2 Efficiency Priority Mode (Operating capacity: 75% = 30.0 kW)

Capacity

		Intake air temperature °C																	
		-25	-20	-15	-10	-7	-5	0	2	5	7	10	16	20	25	30	35	40	43
Outlet water temperature °C	25	-	-	-	-	-	-	-	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
	35	-	21.3	24.9	29.7	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
	45	6.7	21.5	24.2	29.5	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
	55	6.8	21.9	25.3	29.5	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
	60	7.4	22.5	25.7	29.5	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
	65	8.0	23.5	26.3	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
	70	-	24.4	27.3	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0

This table shows the capacity when the relative humidity is 85%.

The intake wet-bulb temperature is fixed to 32°C when the intake dry-bulb temperature is 35°C or higher.

The difference between the outlet water temperature and the inlet water temperature is 5°C.

However, if a difference of 5°C cannot be secured, the lower limit flow rate shall be used.

Power input

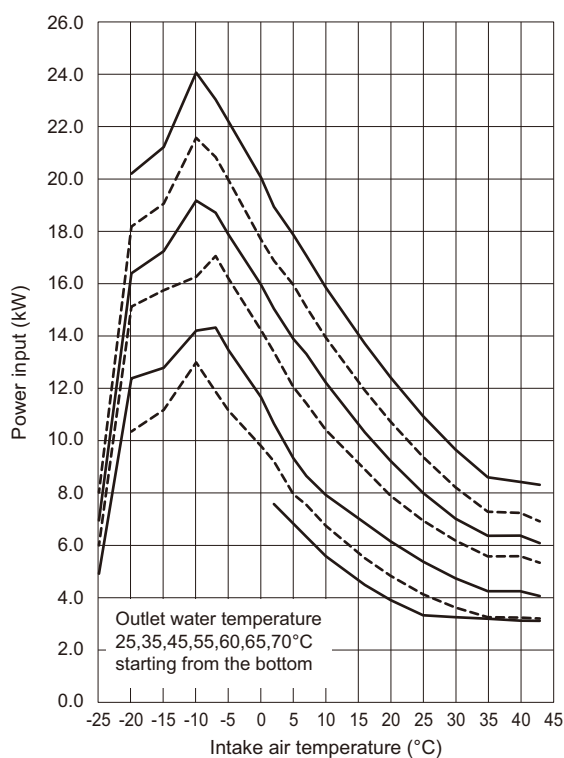
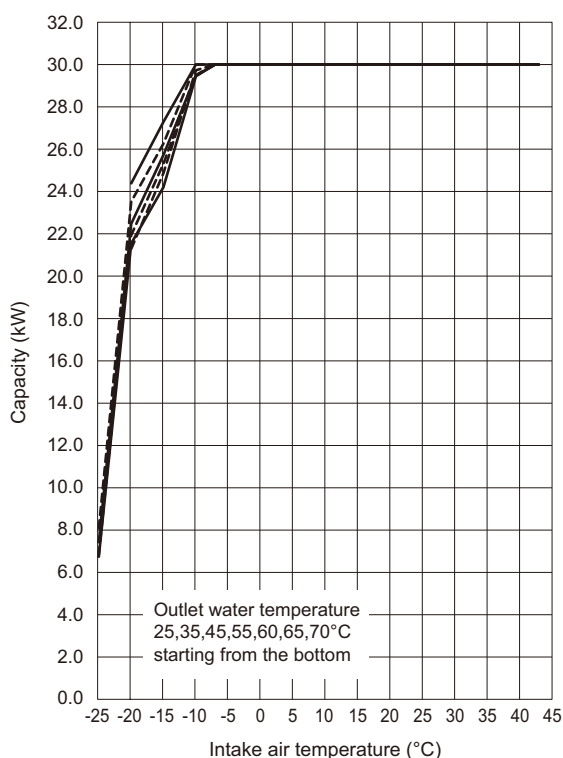
		Intake air temperature °C																	
		-25	-20	-15	-10	-7	-5	0	2	5	7	10	16	20	25	30	35	40	43
Outlet water temperature °C	25	-	-	-	-	-	-	-	7.6	6.8	6.3	5.6	4.5	3.9	3.3	3.2	3.2	3.1	3.1
	35	-	10.3	11.2	13.0	11.9	11.1	9.8	9.2	7.9	7.5	6.7	5.5	4.8	4.1	3.6	3.2	3.2	3.2
	45	4.9	12.4	12.8	14.2	14.3	13.4	11.6	10.6	9.3	8.6	7.9	6.8	6.1	5.4	4.7	4.2	4.2	4.0
	55	6.0	15.1	15.7	16.2	17.0	16.2	14.2	13.4	12.0	11.4	10.4	8.9	7.9	6.9	6.1	5.5	5.6	5.3
	60	6.9	16.4	17.2	19.2	18.7	17.9	15.9	15.0	13.9	13.3	12.2	10.3	9.2	8.0	7.0	6.3	6.3	6.1
	65	8.0	18.2	19.0	21.6	20.8	20.0	17.7	16.9	15.9	15.1	13.9	11.9	10.7	9.4	8.2	7.3	7.2	6.9
	70	-	20.2	21.2	24.1	23.0	22.2	20.0	18.9	17.9	17.1	15.8	13.7	12.4	10.9	9.6	8.6	8.4	8.3

This table shows the power input when the relative humidity is 85%.

The intake wet-bulb temperature is fixed to 32°C when the intake dry-bulb temperature is 35°C or higher.

The difference between the outlet water temperature and the inlet water temperature is 5°C.

However, if a difference of 5°C cannot be secured, the lower limit flow rate shall be used.



2. Product Data

(1)-3 Efficiency Priority Mode (Operating capacity: 50% = 20.0 kW)

Capacity

		Intake air temperature °C																	
		-25	-20	-15	-10	-7	-5	0	2	5	7	10	16	20	25	30	35	40	43
Outlet water temperature °C	25	-	-	-	-	-	-	-	-	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
	35	-	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
	45	6.7	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
	55	6.8	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
	60	7.4	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
	65	8.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
	70	-	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0

This table shows the capacity when the relative humidity is 85%.

The intake wet-bulb temperature is fixed to 32°C when the intake dry-bulb temperature is 35°C or higher.

The difference between the outlet water temperature and the inlet water temperature is 5°C.

However, if a difference of 5°C cannot be secured, the lower limit flow rate shall be used.

Power input

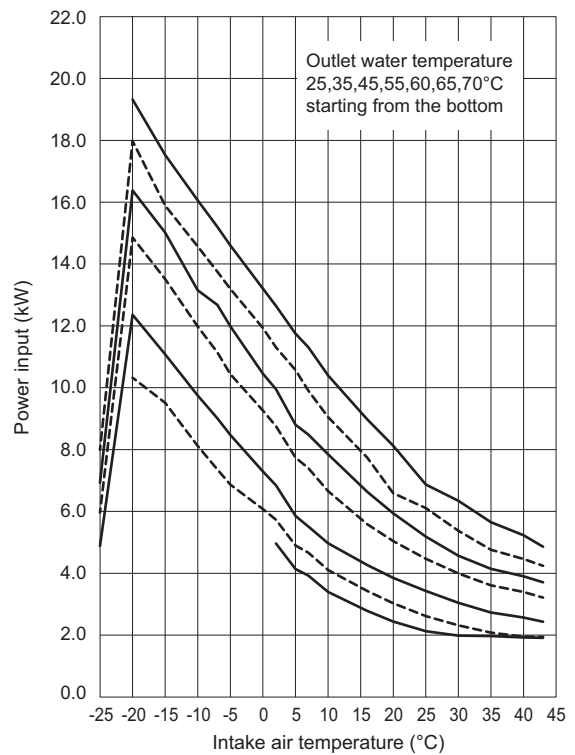
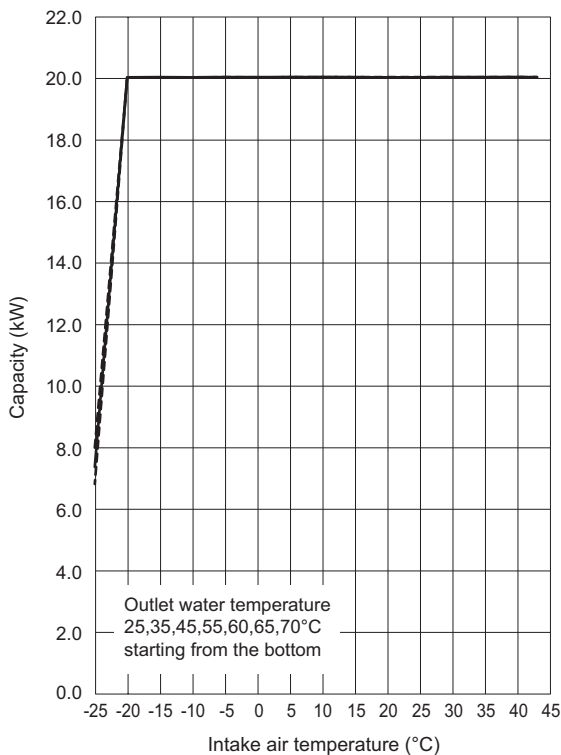
		Intake air temperature °C																	
		-25	-20	-15	-10	-7	-5	0	2	5	7	10	16	20	25	30	35	40	43
Outlet water temperature °C	25	-	-	-	-	-	-	-	5.0	4.1	3.9	3.4	2.8	2.4	2.1	2.0	2.0	1.9	1.9
	35	-	10.3	9.5	8.1	7.4	6.9	6.1	5.7	4.9	4.7	4.1	3.4	3.0	2.6	2.3	2.1	2.0	1.9
	45	4.9	12.4	11.1	9.8	9.0	8.5	7.3	6.8	5.9	5.5	5.0	4.3	3.9	3.4	3.0	2.7	2.6	2.4
	55	6.0	15.1	13.5	12.0	11.1	10.4	9.3	8.8	7.7	7.4	6.7	5.6	5.0	4.5	4.0	3.6	3.4	3.2
	60	6.9	16.4	15.0	13.2	12.7	12.0	10.5	10.0	8.8	8.5	7.8	6.6	5.9	5.2	4.6	4.1	3.9	3.7
	65	8.0	18.0	15.9	14.6	13.8	13.2	11.9	11.3	10.6	9.9	9.0	7.7	6.6	6.1	5.4	4.8	4.5	4.2
	70	-	19.3	17.5	16.1	15.2	14.6	13.2	12.6	11.7	11.3	10.4	9.0	8.1	6.9	6.3	5.7	5.2	4.9

This table shows the power input when the relative humidity is 85%.

The intake wet-bulb temperature is fixed to 32°C when the intake dry-bulb temperature is 35°C or higher.

The difference between the outlet water temperature and the inlet water temperature is 5°C.

However, if a difference of 5°C cannot be secured, the lower limit flow rate shall be used.



2. Product Data

(1)-4 Efficiency Priority Mode (Operating capacity: 25% = 10.0 kW)

Capacity

		Intake air temperature °C																		
		-25	-20	-15	-10	-7	-5	0	2	5	7	10	16	20	25	30	35	40	43	
Outlet water temperature °C	25	-	-	-	-	-	-	-	-	10.0	10.0	10.0	10.0	10.7	12.1	14.0	15.7	17.6	19.4	20.6
	35	-	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.4	11.7	13.6	15.4	17.3	18.4	19.3
	45	6.7	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.9	12.3	13.9	15.4	16.6	17.5
	55	6.8	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	11.1	12.4	13.9	15.0	15.8
	60	7.4	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.2	11.7	13.0	14.1	14.9
	65	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.6	12.2	13.3	14.0
	70	-	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.7	12.2	13.0

This table shows the capacity when the relative humidity is 85%.

The intake wet-bulb temperature is fixed to 32°C when the intake dry-bulb temperature is 35°C or higher.

The difference between the outlet water temperature and the inlet water temperature is 5°C.

However, if a difference of 5°C cannot be secured, the lower limit flow rate shall be used.

Power input

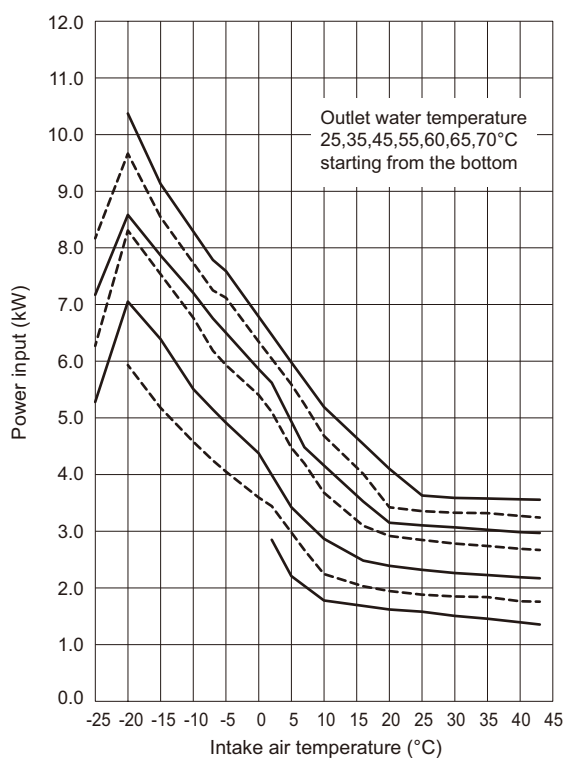
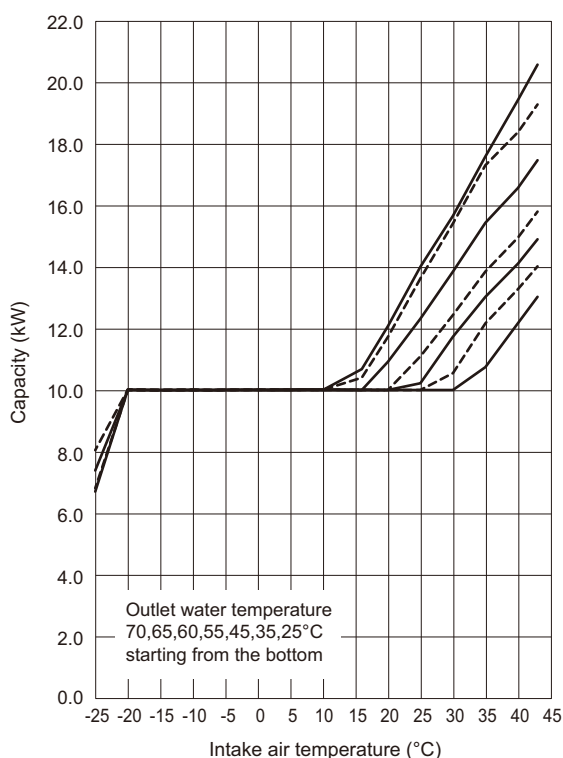
		Intake air temperature °C																		
		-25	-20	-15	-10	-7	-5	0	2	5	7	10	16	20	25	30	35	40	43	
Outlet water temperature °C	25	-	-	-	-	-	-	-	-	2.9	2.2	2.0	1.8	1.7	1.6	1.6	1.5	1.5	1.4	1.4
	35	-	5.9	5.2	4.6	4.2	4.1	3.6	3.4	3.0	2.7	2.2	2.0	1.9	1.9	1.9	1.8	1.8	1.8	1.8
	45	5.3	7.1	6.4	5.5	5.1	4.9	4.4	4.0	3.4	3.2	2.9	2.5	2.4	2.3	2.3	2.2	2.2	2.2	2.2
	55	6.3	8.3	7.5	6.8	6.2	5.9	5.4	5.1	4.5	4.2	3.7	3.1	2.9	2.8	2.8	2.7	2.7	2.7	2.7
	60	7.2	8.6	7.9	7.2	6.8	6.5	5.9	5.6	4.9	4.5	4.2	3.5	3.2	3.1	3.1	3.0	3.0	3.0	3.0
	65	8.2	9.7	8.5	7.7	7.2	7.1	6.3	6.0	5.6	5.2	4.7	4.0	3.4	3.4	3.3	3.3	3.3	3.3	3.2
	70	-	10.4	9.1	8.3	7.8	7.6	6.8	6.5	6.0	5.7	5.2	4.5	4.1	3.6	3.6	3.6	3.6	3.6	3.6

This table shows the power input when the relative humidity is 85%.

The intake wet-bulb temperature is fixed to 32°C when the intake dry-bulb temperature is 35°C or higher.

The difference between the outlet water temperature and the inlet water temperature is 5°C.

However, if a difference of 5°C cannot be secured, the lower limit flow rate shall be used.



2. Product Data

(1)-5 Efficiency Priority Mode (Operating capacity: Lower limit)

Capacity

		Intake air temperature °C																	
		-25	-20	-15	-10	-7	-5	0	2	5	7	10	16	20	25	30	35	40	43
Outlet water temperature °C	25	-	-	-	-	-	-	-	6.7	7.5	8.0	8.8	10.7	12.1	14.0	15.7	17.6	19.4	20.6
	35	-	2.1	3.1	4.1	4.7	5.2	6.2	6.7	7.4	7.8	8.6	10.4	11.7	13.6	15.4	17.3	18.4	19.3
	45	2.3	2.3	2.9	3.8	4.3	4.8	6.0	6.5	7.3	7.9	8.5	9.9	10.9	12.3	13.9	15.4	16.6	17.5
	55	2.4	2.2	2.7	3.6	4.1	4.5	5.3	5.7	6.2	6.5	7.3	8.7	9.8	11.1	12.4	13.9	15.0	15.8
	60	2.4	2.2	2.6	3.4	3.9	4.2	4.9	5.1	5.6	6.0	6.5	7.8	8.8	10.2	11.7	13.0	14.1	14.9
	65	2.4	2.2	2.5	3.2	3.5	3.8	4.6	4.7	5.1	5.4	5.8	7.0	7.9	9.1	10.6	12.2	13.3	14.0
	70	-	2.2	2.3	2.8	3.2	3.4	4.2	4.3	4.5	4.8	5.2	6.1	7.0	8.1	9.3	10.7	12.2	13.0

This table shows the capacity when the relative humidity is 85%.

The intake wet-bulb temperature is fixed to 32°C when the intake dry-bulb temperature is 35°C or higher.

The difference between the outlet water temperature and the inlet water temperature is 5°C.

However, if a difference of 5°C cannot be secured, the lower limit flow rate shall be used.

Power input

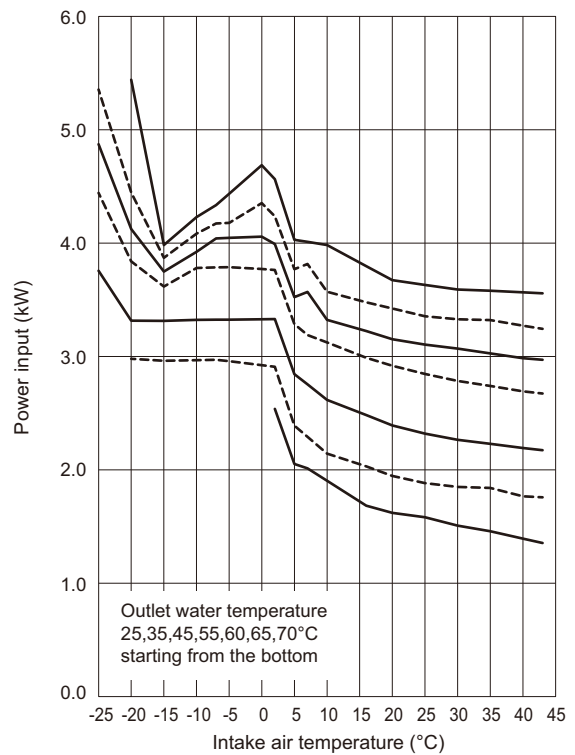
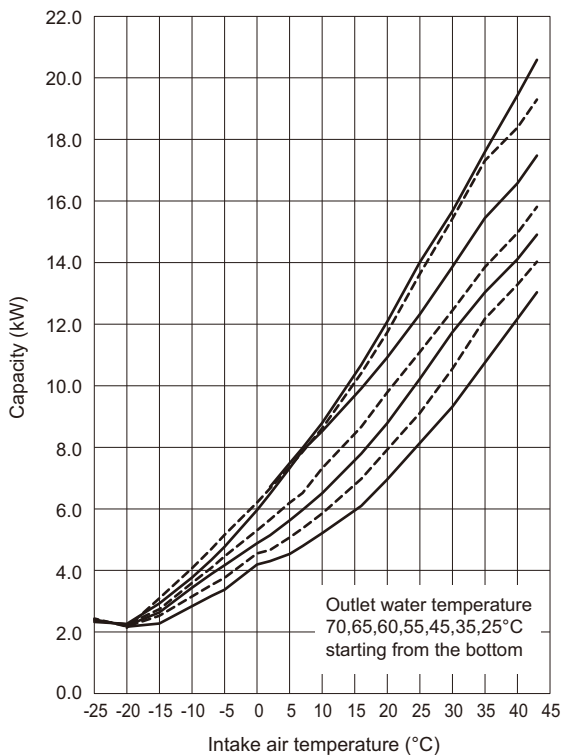
		Intake air temperature °C																	
		-25	-20	-15	-10	-7	-5	0	2	5	7	10	16	20	25	30	35	40	43
Outlet water temperature °C	25	-	-	-	-	-	-	-	2.5	2.1	2.0	1.9	1.7	1.6	1.6	1.5	1.5	1.4	1.4
	35	-	3.0	3.0	3.0	3.0	3.0	2.9	2.9	2.4	2.3	2.1	2.0	1.9	1.9	1.9	1.8	1.8	1.8
	45	3.8	3.3	3.3	3.3	3.3	3.3	3.3	3.3	2.8	2.8	2.6	2.5	2.4	2.3	2.3	2.2	2.2	2.2
	55	4.4	3.8	3.6	3.8	3.8	3.8	3.8	3.8	3.3	3.2	3.1	3.0	2.9	2.8	2.8	2.7	2.7	2.7
	60	4.9	4.1	3.7	3.9	4.0	4.0	4.1	4.0	3.5	3.6	3.3	3.2	3.2	3.1	3.1	3.0	3.0	3.0
	65	5.4	4.4	3.9	4.1	4.2	4.2	4.4	4.2	3.8	3.8	3.6	3.5	3.4	3.4	3.3	3.3	3.3	3.2
	70	-	5.4	4.0	4.2	4.3	4.4	4.7	4.6	4.0	4.0	4.0	3.8	3.7	3.6	3.6	3.6	3.6	3.6

This table shows the power input when the relative humidity is 85%.

The intake wet-bulb temperature is fixed to 32°C when the intake dry-bulb temperature is 35°C or higher.

The difference between the outlet water temperature and the inlet water temperature is 5°C.

However, if a difference of 5°C cannot be secured, the lower limit flow rate shall be used.



2. Product Data

(2) Capacity Priority Mode

Capacity

		Intake air temperature °C																	
		-25	-20	-15	-10	-7	-5	0	2	5	7	10	16	20	25	30	35	40	43
Outlet water temperature °C	25	—	—	—	—	—	—	—	36.1	42.3	46.5	48.1	51.4	52.1	52.9	53.7	54.4	54.5	54.6
	35	—	21.3	24.9	29.7	32.5	34.3	35.6	36.1	40.3	43.0	46.4	53.0	54.1	55.1	56.7	58.1	58.9	59.5
	45	6.7	21.5	24.2	29.5	31.8	33.3	35.6	36.2	36.9	40.1	43.5	50.3	55.6	58.5	60.3	61.9	62.7	63.3
	55	6.8	21.9	25.3	29.5	31.8	33.4	35.6	36.2	37.2	40.6	43.5	49.3	54.4	60.7	63.0	64.9	65.7	66.2
	60	7.4	22.5	25.7	29.5	31.9	33.5	35.7	36.6	38.0	40.9	42.4	45.4	49.8	56.1	61.0	65.8	66.5	67.1
	65	8.0	23.5	26.3	30.5	32.8	34.2	36.1	36.8	37.9	41.0	42.3	44.8	49.1	55.4	60.8	66.3	66.9	67.4
	70	—	24.4	27.3	31.5	33.6	35.0	36.4	36.9	37.8	40.8	41.9	44.1	48.3	54.3	57.8	61.4	65.4	67.7

This table shows the capacity when the relative humidity is 85%.

The intake wet-bulb temperature is fixed to 32°C when the intake dry-bulb temperature is 35°C or higher.

The difference between the outlet water temperature and the inlet water temperature is 5°C.

However, if a difference of 5°C cannot be secured, the lower limit flow rate shall be used.

Power input

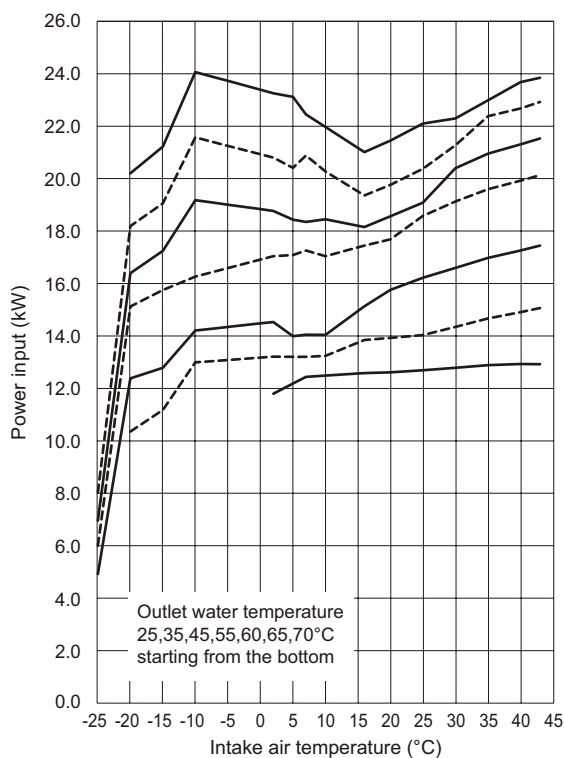
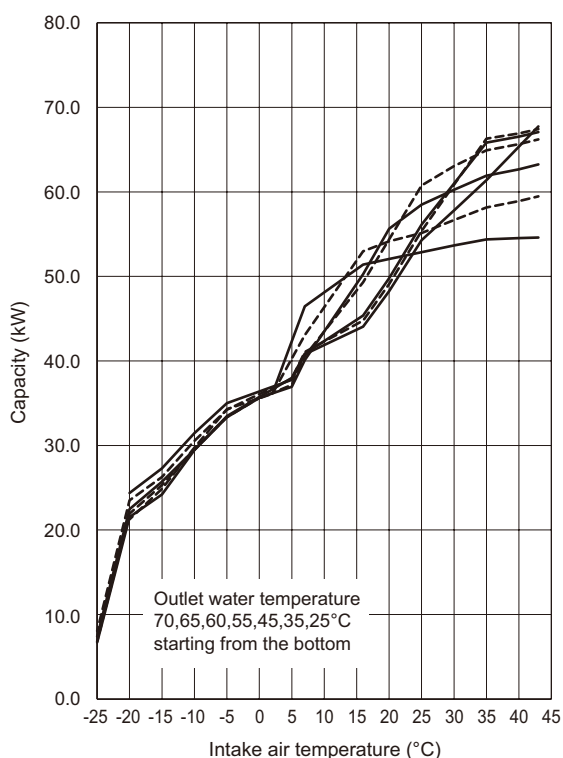
		Intake air temperature °C																	
		-25	-20	-15	-10	-7	-5	0	2	5	7	10	16	20	25	30	35	40	43
Outlet water temperature °C	25	—	—	—	—	—	—	—	11.8	12.2	12.4	12.5	12.6	12.6	12.7	12.8	12.9	12.9	12.9
	35	—	10.3	11.2	13.0	13.0	13.1	13.2	13.2	13.2	13.2	13.2	13.8	13.9	14.0	14.3	14.7	14.9	15.1
	45	4.9	12.4	12.8	14.2	14.3	14.3	14.5	14.5	14.0	14.0	14.0	15.1	15.7	16.2	16.6	17.0	17.2	17.4
	55	6.0	15.1	15.7	16.2	16.4	16.6	16.9	17.0	17.1	17.2	17.0	17.4	17.7	18.6	19.1	19.6	19.9	20.1
	60	6.9	16.4	17.2	19.2	19.1	19.0	18.8	18.8	18.4	18.3	18.4	18.1	18.6	19.1	20.4	20.9	21.3	21.5
	65	8.0	18.2	19.0	21.6	21.4	21.2	20.9	20.8	20.4	20.9	20.3	19.4	19.8	20.4	21.3	22.4	22.7	22.9
	70	—	20.2	21.2	24.1	23.9	23.7	23.4	23.3	23.1	22.4	22.0	21.0	21.4	22.1	22.3	23.0	23.7	23.8

This table shows the power input when the relative humidity is 85%.

The intake wet-bulb temperature is fixed to 32°C when the intake dry-bulb temperature is 35°C or higher.

The difference between the outlet water temperature and the inlet water temperature is 5°C.

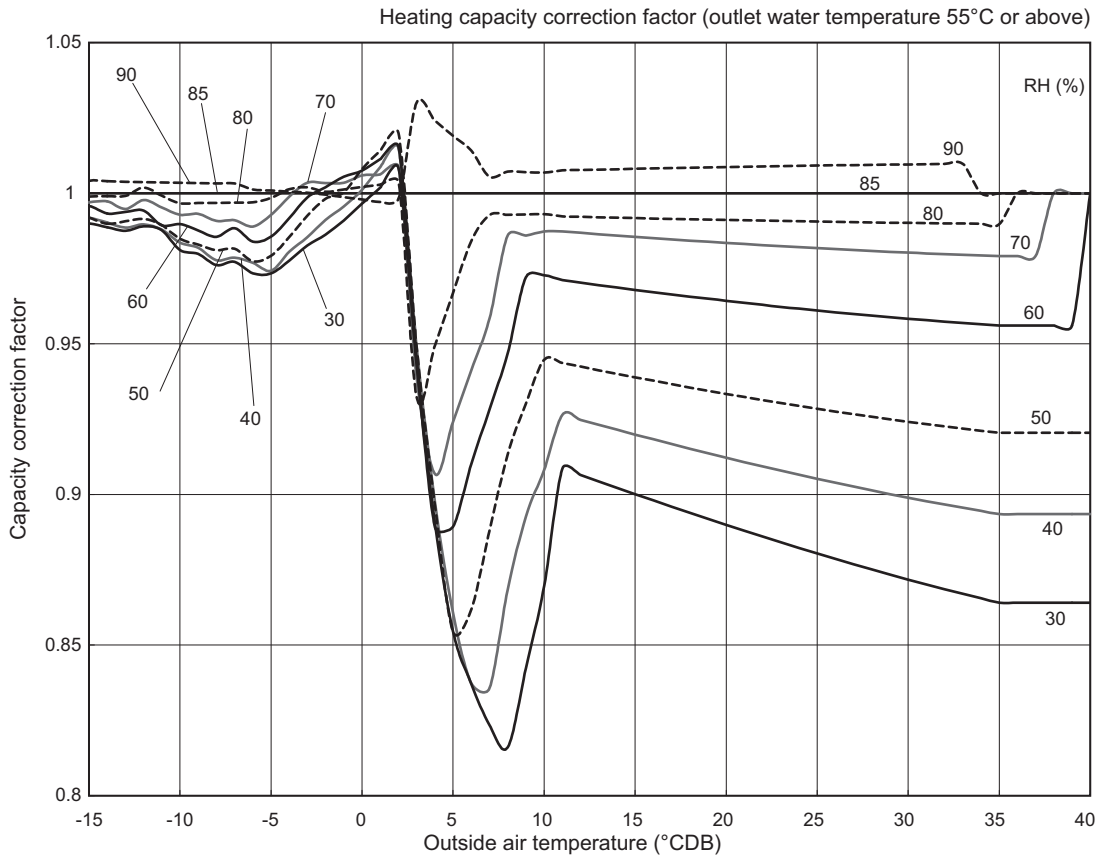
However, if a difference of 5°C cannot be secured, the lower limit flow rate shall be used.



2. Product Data

2-1-2. Correction by relative humidity

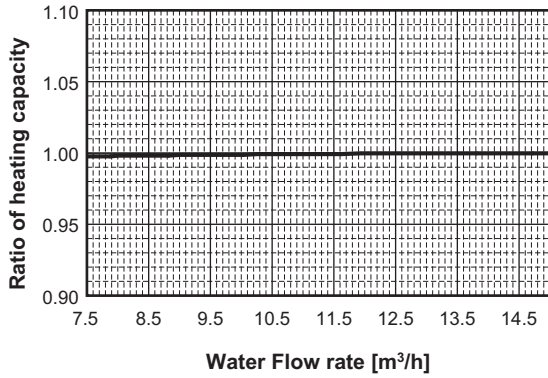
CAHV-R450YA-HPB (-BS)



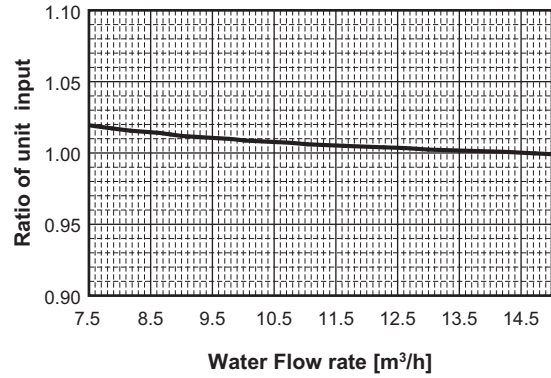
2. Product Data

2-1-3. Correction by water flow rate

CAHV-R450YA-HPB (-BS)



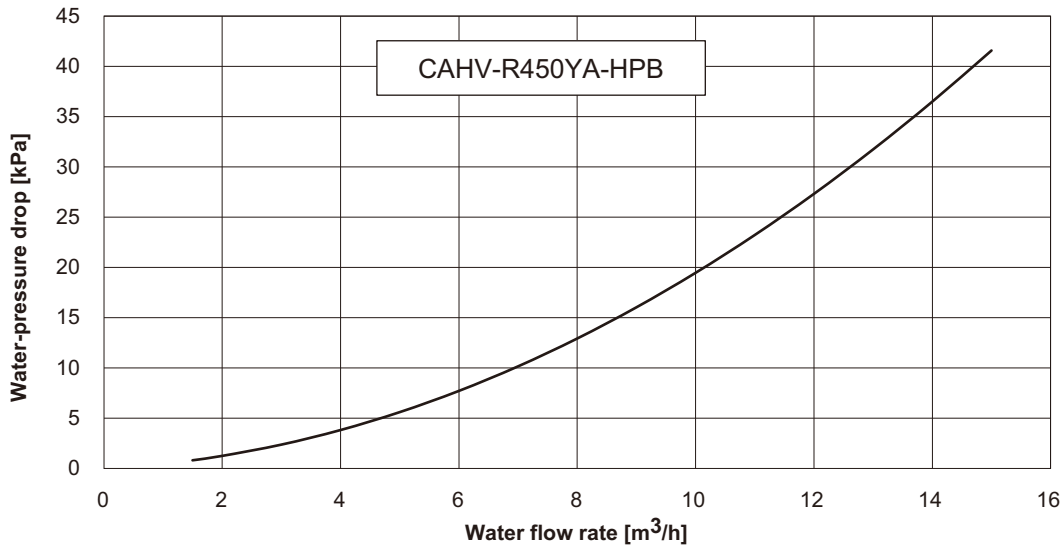
*Conditions Outdoor temperature 0°C
Intake water temperature 65°C
Frequency of compressor 100Hz



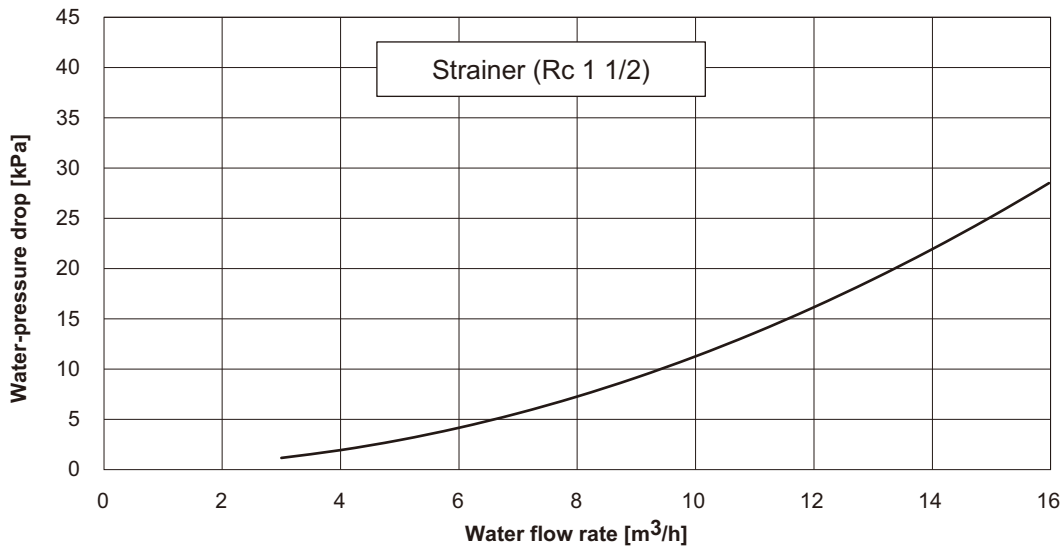
*Conditions Outdoor temperature 0°C
Intake water temperature 50°C
Frequency of compressor 100Hz

2-1-4. Water pressure drop

CAHV-R450YA-HPB (-BS)



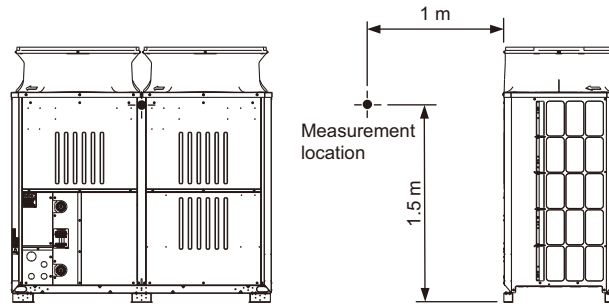
(When the optional strainer is used)



2. Product Data

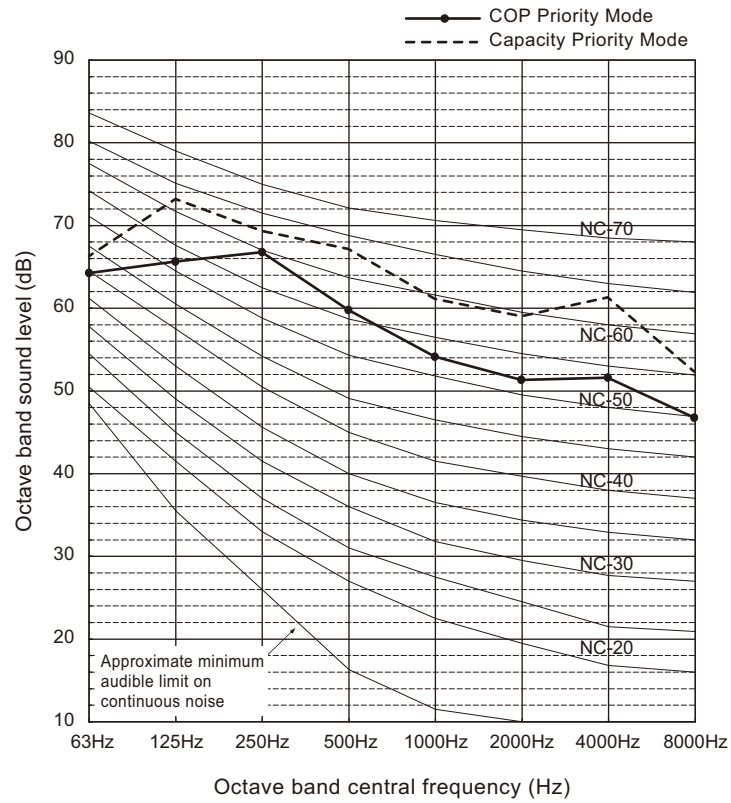
2-2. Sound pressure levels

Measurement condition
CAHV-R450YA-HPB (-BS)



Sound Pressure Level: 64/72 dB (COP Priority Mode/Capacity Priority Mode)

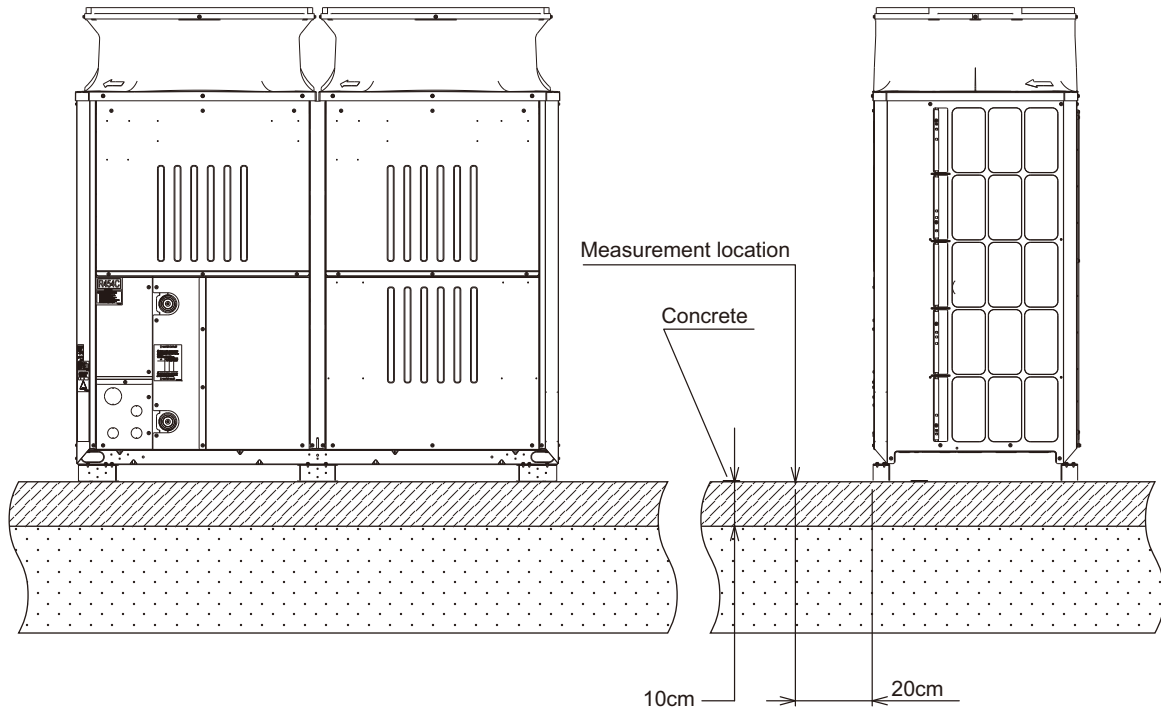
Operation condition... COP Priority Mode: 7°CDB/6°CWB, Inlet water temp.: 40°C, Outlet water temp. 45°C
Capacity Priority Mode: 7°CDB/6°CWB, Inlet water temp.: 65°C, Outlet water temp. 70°C



2. Product Data

2-3. Vibration levels

CAHV-R450YA-HPB (-BS)



Model	Vibration Levels [dB]
CAHV-R450YA-HPB (-BS)	47 or less

3. Installation

3-1. Selecting the Installation Site

3-1-1. Installation Conditions

Select the installation site in consultation with the client.

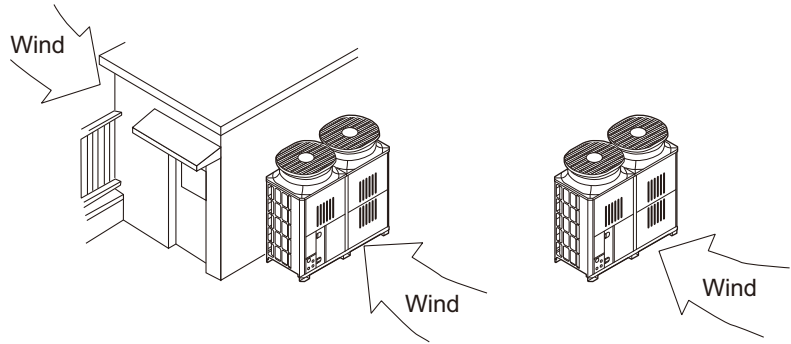
Select a site to install the outdoor unit that meets the following conditions:

- ♦The unit will not be subject to heat from other heat sources.
- ♦The noise from the unit will not be a problem.
- ♦The unit will not be exposed to strong winds.
- ♦Water from the unit can be drained properly.
- ♦The space requirements as shown in 3-1-2. are met.

1. Providing protection against winds

Using the figures at right as a reference, provide adequate protection against winds.

A unit installed alone is vulnerable to strong winds. Select the installation site carefully to minimize the effect of winds. When installing a unit in a place where the wind always blows from the same direction, install the unit so that the outlet faces away from the direction of the wind.



- Install the outdoor unit in a place where it is not exposed to direct wind, such as behind a building.

- Install the outdoor unit so that the outlet/inlet faces away from the wind.

2. Cold Climate Installation

Observe the following when installing the units in areas where snow or strong winds prevail.

- ♦Avoid direct exposure to rain, winds, and snow.
- ♦Icicles that may form under the foundation can fall and inflict personal injury or property damage. Select the installation site carefully to reduce these risks, especially when installing the unit on a roof.
- ♦If the units are installed in the direct line of rain, winds, or snow, install snow hoods (on both the discharge and suction ducts). Use a snow net or snow fence as necessary to protect the unit.
- ♦Install the unit on a base approximately twice as high as the expected snowfall.
- ♦If the unit is continuously operated for a long time with the outside air temperature below the freezing point, install a heater at the base of the unit to prevent the water from freezing at the unit bottom.
- ♦Install snow hoods in regions where the outdoor temperature is -10°C or below.

3. Installation

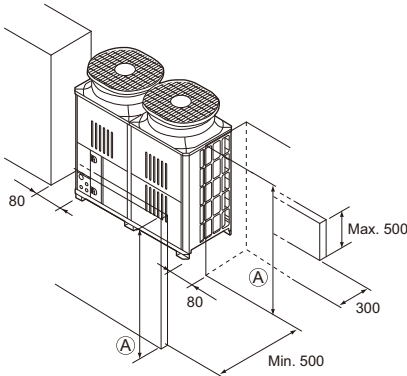
3-1-2. Installation space requirements

1. Single unit installation

Secure enough space around the unit as shown in the figures below.

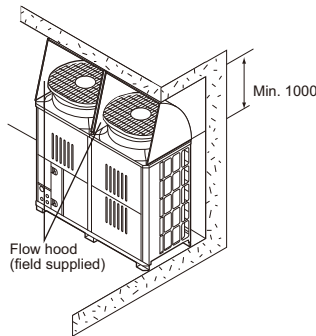
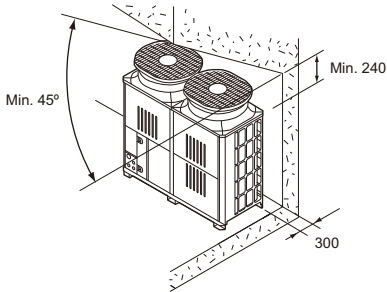
(1) Walls around the unit do not exceed the height limit.

<Unit: mm>

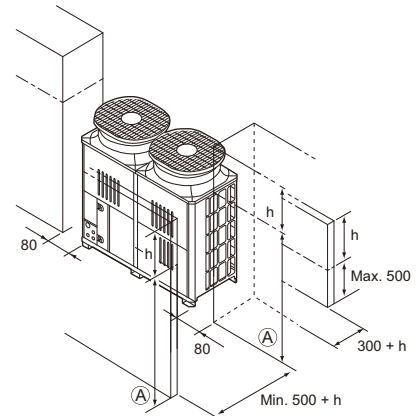
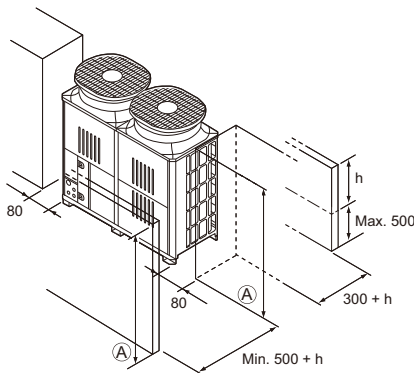
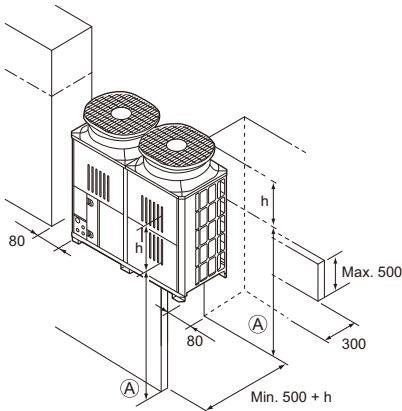


Ⓐ Walls are lower than the unit's height.

(2) There is a wall above the unit.

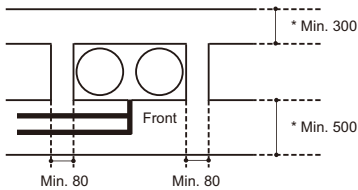


(3) One or more of the walls around the unit are taller than the maximum allowable height <h>.

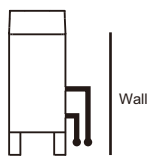


Ⓐ Walls are lower than the unit's height.

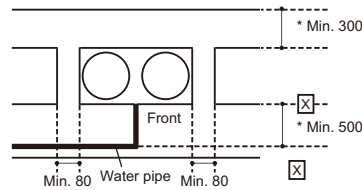
(4) Water pipe installation



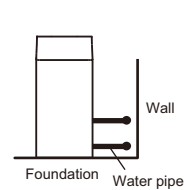
<Top view>



<Side view>



<Top view>



<Side view>

Leave a space of at least 500 between the unit and the water pipe if it is not possible to install the unit on a raised foundation. (See X in the figure.)

3. Installation

2. Grouped and side-by-side installation

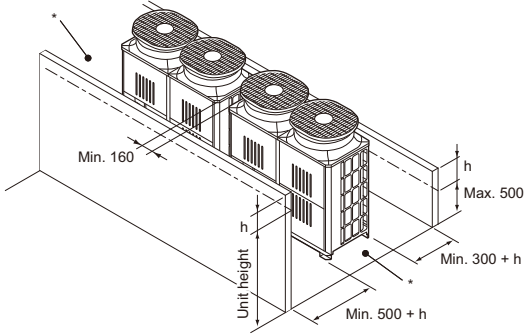
When multiple units are installed adjacent to each other, allow enough space for air circulation and a walk way between groups of units as shown in the figures below.

* Leave both sides of each group of units open.

As with individual installation, if the wall height exceeds the height limit, widen the space in the front and the back of a given group of units by the amount that exceeds the limit (labeled $<h>$ in the figure).

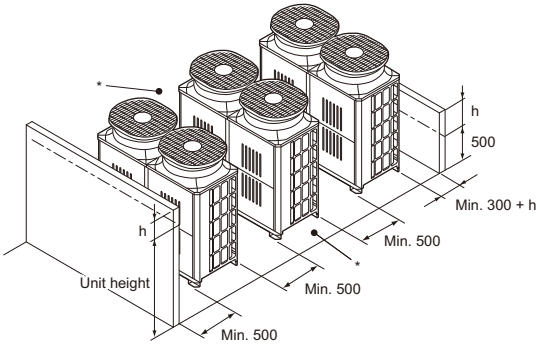
(1) Side-by-side installation

<Unit: mm>

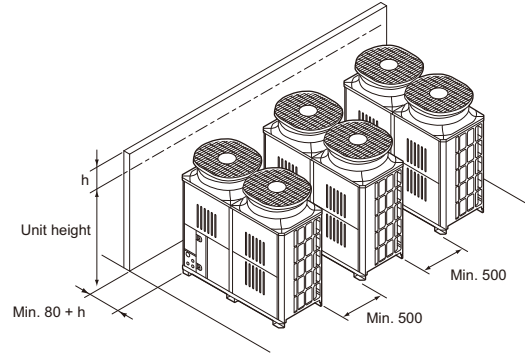


(2) Face-to-face installation

- There are walls in the back and the front of a given group of units.

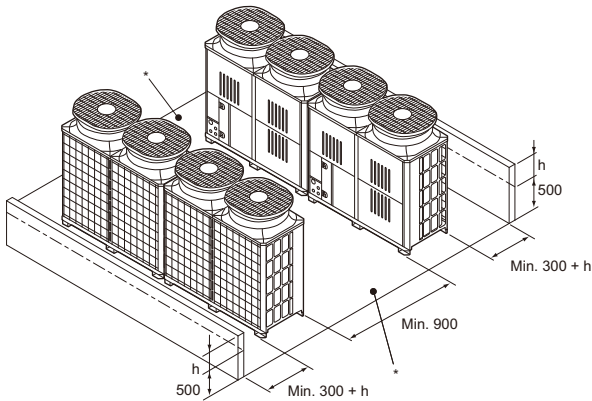


- There is a wall on one side.

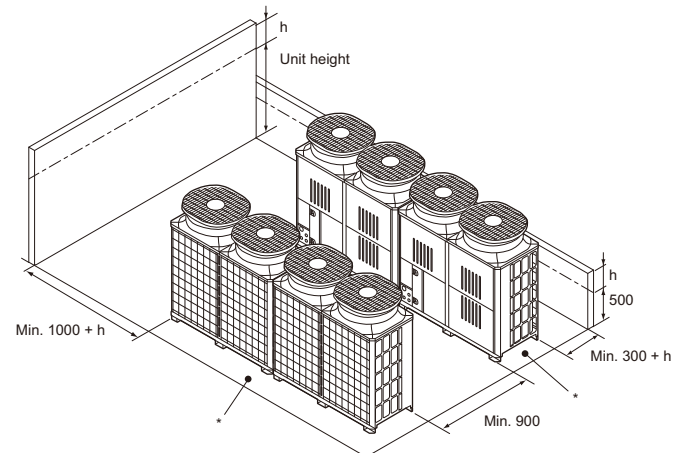


(3) Combination of face-to-face and side-by-side installations

- There are walls in the back and the front of a given group of units.



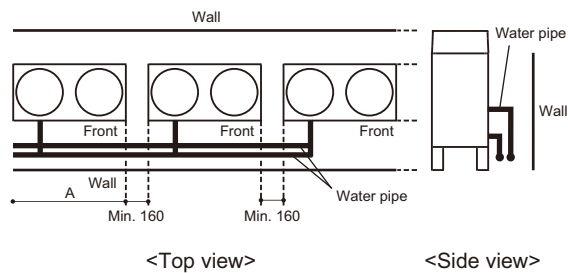
- There is a wall on one side and either the front or the back of a given group of unit.



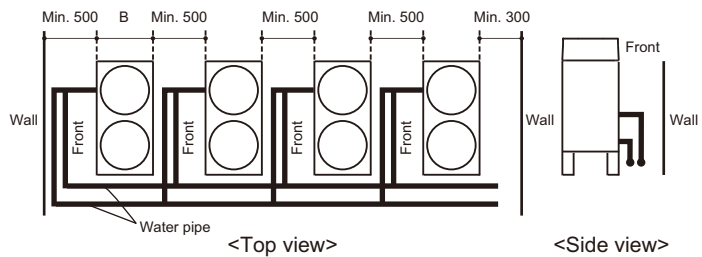
3. Installation

(4) Water pipe installation

Pattern A



Pattern B



If the product width (labeled A in the figure) times the number of units that are installed side by side exceeds 6 m, leave a space of 1000 mm between each block. Each block is defined as a group of units that fit within 6 m.

If the product depth (labeled B in the figure) times the number of units that are installed in rows exceeds 6 m, leave a space of 1000 mm between each block. Each block is defined as a group of units that fit within 6 m.

3. Required airflow rate for the unit

Unit: m³/min

Model	Standard airflow rate	Minimum airflow rate	Allowable external static pressure (Unit: Pa)
CAHV-R450YA-HPB (-BS)	150 × 2	65 × 2	10

3. Installation

3-2. Unit Installation

Units should be installed only by personnel certified by Mitsubishi Electric.

- ♦ Securely fix the unit with bolts to keep the unit from falling down during earthquakes or due to strong winds.
- ♦ Install the unit on a foundation made of concrete or iron.
- ♦ Noise and vibrations from the unit may be transmitted through the floor and walls. Provide adequate protection against noise and vibration.
- ♦ Build the foundation in such way that the corners of the installation legs are securely supported as shown in the figure below. When using rubber vibration isolators, make sure they are large enough to cover the entire width of the unit's legs. If the corners of the legs are not firmly seated, the legs may bend.
- ♦ The projecting length of the anchor bolt should be less than 30 mm.
- ♦ This unit is not designed to be installed using hole-in anchor bolts unless brackets are used to support the four corners of the unit.
- ♦ The legs on the unit are detachable.
- ♦ Detaching the legs
Loosen the three screws on the legs to detach each leg (two each in the front and back). If the finish coat becomes damaged when detaching the legs, be sure to touch it up.
- ♦ With some types of installation, unit vibration and sound will be transmitted to the floors and walls. Excessive vibrations can damage the pipes, resulting in refrigerant gas leakage. Take measures to prevent vibration (such as using anti-vibration rubber pads).

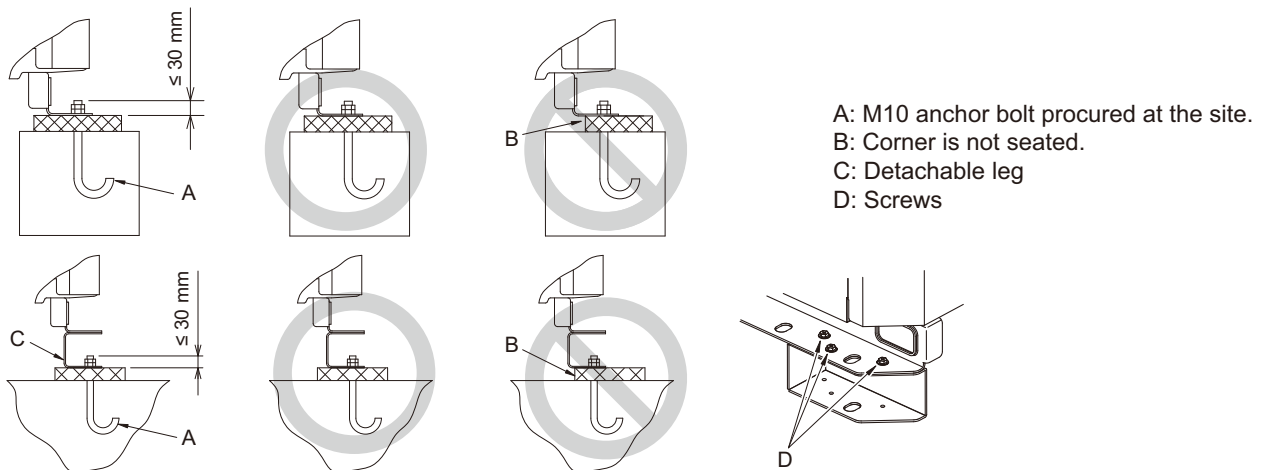
⚠ WARNING

- ♦ **Install the unit in accordance with the instructions to minimize the risk of damage from earthquakes and strong winds.**
 - Improper installation will cause the unit to topple, resulting in serious injury.
 - To reduce the vibration of the unit operation, irrespective of the cause of the vibration such as earthquakes and strong winds, perform the foundation work in accordance with the installation instructions (including the instructions for installing anti-vibration rubber pads) provided in this section.
- ♦ **The unit must be securely installed on a structure that can sustain its weight.**
 - Failure to do so will cause the unit to fall, resulting in serious injury. Abnormal vibrations that result from improper installation can generate abnormal sound and damage the pipes, resulting in refrigerant gas leakage.
 - Take adequate measures against typhoon winds and earthquakes so that the unit will not fall or tip over. Consult the local specialists for safety measures to be taken.

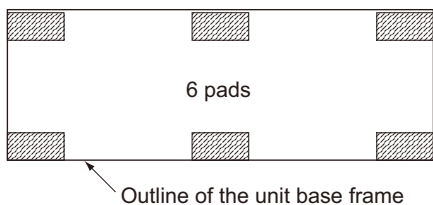
When building the foundation, take the floor strength, water drainage during operation, and piping and wiring routes into consideration.

Precautions for routing the pipes and wires underneath the unit without detachable legs

When routing the pipes and wires underneath the unit, make sure that the foundation will not block the piping access holes. Also, make sure the foundation is at least 100 mm high so that the piping can pass under the unit.



(1) Position of anti-vibration pads



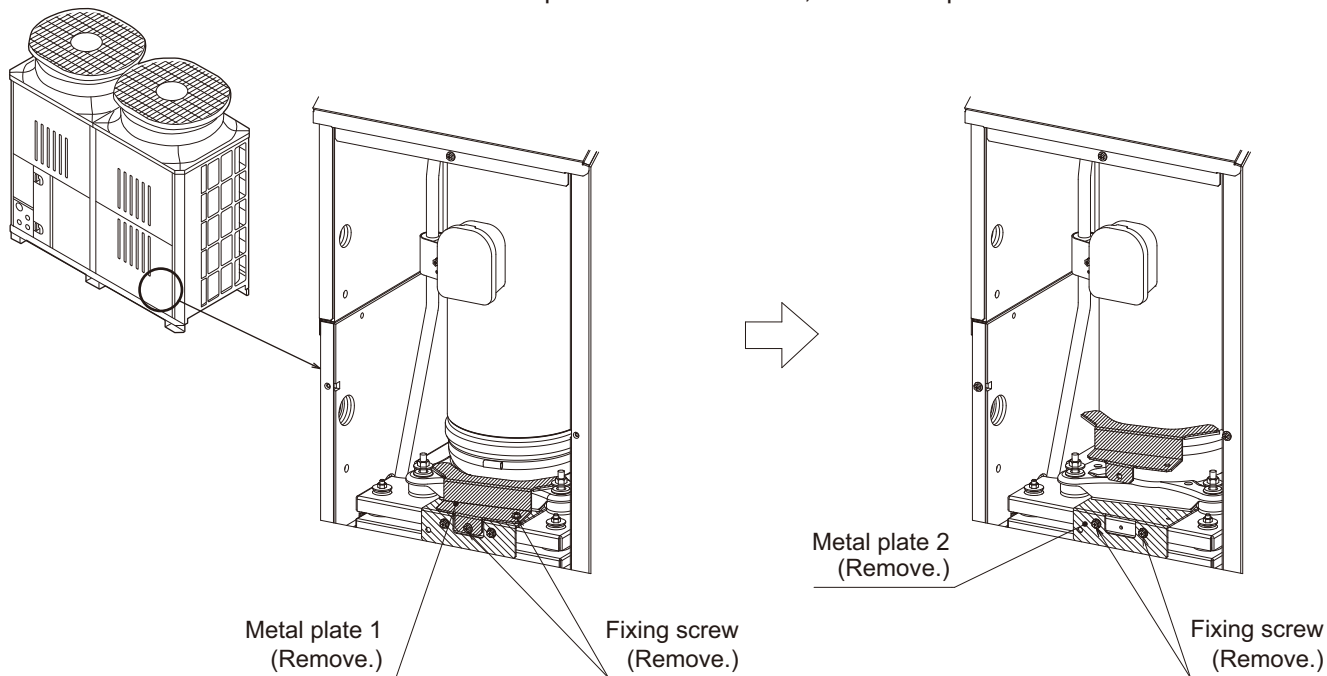
3. Installation

3-3. Removing the metal plates and saddles around the compressor



The metal plates and saddles are used only for transportation. Remove the metal plates and saddles before operating the unit to keep the unit from vibrating excessively.

Note. Make sure which part must be removed, and which part must not.



3. Installation

3-4. Installing the unit in a snow area

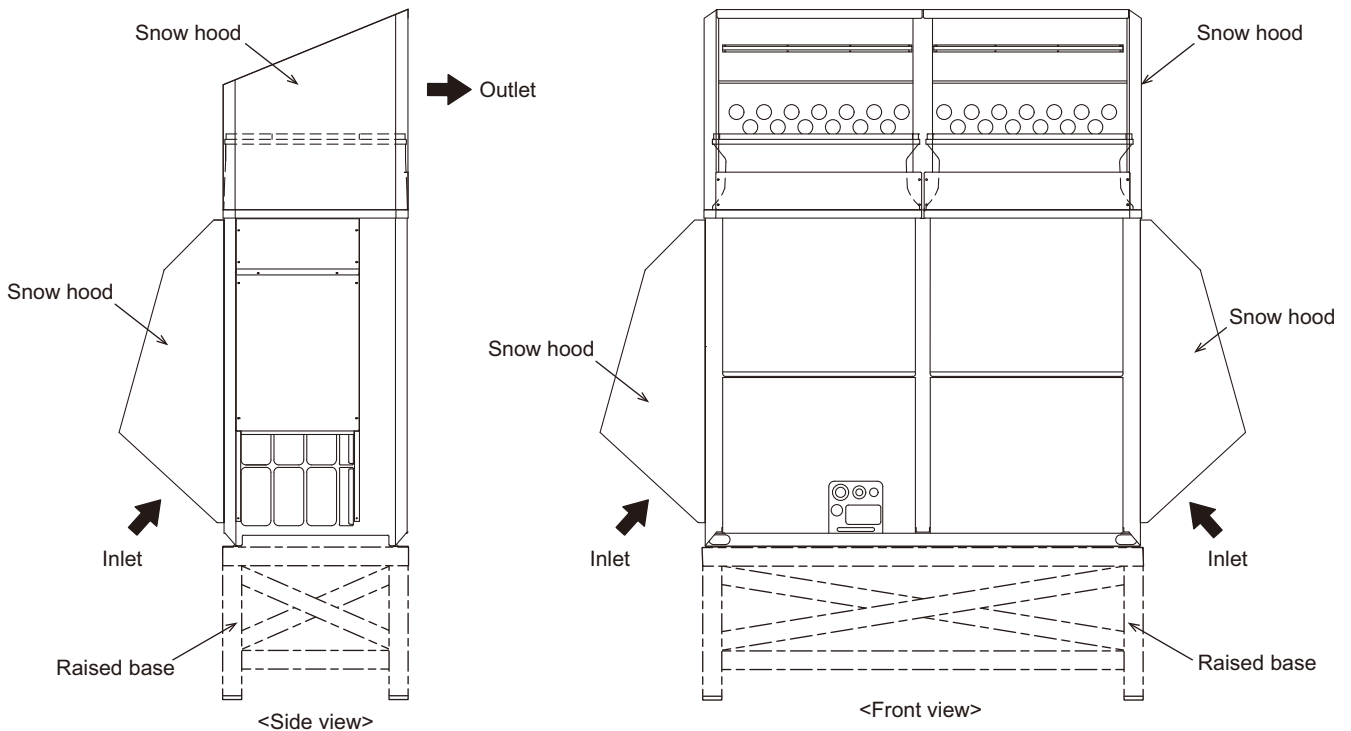
In snowy areas, sufficient protection against snow and winds should be provided to ensure proper operation. Even in other areas, appropriate measures should be taken to minimize the effects of winds and snow to ensure normal operation.

To ensure proper operation, install a field-supplied outlet/inlet duct if the unit is directly exposed to wind, rain, or snow and is operated in the cooling mode with the outside air temperature of 10°C or below.

(Note)

- Install the unit on a base approximately twice as high as the expected snowfall. The base must be made of angle steel or something to let snow and wind slip through the structure. The base width must not exceed the unit size, otherwise snow will accumulate on the base.
- Install the unit so that the outlet/inlet faces away from the wind.

CAHV-R450YA-HPB (-BS)



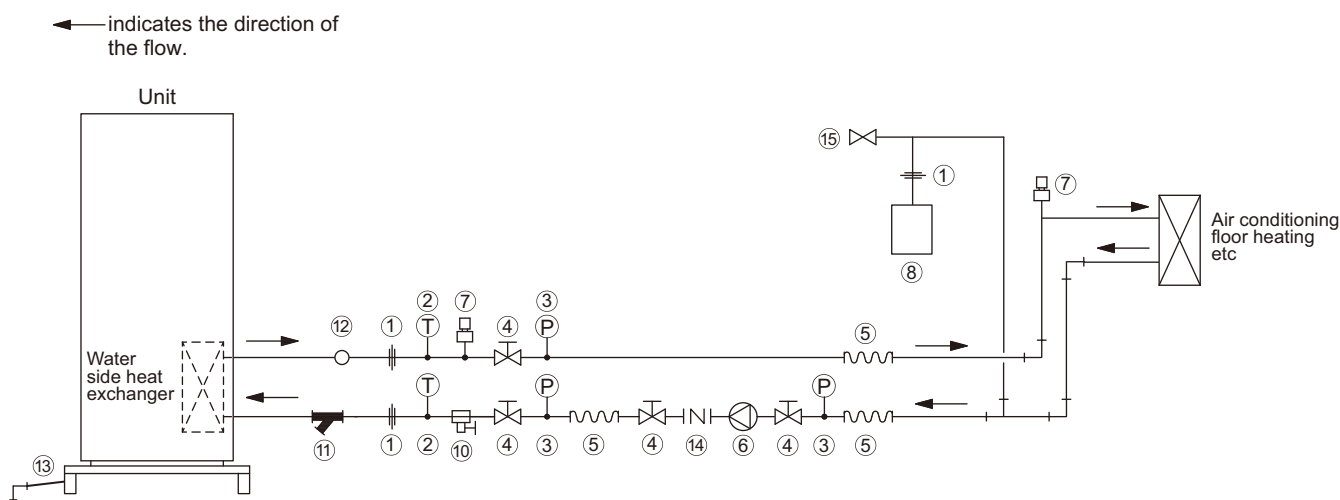
(Note)

1. Install the unit so that the outlet/inlet faces away from the wind. Secure enough space around the unit to avoid a short cycle.
2. Do not install the unit in a place where snow may fall from the roof. Also, remove the snow on the unit before it accumulates.
3. Refer to the figure above when installing the base on site.

4. System Design

4-1. Water Pipe Installation

4-1-1. Schematic Piping Diagram and Piping System Components



① Union joints/flange joints	Required to allow for a replacement of equipment.
② Thermometer	Required to check the performance and monitor the operation of the units.
③ Water pressure gauge	Recommended for checking the operation status.
④ Valve	Required to allow for a replacement or cleaning of the flow adjuster.
⑤ Flexible joint	Recommended to prevent the noise and vibration from the pump from being transmitted.
⑥ Pump	Use a pump that is large enough to compensate for the total water pressure loss and supply sufficient water to the unit.
⑦ Automatic air vent valve	Install automatic air vent valves where air accumulates. Even in the case of a failure of the water-side heat exchanger in the unit, the refrigerant may leak from the automatic air vent valve. To prevent accidents resulted from refrigerant leakage, install the unit where leaked refrigerant will not accumulate, such as outdoors.
⑧ Closed expansion tank	Install a closed expansion tank to accommodate expanded water and to supply water.
⑨ Water pipe	Use pipes that allow for easy air purging, and provide adequate insulation.
⑩ Drain valve	Install drain valves so that water can be drained for servicing.
⑪ Strainer	Install a strainer near the unit to keep foreign materials from entering the water-side head exchanger.
⑫ Flow switch	Required to protect the unit.
⑬ Drain pipe	Install the drain pipe with a downward inclination of between 1/100 and 1/200. To prevent drain water from freezing in winter, install the drain pipe as steep an angle as practically possible and minimize the straight line. For cold climate installation, take an appropriate measure (e.g., drain heater) to prevent the drain water from freezing.
⑭ Check valve	Required to prevent the backward flow.
⑮ Safety valve	Install a safety valve near the closed expansion tank. Even in the case of a failure of the water-side heat exchanger in the unit, the refrigerant may leak from the safety valve. To prevent accidents resulted from refrigerant leakage, install the unit where leaked refrigerant will not accumulate, such as outdoors.

4-1-2. Notes on pipe corrosion

Water treatment and water quality control

When the circulating water quality is poor, the water heat exchanger can develop scales, leading to a reduction in heat-exchange power and possible corrosion of the heat exchanger. Please pay careful attention to water processing and water quality control when installing the water circulation system.

- ♦Removal of foreign objects or impurities within the pipes.

During installation, be careful that foreign objects, such as welding fragments, sealant particles, or rust, do not enter the pipes.

- ♦Water Quality Control

(1) Depending on the quality of water used, the heat exchanger may become corroded or scaled up.

We recommend regular water quality processing.

Water circulation systems using open heat storage tanks are particularly prone to corrosion.

When using an open-type heat storage tank, install a water-to-water heat exchanger, and use a closed-loop circuit on the hot water heat pump unit side. If a water supply tank is installed, keep contact with air to a minimum, and keep the level of dissolved oxygen in the water no higher than 1 mg/l.

(2) Water quality standard

Items		Lower mid-range temperature water system Water Temp. ≤ 60°C		Higher mid-range temperature water system Water Temp. > 60°C		Tendency	
		Recirculating water	Make-up water	Recirculating water	Make-up water	Corrosive	Scale-forming
Standard items	pH (25 °C)	7.0 ~ 8.0	7.0 ~ 8.0	7.0 ~ 8.0	7.0 ~ 8.0	○	○
	Electric conductivity (mS/m) (25 °C) (µs/cm) (25 °C)	30 or less [300 or less]	30 or less [300 or less]	30 or less [300 or less]	30 or less [300 or less]	○	○
	Chloride ion (mg Cl/l)	50 or less	50 or less	30 or less	30 or less	○	
	Sulfate ion (mg SO ₄ ²⁻ /l)	50 or less	50 or less	30 or less	30 or less	○	
	Acid consumption (pH4.8) (mg CaCO ₃ /l)	50 or less	50 or less	50 or less	50 or less		○
	Total hardness (mg CaCO ₃ /l)	70 or less	70 or less	70 or less	70 or less		○
	Calcium hardness (mg CaCO ₃ /l)	50 or less	50 or less	50 or less	50 or less		○
	Ionic silica (mg SiO ₂ /l)	30 or less	30 or less	30 or less	30 or less		○
Reference items	Iron (mg Fe/l)	1.0 or less	0.3 or less	1.0 or less	0.3 or less	○	○
	Copper (mg Cu/l)	1.0 or less	0.1 or less	1.0 or less	0.1 or less	○	
	Sulfide ion (mg S ²⁻ /l)	Not to be detected	Not to be detected	Not to be detected	Not to be detected	○	
	Ammonium ion (mg NH ₄ ⁺ /l)	0.3 or less	0.1 or less	0.1 or less	0.1 or less	○	
	Residual chlorine (mg Cl/l)	0.25 or less	0.3 or less	0.1 or less	0.3 or less	○	
	Free carbon dioxide (mg CO ₂ /l)	0.4 or less	4.0 or less	0.4 or less	4.0 or less	○	
Ryzner stability index	-	-	-	-	○	○	

Reference: Guideline of Water Quality for Refrigeration and Air Conditioning Equipment. (JRA GL02E-1994)

(3) Please consult with a water quality control specialist about water quality control methods and water quality calculations before using anti-corrosive solutions for water quality management.

(4) When replacing a previously installed hot water heat pump unit (even when only the heat exchanger is being replaced), first conduct a water quality analysis and check for possible corrosion.

Corrosion can occur in water systems even if there has been no prior signs of corrosion.

If the water quality level has dropped, please adjust water quality sufficiently before replacing the unit.

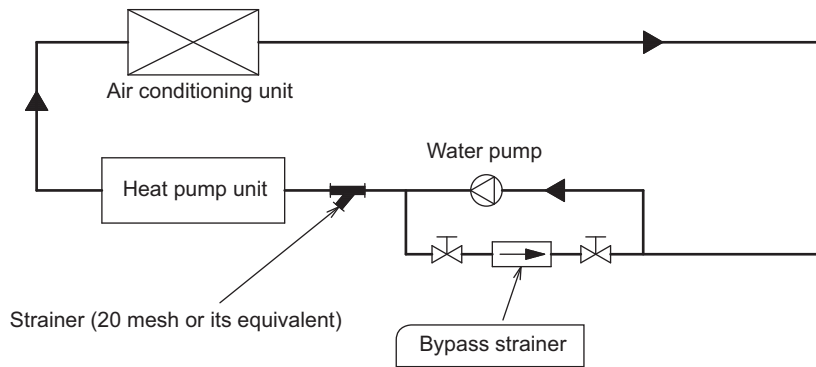
4. System Design

(5) Suspended solids in the water

Sand, pebbles, suspended solids, and corrosion products in water can damage the heating surface of the heat exchanger and cause corrosion. Install a good quality strainer (20 mesh or better) at the inlet of the unit to filter out suspended solids.

Removing foreign substances from the water system

Consider installing a settlement tank or a bypass strainer to remove foreign substances from the water system. Select a strainer capable of handling two to three percent of the circulating water. The figure below shows a sample system with a bypass strainer.



(6) Connecting pipes made from different materials

If different types of metals are placed in direct contact with each other, the contact surface will corrode.

Install an insulating material between pipes that are made of different materials to keep them out of direct contact with each other.

4. System Design

4-1-3. Installing the water pipes

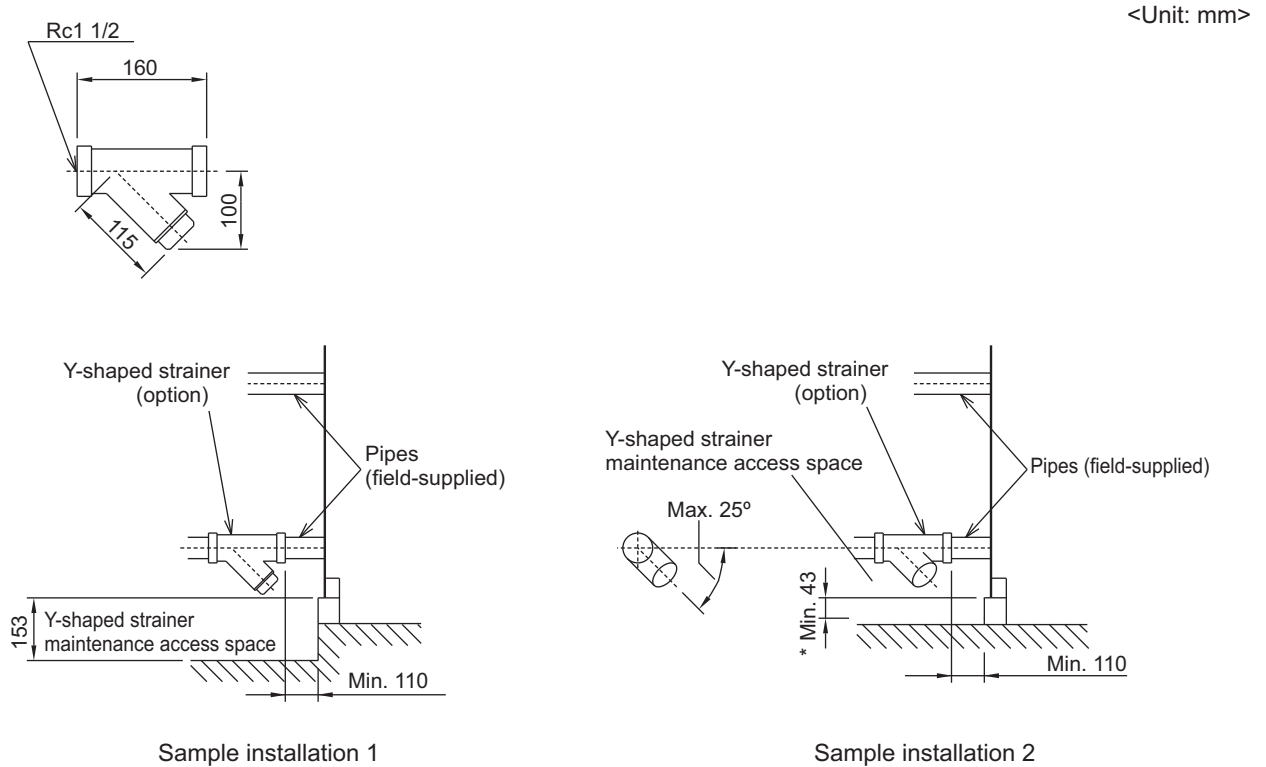
1. Installing the strainer

Install the optional strainer on the inlet water pipe near the unit to filter out suspended solids and prevent clogging or corrosion of the heat exchanger.

Install the strainer in a way that allows for easy access for cleaning, and instruct the user to clean it regularly. Operating the units with a clogged strainer may cause the units to make an abnormal stop.

Select a location to install a strainer, taking into consideration the installation angle, insulation thickness, and maintenance space.

* The dimensions given below indicate the amount of space necessary when screwing in a Y-shaped strainer.



2. Installing a flow switch

Install a flow switch that meets the following specifications on the water pipe. Connect the flow switch to the flow switch contact on the unit.

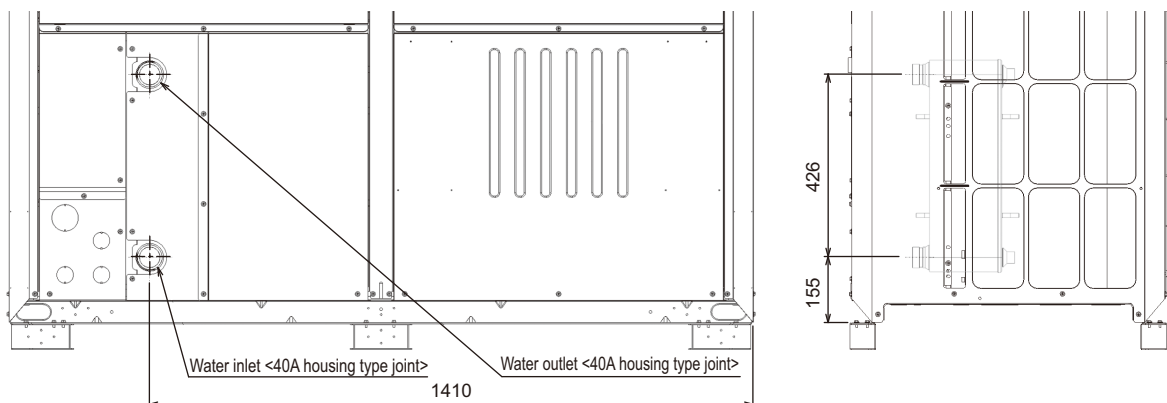
Minimum flow rate = 1.5 m³/h (25 L/min)

Unit usage range (water flow rate): 1.5 - 15.0 m³/h *

* 4.0 - 15.0 m³/h under the following conditions:

- a. When the outdoor temperature is below 0°C,
- b. When the outlet water temperature is 30°C or below AND the outdoor temperature is 6°C or below.

4-1-4. Water pipe hole size and location



4. System Design

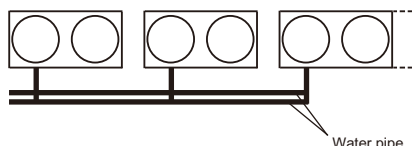
4-2. Ensuring enough water in the water circuit

1. Required amount of water

If the amount of water in the water circuit (circulating water circuit) is insufficient, the unit operation hours may become shorter or the amount of water temperature change to be controlled may become extremely large. Also, the defrost operation during the heating mode may not function properly. Refer to the table below for the minimum amount of water required in the circuit. If the water pipe is too short to keep enough amount of water, install a cushion tank in the water pipe to ensure enough amount of water.

Model	Minimum amount of water (ℓ)
CAHV-R450YA-HPB (-BS)	525

* When multiple units are installed consecutively with the outlet water temperature of 55°C or higher, the minimum amount of water is <360 × number of units>.



$$\text{Minimum amount of water} = 360 \times 3 = 1080 \text{ ℓ}$$

2. Calculating the required amount of water in the water circuit

The required amount of water in the water circuit can be obtained from the following formula.

(Required amount of water in the water circuit) = (Amount of water that can be held in the water pipe) + (Amount of water that can be held in the heat source unit) + (Amount of water that can be held in the load-side unit)

The amount of water that can be held per meter of the water pipe (ℓ/m)

Pipe size					
3/4B (20A)	1B (25A)	1 1/4B (32A)	1 1/2B (40A)	2B (50A)	2 1/2B (65A)
0.37	0.60	0.99	1.36	2.20	3.62

The amount of water that can be held in the heat source unit (ℓ)

CAHV-R450YA-HPB (-BS)
4.3

4-3. Inlet/Outlet pipe connection size and material

The table below shows the inlet/outlet pipe connection size.

Inlet/Outlet pipe connection size

Model	Inlet pipe connection	Outlet pipe connection
CAHV-R450YA-HPB (-BS)	R1 - 1/2 Housing type joint	R1 - 1/2 Housing type joint

5. Wiring Design

5-1. System Configurations

1. Types of control cables

Remote controller cable	Size	0.3 - 1.25 mm ² (Max. 200 m total)
	Recommended cable types	CVV
M-NET cable between units *1	Size	Min. 1.25 mm ² (Max. 120 m total)
	Recommended cable types	Shielded cable CVVS, CPEVS or MVVS
External input wire size *2	Size	Min. 0.3 mm ²
	Recommended cable types	Shielded cable CVVS, CPEVS or MVVS
External output wire size	Size	1.25 mm ²
	Recommended cable types	Shielded cable CVVS, CPEVS or MVVS

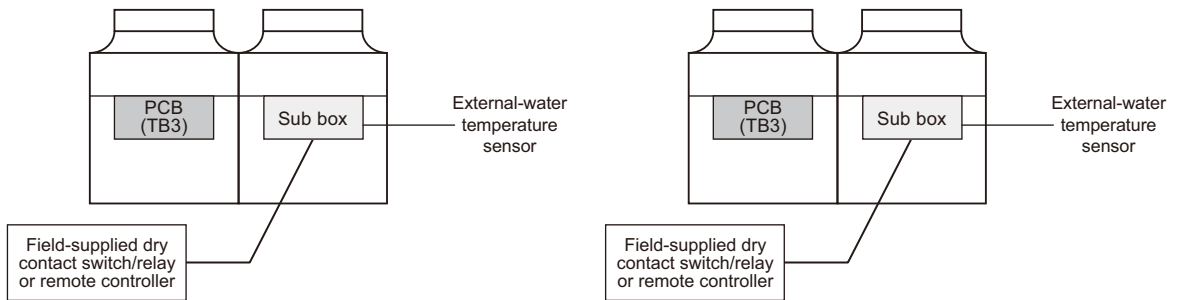
*1. Use a CVVS or CPEVS cable (Max. total length of 200 m) if there is a source of electrical interference near by (e.g., factory) or the total length of control wiring exceeds 120 m.

*2 At least 1mm thickness of supplementary insulation shall be provided.

2. System Configuration

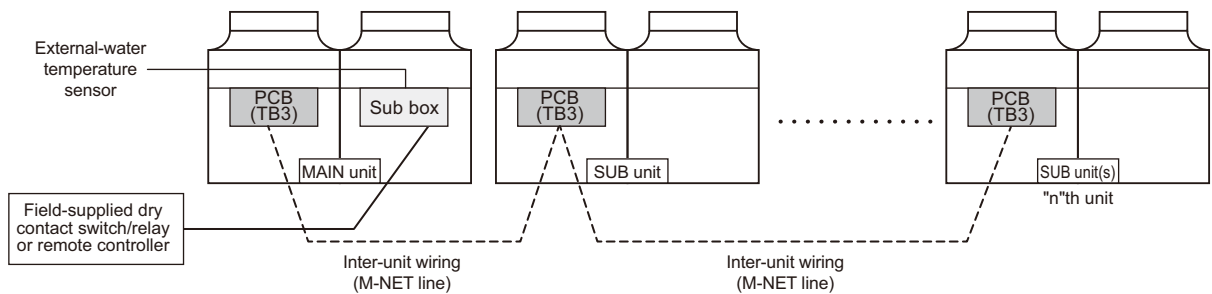
(1) Individual system

* Each unit is operated individually by connecting a dry contact switch/relay to each unit.



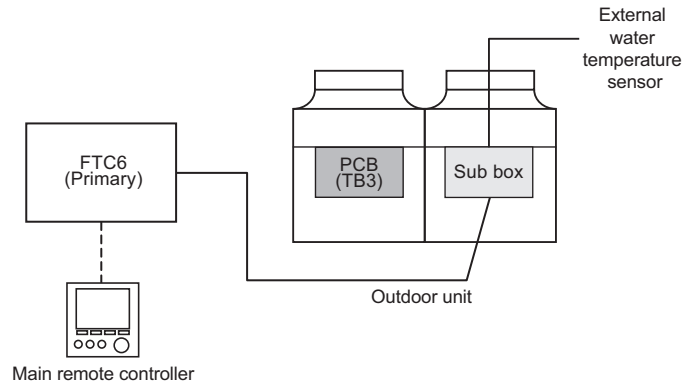
(2) Multiple system (2-16 units)

* A group of unit that consists of one main unit and up to 15 sub units is operated collectively by connecting an external water temperature sensor and a dry contact switch/relay to the main unit.



5. Wiring Design

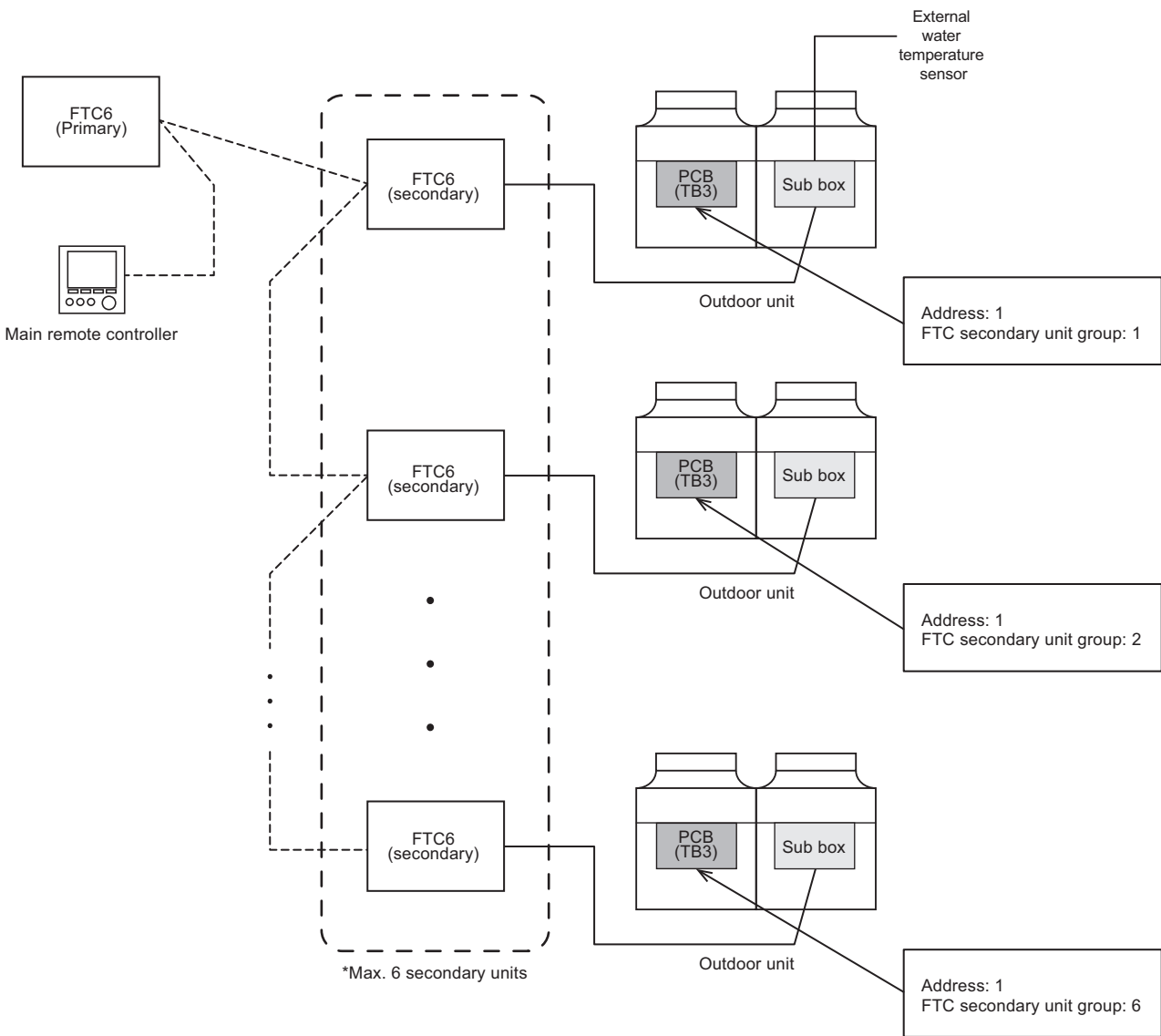
(3) Individual system (for FTC connection)



* One unit is connected to one FTC primary unit.

For detailed FTC, please refer to the FTC manual.

(4) Multiple system (2-6 units) (for FTC connection)



* The main unit is the unit to which an external water temperature sensor is connected.
 * One unit is connected to one FTC secondary unit.

For detailed FTC, please refer to the FTC manual.

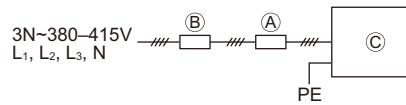
5. Wiring Design

5-2. Electrical Wiring Installation

5-2-1. Main Power Supply Wiring and Switch Capacity

Schematic Drawing of Wiring (Example)

- Ⓐ: Switch (with current breaking capability)
- Ⓑ: Earth leakage breaker
- Ⓒ: Hot water heat pump



Main power supply wire size, switch capacities, and system impedance

Model	Minimum wire thickness (mm ²)			Earth leakage breaker	Local switch (A)		Overcurrent breaker (A)	Max. Permissible System Impedance
	Main cable	Branch	Ground		Capacity	Fuse		
CAHV-R450YA-HPB	14	-	14	50 A 100 mA 0.1 sec. or less	50	50	50	0.16 Ω

- 1) Use a dedicated power supply for each unit. Ensure that each unit is wired individually.
- 2) When installing wiring, consider ambient conditions (e.g., temperature, sunlight, rain).
- 3) The wire size is the minimum value for metal conduit wiring. If voltage drop is a problem, use a wire that is one size thicker. Make sure the power-supply voltage does not drop more than 10%.
- 4) Specific wiring requirements should adhere to the wiring regulations of the region.
- 5) Power supply cords of appliances for outdoor use shall not be lighter than polychloroprene sheathed flexible cord (design 60245 IEC57).
- 6) Do not install a phase advancing capacitor on the motor. Doing so may damage the capacitor and result in fire.
- 7) Use the breakers that match the unit capacity (leakage current limit, current breaking threshold, etc.).
- 8) Select the type of breaker for an inverter circuit as an earth leakage breaker. (Mitsubishi Electric NV-S series or its equivalent)
- 9) A breaker with at least 3.0 mm contact separation in each pole shall be provided.
- 10) When using an earth leakage breaker without an overcurrent breaker, use a local switch and a moldedcase circuit breaker in combination.
- 11) If the power cable is damaged, it must be replaced by qualified personnel in order to avoid a hazard.
- 12) The appliance shall be installed in accordance with national wiring regulations. However, the local standards and/or regulations is applicable at a higher priority.
- 13) When the power cable is connected, the grounding wire must be longer than the power wire.

⚠ WARNING

- ◆ All electric work must be performed by a qualified electrician according to the local regulations, standards, and the instructions detailed in the Installation Manual.
- ◆ Be sure to use specified wires and ensure no external force is imparted to terminal connections. Loose connections may cause overheating and fire.
- ◆ Proper grounding must be provided by a qualified personnel. Do not connect the grounding wire to gas pipe, water pipe, lightning rod, or telephone wire.
 - Improper grounding may result in electric shock, smoke, fire, or malfunction due to electrical noise interference.
- ◆ Include some slack in the power cables.
 - Failure to do so may break or overheat the cables, resulting in smoke or fire.
- ◆ Install an earth leakage breaker on the power supply of each unit.
 - Failure to do so may result in electric shock or fire.
- ◆ Only use properly rated breakers (an earth leakage breaker, local switch <a switch + fuse that meets local electrical codes>, or overcurrent breaker).
 - Failure to do so may result in electric shock, malfunction, smoke, or fire.
- ◆ Only use standard power cables of sufficient capacity.
 - Failure to do so may result in current leakage, overheating, smoke, or fire.
- ◆ Tighten all terminal screws to the specified torque.
 - Loose screws and contact failure may result in smoke or fire.

⚠ CAUTION

- ◆ Some installation sites may require an installation of an earth leakage breaker for the inverter. If no earth leakage breaker is installed, there is a danger of electric shock.
- ◆ Only use properly rated breakers and fuses. Using a fuse or wire of the wrong capacity may cause malfunction or fire.
- ◆ If a large electric current flows due to a malfunction or faulty wiring, earth-leakage breakers on the unit side and on the upstream side of the power supply system could both operate. Depending on the importance of the system, separate the power supply system or take protective coordination of breakers.

Note

- ◆ This device is intended for the connection to a power supply system with a maximum permissible system impedance shown in the above table at the interface point (power service box) of the user's supply.
- ◆ Ensure that this device is connected only to a power supply system that fulfills the requirements above. If necessary, consult the public power supply company for the system impedance at the interface point.
- ◆ This equipment complies with IEC 61000-3-12 provided that the short-circuit power S_{sc} is greater than or equal to $S_{sc} (*2)$ at the interface point between the user's supply and the public system. It is the responsibility of the installer or user of the equipment to ensure, in consultation with the distribution network operator if necessary, that the equipment is connected only to a supply with a short-circuit power S_{sc} greater than or equal to $S_{sc} (*2)$.

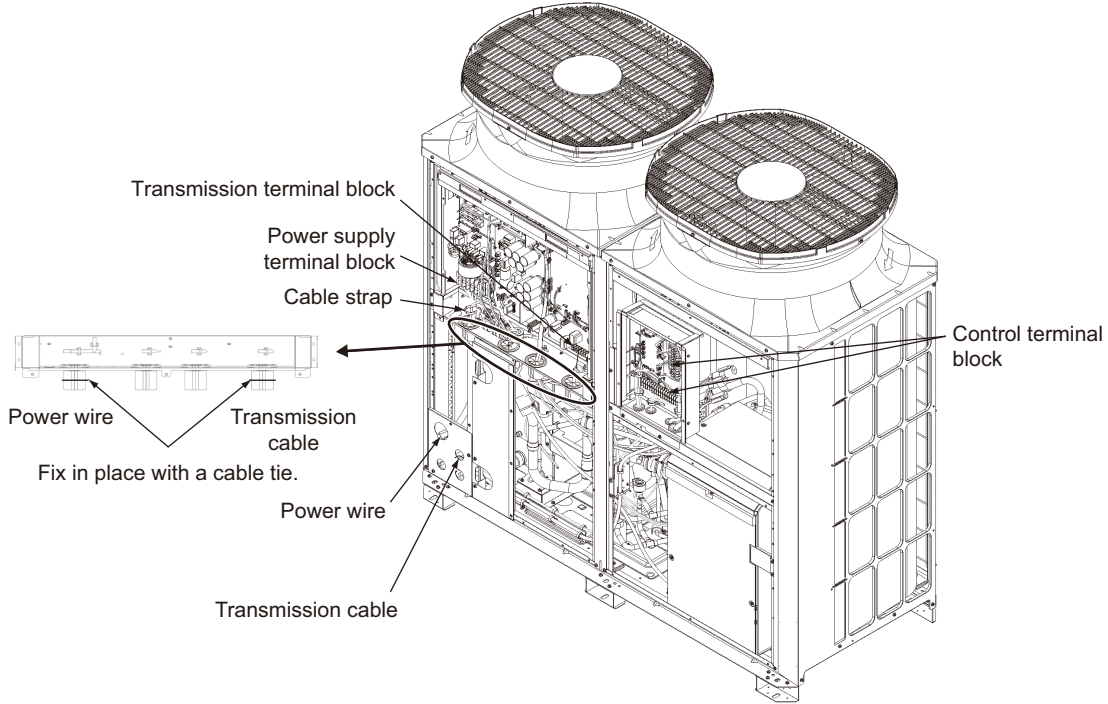
$S_{sc} (*2)$

S_{sc} (MVA)
3.80

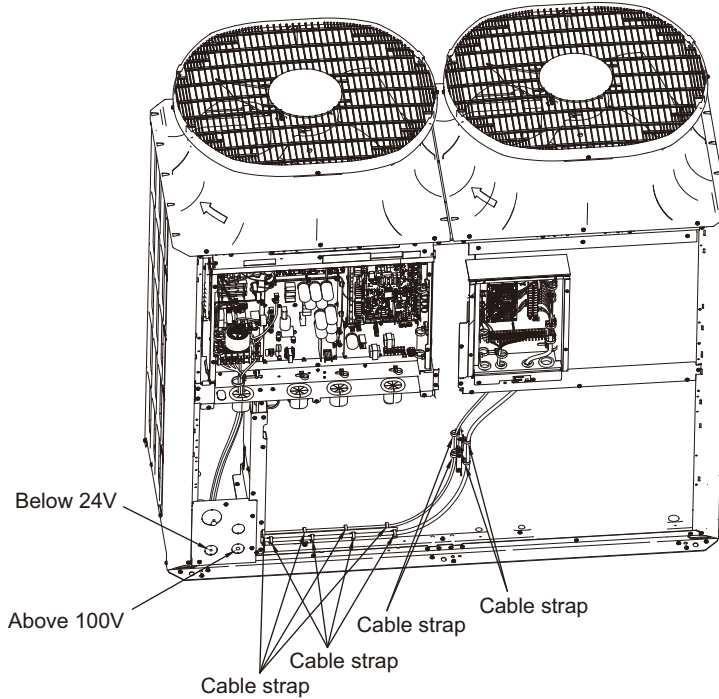
5-2-2. Cable Connections

(1) Schematic Diagram of a Unit and Terminal Block Arrangement

To remove the front panel of the control box, unscrew the four screws and pull the panel forward and then down.

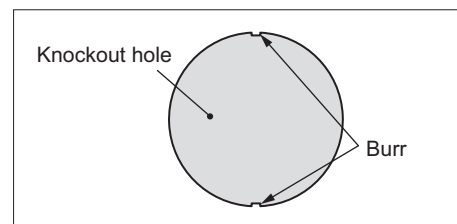


Important: Power supply cables larger than 25 mm² in diameter are not connectable to the power supply terminal block (TB1). Use a pull box to connect them.



(2) Installing the conduit tube

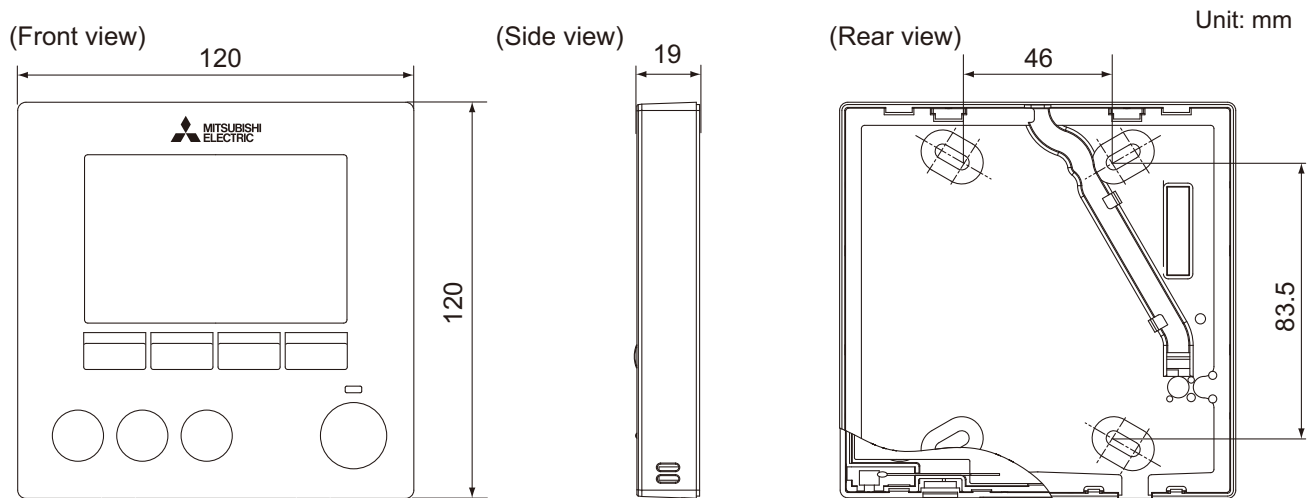
- Punch out the knockout hole for wire routing at the bottom of the front panel with a hammer.
- When putting wires through knockout holes without protecting them with a conduit tube, deburr the holes and protect the wires with protective tape.
- If damage from animals is a concern, use a conduit tube to narrow the opening.



6. Controller

6-1. PAR-W31MAA specifications

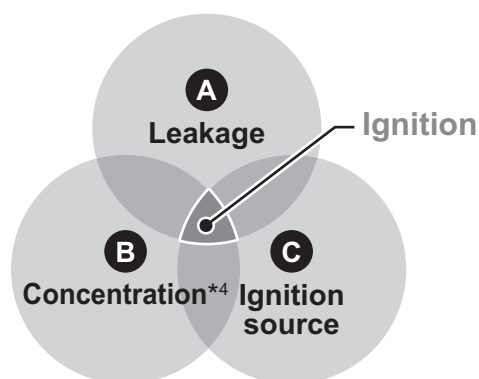
Item	Description	Operations	Display
ON/OFF	Runs and stops the operation of a group of units	○	○
Operation mode switching	Switches between Hot Water/Heating/Heating ECO/Anti-freeze/Cooling * Available operation modes vary depending on the unit to be connected. * Switching limit setting can be made via a remote controller.	○	○
Water temperature setting	Temperature can be set within the ranges below. (in increments of 0.5°C or 0.5°F) 24°C ~ 70°C * The settable range varies depending on the unit to be connected.	○	○
Water temperature display	10°C ~ 90°C (in increments of 0.5°C or 0.5°F) * The settable range varies depending on the unit to be connected.	×	○
Permit/Prohibit local operation	Individually prohibits operations of each local remote control function: ON/OFF, Operation modes, water temperature setting, Circulating water replacement warning reset. * Upper level controller may not be connected depending on the unit to be connected.	×	○
Weekly scheduler	ON/OFF/Water temperature setting can be done up to 8 times one day in the week. (in increments of a minute)	○	○
Error	When an error is currently occurring on a unit, the afflicted unit and the error code are displayed.	×	○
Self check (Error history)	Searches the latest error history by selecting "CHECK" from the Main menu.	○	○
LANGUAGE setting	The language on the dot matrix LCD can be changed. (11 languages) English/French/German/Swedish/Spanish/Italian/Danish/Dutch/Finnish /Norwegian/Portuguese	○	○



7. Safe handling of R454C

7-1. R454C refrigerant properties

Under the conditions shown below, there is a possibility that R454C could burn.



	R454C	R407C
Chemical formula	CH ₂ F ₂ /C ₃ H ₂ F ₄	CH ₂ F ₂ /CHF ₂ CF ₃ /CH ₂ FCF ₃
Composition (blend ratio wt. %)	R32/R1234yf (21.5/78.5 wt%)	R32/R125/R134a (23/25/52 wt%)
Ozone depletion potential (ODP)	0	0
Global warming potential (GWP) *1	148	1770
LFL (kg/m ³) *2	0.293	–
Flammability *3	Lower flammability (2L)	No flame propagation (1)

*1 IPCC 4th assessment report

*2 LFL: Lower flammable limit EN 378-1: 2016+A1: 2020

*3 IEC60335-2-40: 2018

*4 R454C consistency is higher than LFL and lower than UFL.

Be sure to observe the following three points to use R454C safely.

WARNING

A Do not leak refrigerant.

<Installation>

- Vacuum drying should be done. Do not release refrigerant into the atmosphere unnecessarily.

<Repair/Removal>

- Refrigerant should be recovered.

B Prevent concentration.

- Follow "Installation restrictions."

C Keep ignition sources away from the unit.

- Do not braze pipes that contain refrigerant. Before brazing, refrigerant should be recovered.
- Do not install the unit while electricity is on. Turn off electricity and check using a tester.
- Do not smoke during work and transportation.

Note: R454C emit toxic gas when exposed to naked flame.

7-2. Installation restrictions

General restrictions

! WARNING

Do not install the unit where combustible gas may leak.

- If combustible gas accumulates around the unit, fire or explosion may result.

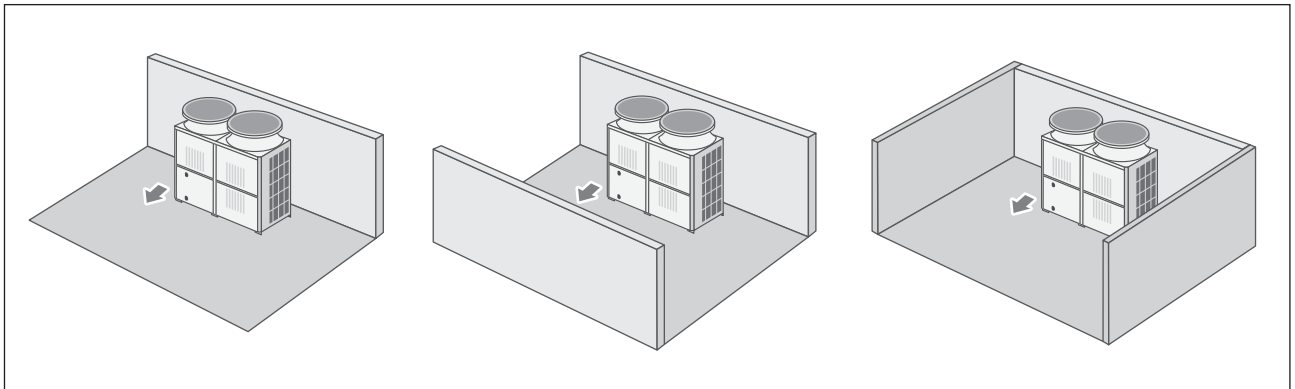
- Provide sufficient space around the unit for effective operation, efficient air movement, and ease of access for maintenance.
- All restrictions mentioned in this manual apply not only to new installations but also to relocations and layout changes.
- Refer to the Installation manual for other precautions on installation.

Installation space requirement

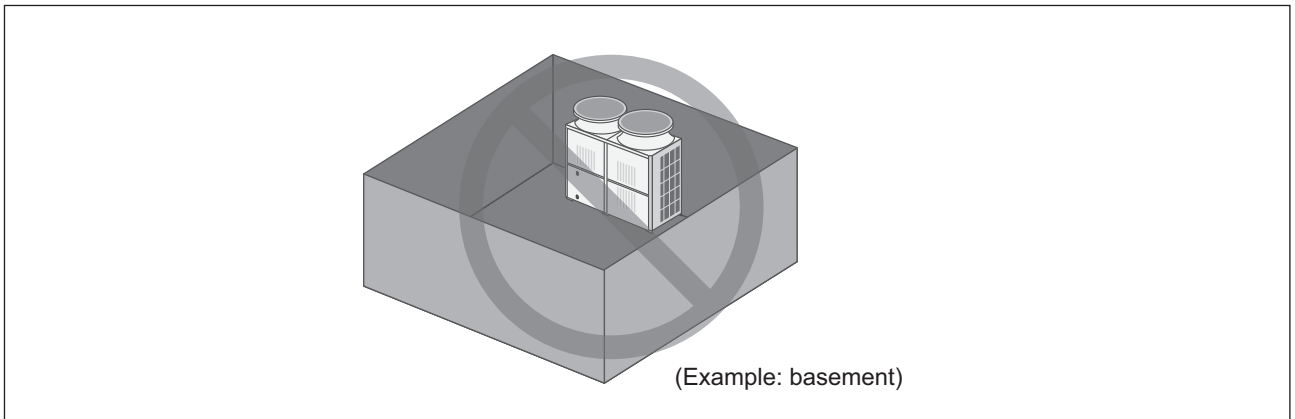
- Do not install the unit inside a building such as the basement or machine room, where the refrigerant may stagnate.
- Install the unit in a place where at least one of four sides is open.

Figure 1

Correct installation



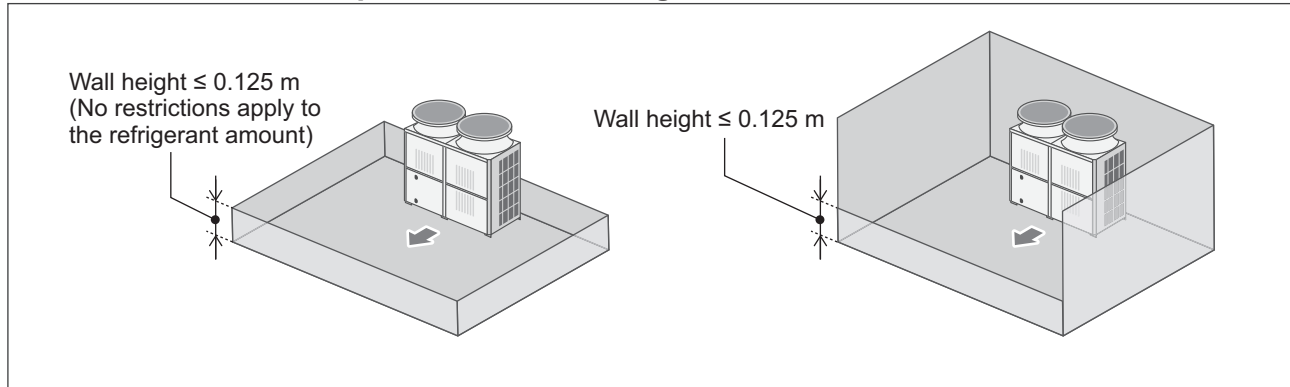
Incorrect installation



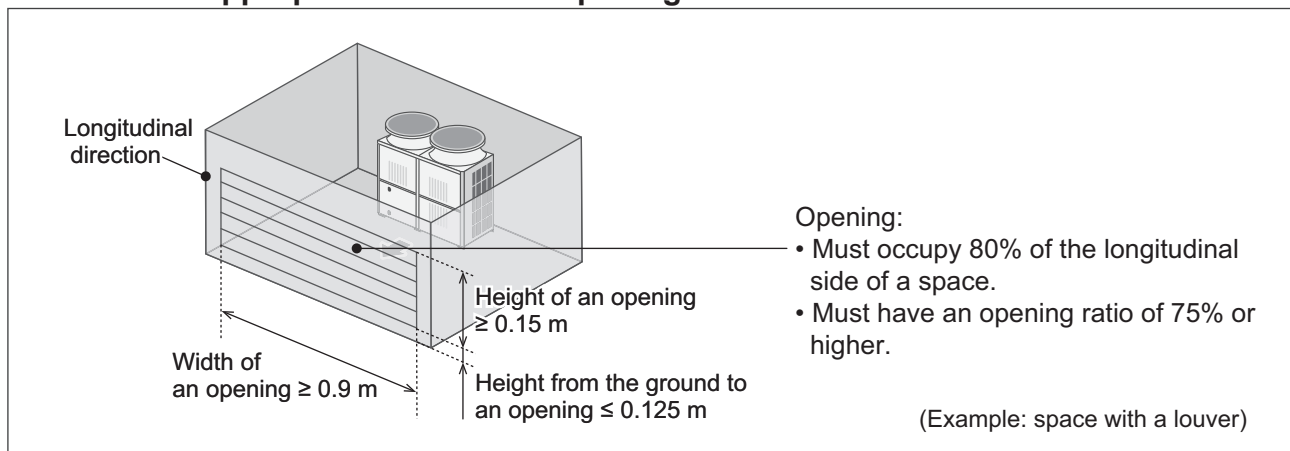
7. Safe handling of R454C

If the unit needs to be installed in a space where all four sides are blocked, confirm that one of the following situations (A or B) is satisfied.

A. Install the unit in a space with a wall height of ≤ 0.125 m.



B. Create an appropriate ventilation opening.

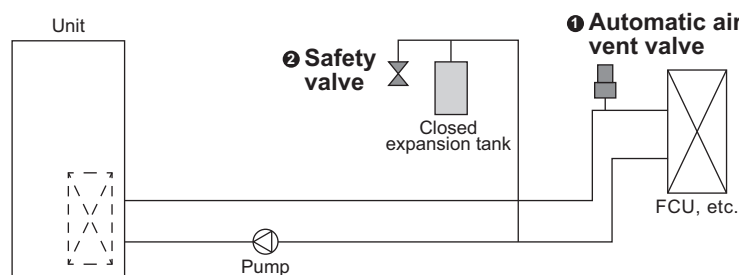


7-3. Regulatory requirements for safety

See below for information on installing a safety device on hot water heat pump system.

* Safety devices shall be regularly inspected, maintained, and replaced in accordance with relevant laws, regulations, and the instructions of the manufacturers.

* The requirements listed below were established based on IEC60335-2-40 (Edition 6.0) G.G.6. See the original standards for further information on selecting a safety device.



Required items

- ① Automatic air vent valve
- ② Safety valve

Note

* In the event of a failure of the waterside heat exchanger in the unit, the refrigerant may leak from the automatic air vent valve or safety valve, so install it in a place where the refrigerant will not accumulate, such as outdoors.

⚠ Warning

- Do not use refrigerant other than the type indicated in the manuals provided with the unit and on the nameplate.
 - Doing so may cause the unit or pipes to burst, or result in explosion or fire during use, repair, or at the time of disposal of the unit.
 - It may also be in violation of applicable laws.
 - MITSUBISHI ELECTRIC CORPORATION cannot be held responsible for malfunctions or accidents resulting from the use of the wrong type of refrigerant.
- Our air conditioning equipment and heat pumps contain a fluorinated greenhouse gas, R407C.

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