MITSUBISHI ELECTRIC

Changes for the Better

HOT WATER HEAT PUMP

DATA BOOK

MODEL

CAHV-Z450YA-HPB (-BS)

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HOT WATER HEAT PUMP

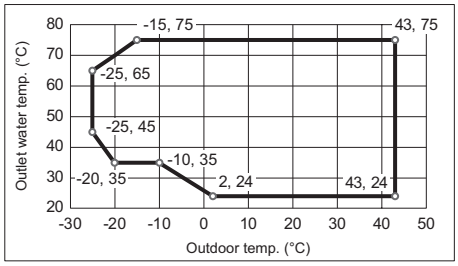
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1. Specifications

Model			CAHV-Z450YA-HPB (-BS)
Power source			3-phase 4-wire 380-400-415V 50/60 Hz
Capacity(EN14511) *1		kW	40.0
	Power input	kW	12.62
	Current input	A	21.3-20.2-19.5
	COP		3.17
	SCOP Low/Medium		4.12/3.25
	Water flow rate	m^3/h	6.88
Maximum current input		A	45.6
Water pressure drop		kPa	10.2
Temperature range *2	Outlet water temperature	°C	24-75
	Outdoor temperature	°C	-25-43
Circulating water volume range *3		m^3/h	4.0-10.0
Sound pressure level (measured in an anechoic room) at 1m *1*4		dB (A)	65
Sound pressure level (measured in an anechoic room) at 1m *4 *5		dB (A)	72
Water pipe diameter and type	Inlet		40A, Rc 1-1/2B
	Outlet		40A, Rc 1-1/2B
External finish			Acrylic painted steel sheet <Munsell 5Y 8/1 or similar>
External dimensions H × W × D		mm	1710 × 1750 × 740
Net weight		kg	363
Design pressure	R290	MPa	3.85
	Water	MPa	1.0
Drawing number	Wiring		KW94R794
	External appearance		KW94R768
Heat exchanger	Water-side		Stainless steel plate and copper brazing
	Air-side		Plate fins and copper tubes
Compressor	Type		Inverter scroll hermetic compressor
	Manufacturer		MITSUBISHI ELECTRIC CORPORATION
	Starting method		Inverter
	Motor output	kW	10.8
	Lubricant		PZ46M
Fan	Air flow rate	m^3/min	150 × 2
		L/s	2500 × 2
		cfm	5297 × 2
	External static pressure	Pa	10
	External static pressure *6	Pa	40
	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
	Inverter circuit		Overheat and overcurrent protection
	Compressor		Overheat protection
	Fan motor		Thermal switch
	Refrigerant sensor		Refrigerant leakage protection
Defrosting method			Auto-defrost mode (Reversed refrigerant cycle)
Refrigerant	Type and factory charge *7		R290, 4.8 kg
	GWP *8		3
	Flow and temperature control		LEV and HIC circuit

*1 Under normal heating conditions at the outdoor temp. of 7 °CDB / 6 °CWB, the outlet water temp. of 45 °C, and the inlet water temp. of 40 °C.

*2



· Keep inlet water temp. of 19 °C or higher during the unit operation

*3 The unit can operate at the water volume range of 1.5 - 4.0 m^3/h if the water volume exceeds 4.0 m^3/h during defrost cycle.
The defrost signal is output from the terminal block of the unit.

*4 SPL is the value measured in an anechoic room at 1 m away from the unit and 1.5 m above the floor.

*5 Under conditions with maximum compressor frequency and fan rotated speed.

*6 External static pressure mode.

*7 The unit is not charged with R290 refrigerant when shipping from the factory.

*8 IPCC 4th assessment report.

· Due to continuing improvements, specifications may be subject to change without notice.
· Do not use steel pipes as water pipes.
· Keep the water circulated at all times. Blow the water out of the pipes if the unit will not be used for an extended period of time.
· Do not use ground water or well water.
· The water circuit must be a closed circuit.

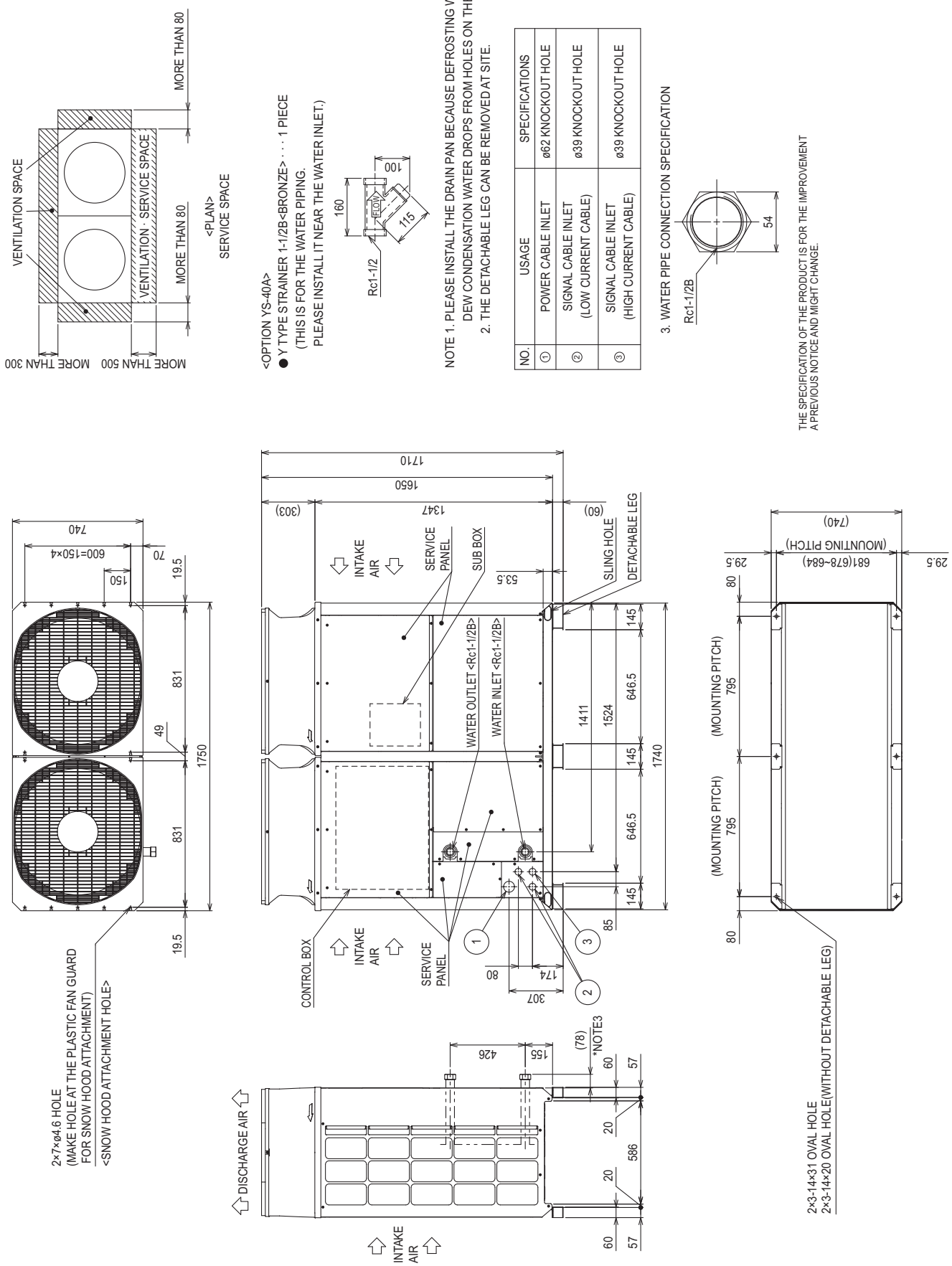
Unit converter

BTU/h = kW × 3,412
cfm = m^3/min × 35.31
lbs = kg/0.4536
Kcal = kW × 860

2. External Dimensions

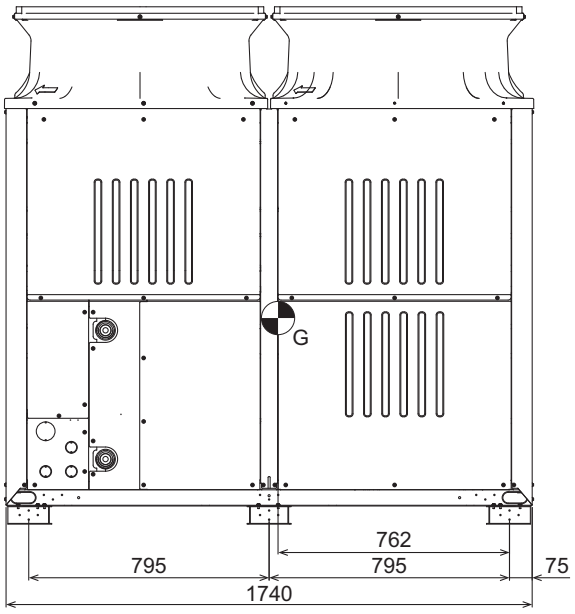
CAHV-Z450YA-HPB (-BS)

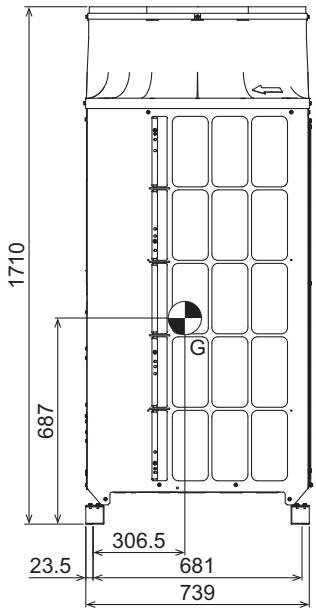
Unit: mm



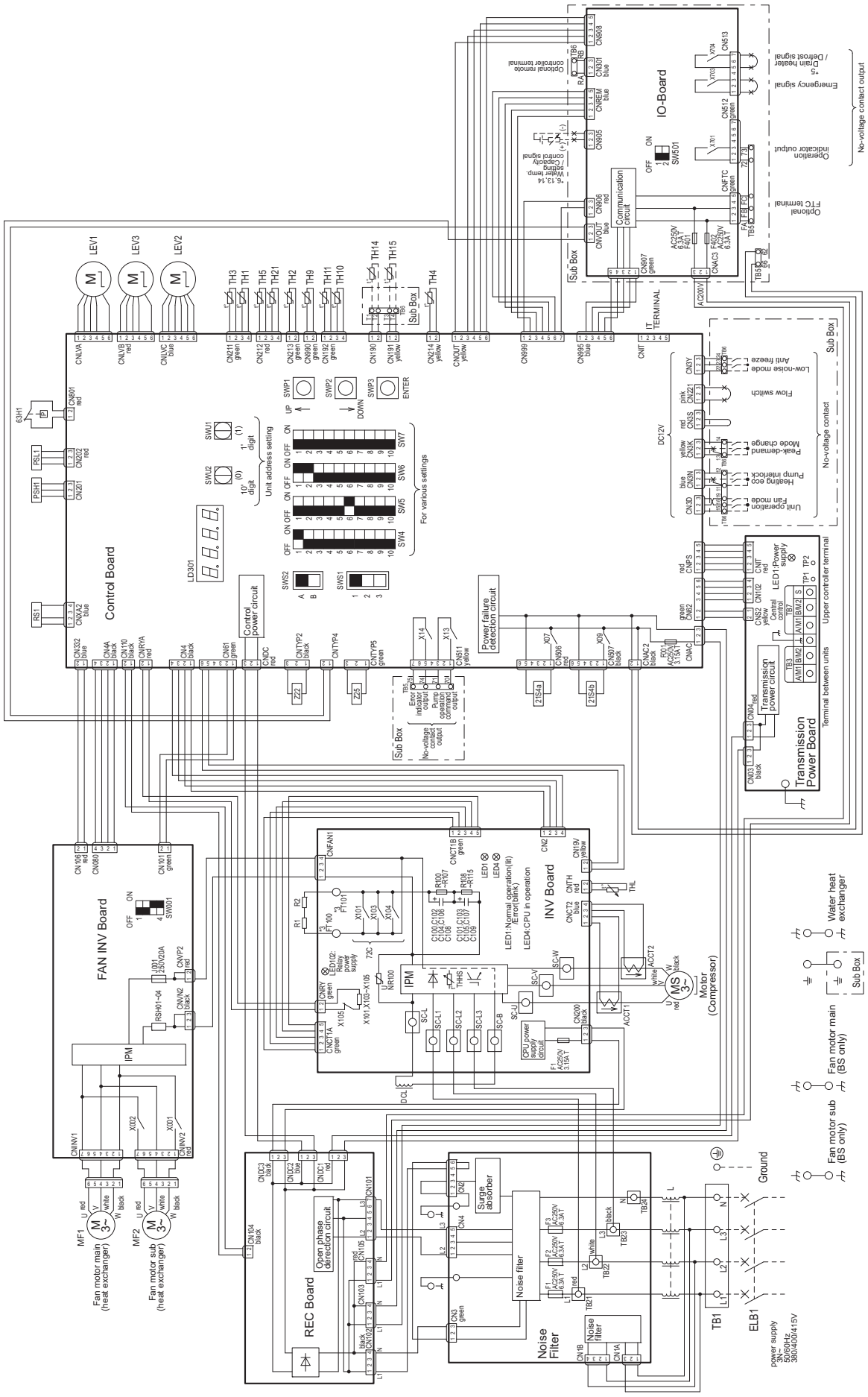
3. Center of Gravity

Unit: mm





CAHV-Z450YA-HPB (-BS)



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

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 heater signal or Defrost signal by SW5 and SW6 settings.
(Item code 1056)
6.Selects either Water temp. setting 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 temp. 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 cabtyre cable as this will damage the circuit board.
11.When cabtyre cable is used for the control cable wiring, use a separate cabtyre cable for the following wiring.
Using the same cabtyre 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 temp. setting
12.Use a contact that takes 12VDC 1mA for no-voltage contact input.
13.Need to selects either Water temp. 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, 2	AC current sensor	
DCL	DC reactor	
F1 (INV Board)	Fuse	
J001 (FAN INV Board)		
LEV1, 3	Linear expansion valve	Pressure control, Refrigerant flow rate control
LEV2		HIC bypass, Refrigerant flow rate control in HIC circuit
MF1, 2	Motor	Fan
MS		Compressor
63H1	Pressure switch	High pressure protection
PSH1	Pressure sensor	High pressure
PSL1		Low pressure
R1, 2	Electrical resistance	
21S4a, b	4-way valve	Heating/Defrost switching
TH1	Thermistor	Discharge pipe temp.
TH2		Suction pipe temp.
TH3		Compressor shell bottom temp.
TH4, 5		Air heat exchanger outlet pipe temp.
TH9		Outdoor temp.
TH10		Inlet water temp.
TH11		Outlet water temp.
TH21		Water heat exchanger outlet pipe temp. (refrigerant side)
THHS		IPM temp.
THL		DC reactor temp.
TH14, 15	External Thermistor (optional)	Water temp.
RS1	Refrigerant sensor	Leakage from refrigerant pipe
Z22, 25	Function setting connector	
72C	Electromagnetic relay (Inverter main circuit)	
ELB1	Earth leakage breaker (field-supplied)	

4-1. External Input/Output

Available signals for local controllers

Input

Dry contact		ON (Close)	OFF (Open)	Terminal block/ connector
(a) UNIT OPERATION	ON/OFF	Unit will start when water temp. drops below the pre-set temp.	Unit will stop except when in the Anti-Freeze mode.	TB6 15-16
(b) HEATING ECO	Heating ECO/ Heating	Unit will start when water temp. drops below water temp. setting C. (Heating ECO mode)	Unit will start when water temp. drops below water temp. setting A. (Heating mode)	CN3N 1-2
(c) MODE CHANGE	Hot water/Heating	Unit will operate when water temp. drops below water temp. setting B.	Unit will start when water temp. drops below water temp. setting A. (Heating)	TB6 13-14
(d) ANTI FREEZE	ON/OFF	Unit will operate in the Anti-Freeze mode (target temp. 25ºC) when the contact status of unit operation (item (a)) is Stop, or the ON/OFF button on the remote controller is off.	Unit will operate based on the status of the unit operation contact (item (a)) or the ON/OFF command from the remote controller.	TB6 22-24
(e) LOW-NOISE MODE	ON/OFF	Unit will operate in the Low-noise mode and below the max. capacity for low noise.	Unit will operate at the max. capacity.	TB6 22-23
(f) FAN MODE	Forced/Normal	Fan will stay in operation after the compressor has stopped (incl. when the operating status is Stop).	Fan will stop when compressor stops.	TB6 15-19
(g) FLOW SWITCH	Normal/Error	Unit is allowed to operate.	Unit will not operate.	CN221 1-3
(h) PUMP INTERLOCK	Normal/Error	Unit is allowed to operate.	Unit will not operate.	TB6 11-12
(i) PEAK-DEMAND CONTROL	ON/OFF	Unit will operate at or below the max. capacity for peak-demand control.	Unit will operate at the max. capacity.	CN3K 1-2
Analog				Terminal block/ connector
Input type		Action		
(j) WATER TEMP. SETTING/CAPACITY CONTROL		Settable by using external analog input to CN905 on IO board. Available analog inputs: 4-20 mA, 1-5 V, 0-10 V, or 2-10 V.		CN905 2-3
(k) EXTERNAL WATER TEMP. THERMISTOR (TH14/Optional)		-		TB6 T1-T2
(l) EXTERNAL WATER TEMP. THERMISTOR (TH15/Optional)		-		TB6 T3-T4

Output

Contact type		Conditions in which the contact closes (turns on)	Conditions in which the contact opens (turns off)	Terminal block/ connector
(m) ERROR INDICATOR	Close/Open	Unit has stopped abnormally.	During normal operation	TB5 74-75
(n) OPERATION INDICATOR	Close/Open	Unit operation contact (item (a)) or the ON/OFF button on the remote controller is ON.	Unit operation contact (item (a)) or the ON/OFF button on the remote controller is OFF.	TB5 72-73
(o) PUMP OPERATION COMMAND	Close/Open	(1) When SW5-8 is set to ON Pump will operate based on Thermo-ON/OFF status. (2) When SW5-8 is set to OFF Pump will operate based on the status of the unit operation contact or the ON/OFF button on the remote controller.	All conditions other than the ones at left	TB5 70-71
(p) EMERGENCY SIGNAL	Close/Open	Water temp. below booster heater operation water temp. (TWL1 value) (Item code 1057) and outdoor temp. (TAL1 value) (Item code 1058).	Water temp.≥ TWL1 + 2ºC or Outdoor temp.≥ TAL1 + 2ºC	CN513 1-3
(q) DRAIN HEATER SIGNAL/ DEFROST SIGNAL	Close/Open	Item code 1056 set to "1": Defrost signal Item code 1056 set to "0": Drain heater signal Outdoor temp. ≤ 1ºC, Outdoor temp. ≤ 3ºC after having once dropped below 1°C, or 1°C ≤ Outdoor temp. ≤ 8°C during defrost cycle	-	CN513 5-7

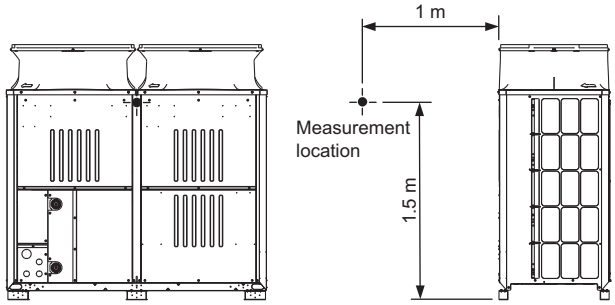
RC/M-NET

REMOTE CONTROLLER	PAR-W31MAA	TB6 RA-RB
M-NET	Transmission line	TB3 A/M1-B/M2
Centralized controller	AE-C400E, EW-C50E	TB7 A/M1-B/M2
Internal/external A-control signal Flow temp. controller	Flow temp. controller (FTC) PAC-IF071B-E PAC-IF072B-E PAC-IF073B-E PAC-SIF051B-E	TB5 FA-FB-FC

5. Sound pressure levels

5-1. Measurement condition

Measurement condition
CAHV-Z450YA-HPB (-BS)

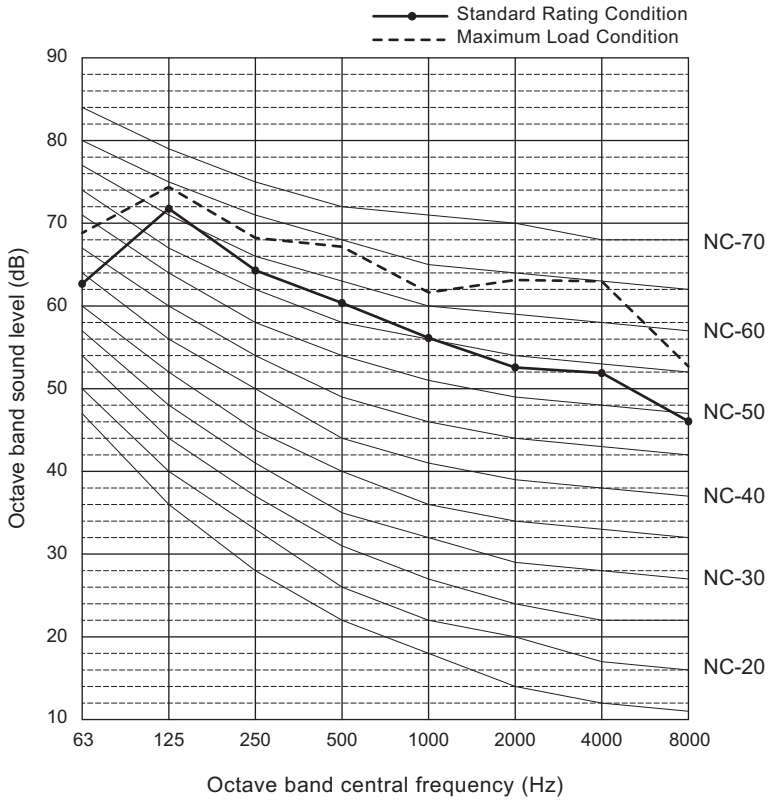


Sound Pressure Level
65/72 dB (Standard Rating Condition/Maximum Load Condition)

Operation condition
Standard Rating Condition: 7°CDB/6°CWB, Inlet water temp.: 40°C, Outlet water temp.: 45°C
Maximum Load Condition: At -5°CDB or below, with maximum compressor frequency and fan speed.
NOTE:
The sound level is measured in an anechoic room where echoes are few. The sound may be bigger than displays level under actual installation condition by surrounding echoes.

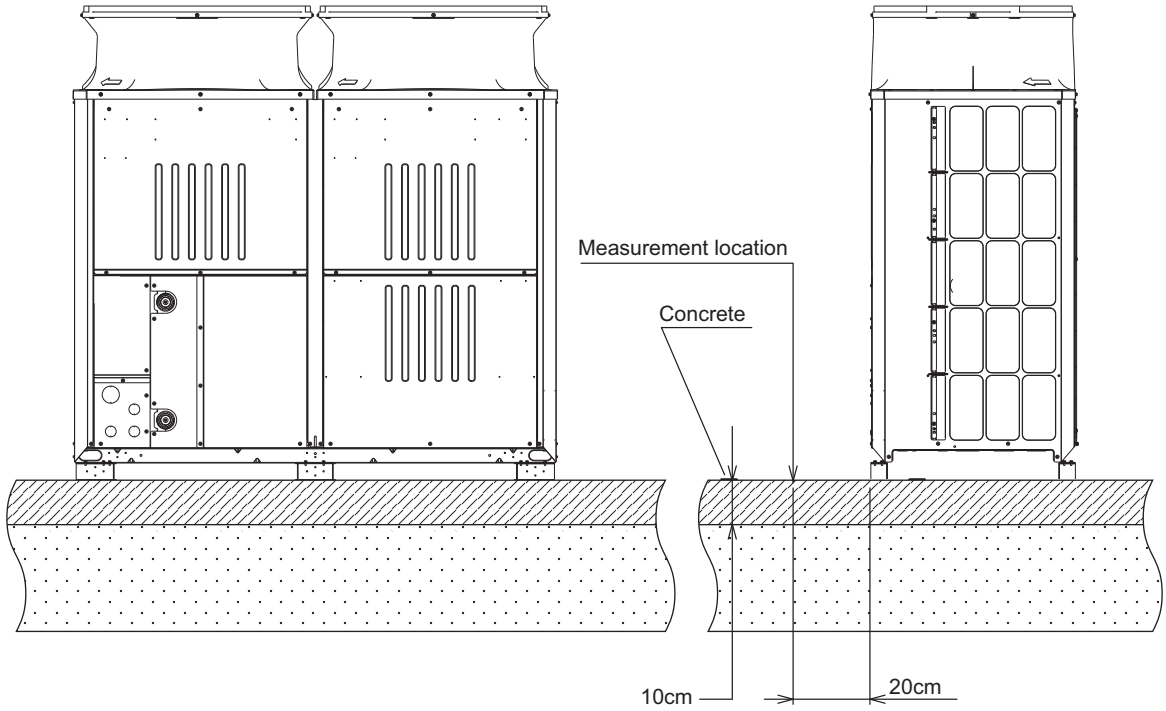
5-2. Sound levels

CAHV-Z450YA-HPB (-BS)



6. Vibration levels

CAHV-Z450YA-HPB (-BS)



Model	Vibration Levels [dB]
CAHV-Z450YA-HPB (-BS)	47 or less

7-1. Correction by temperature

CAHV-Z450YA-HPB (-BS)

NOTE:

These values are only for reference purpose. Actual performance may vary depending on operating conditions.

The values in the table include interpolation/calculation basing upon measured data in accordance with EN14511.

(1) Operating capacity: 100% = 40.0 kW

Capacity

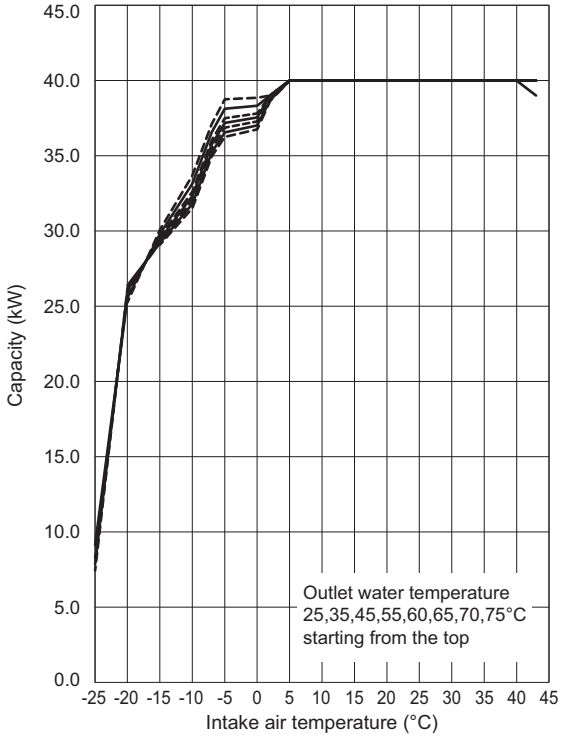
		Intake air temperature °C																		
		-25	-20	-15	-10	-7	-5	0	2	5	7	10	16	20	25	30	35	40	43
Outlet water temperature °C	25	-	-	-	-	-	-	-	39.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	39.0
	35	-	25.3	30.1	33.7	37.1	38.7	38.9	39.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
	45	9.2	25.6	29.8	33.1	36.6	38.1	38.3	39.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
	55	8.3	25.9	29.6	32.6	36.0	37.5	37.8	39.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
	60	7.9	26.1	29.4	32.3	35.8	37.2	37.5	39.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
	65	7.4	26.2	29.3	32.1	35.5	36.9	37.3	38.8	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
	70	-	26.4	29.2	31.8	35.2	36.6	37.0	38.7	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
	75	-	-	29.1	31.5	35.0	36.3	36.8	38.6	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0

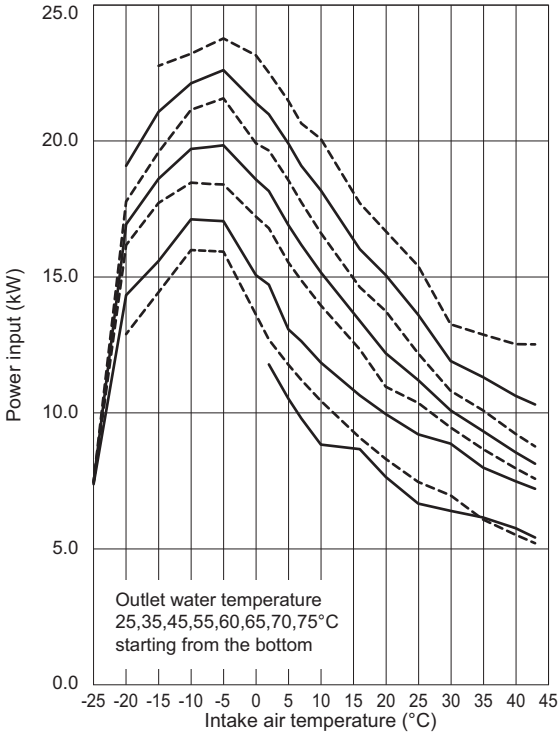
This table shows the capacity when the relative humidity is 85%.
The intake wet-bulb temperature is fixed to 32°C when the intake dry-bulb temperature is 35°C or higher.
The difference between the outlet water temperature and the inlet water temperature is 5°C.
However, if a difference of 5°C cannot 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	10.5	9.8	8.8	8.6	7.6	6.6	6.4	6.1	5.7	5.4
	35	-	12.9	14.4	16.0	15.9	15.9	13.6	12.7	11.8	11.2	10.4	9.1	8.3	7.4	6.9	6.0	5.5	5.2
	45	7.3	14.3	15.6	17.1	17.1	17.0	15.0	14.7	13.1	12.6	11.8	10.6	9.9	9.2	8.8	8.0	7.5	7.2
	55	7.4	16.2	17.7	18.5	18.4	18.4	17.2	16.8	15.5	14.9	13.9	12.3	10.9	10.3	9.4	8.6	7.9	7.5
	60	7.4	16.9	18.6	19.7	19.8	19.8	18.6	18.2	16.9	16.2	15.2	13.4	12.2	11.2	10.1	9.3	8.5	8.1
	65	7.4	17.8	19.6	21.1	21.4	21.6	19.9	19.6	18.6	17.7	16.6	14.6	13.7	12.2	10.8	10.1	9.2	8.7
	70	-	19.1	21.1	22.1	22.4	22.6	21.4	21.0	19.9	19.1	18.2	16.0	15.1	13.6	11.9	11.3	10.6	10.3
	75	-	-	22.8	23.2	23.6	23.8	23.2	22.5	21.5	20.6	20.1	17.7	16.7	15.4	13.2	12.9	12.5	12.5

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.





7. Capacity tables

(2) Operating capacity: 75% = 30.0 kW

Capacity

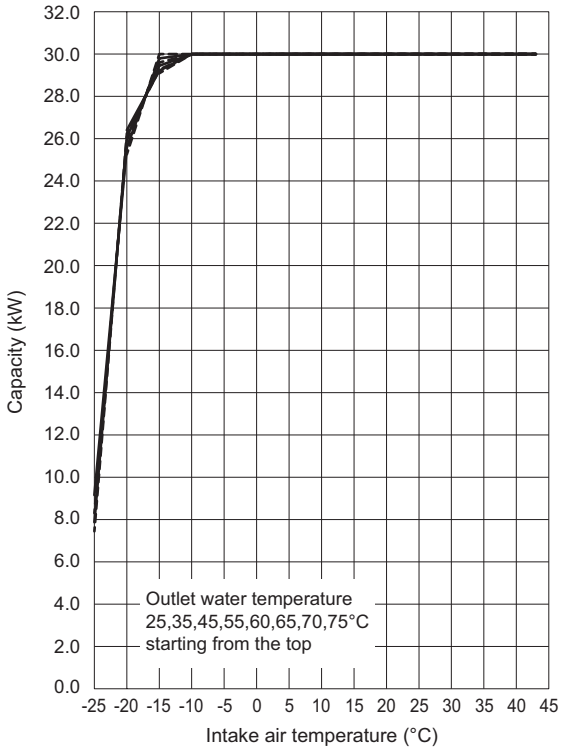
		Intake air temperature °C																		
		-25	-20	-15	-10	-7	-5	0	2	5	7	10	16	20	25	30	35	40	43
Outlet water temperature °C	25	-	-	-	-	-	-	-	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
	35	-	25.3	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
	45	9.2	25.6	29.8	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
	55	8.3	25.9	29.6	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
	60	7.9	26.1	29.4	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
	65	7.4	26.2	29.3	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	-	26.4	29.2	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
	75	-	-	29.1	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

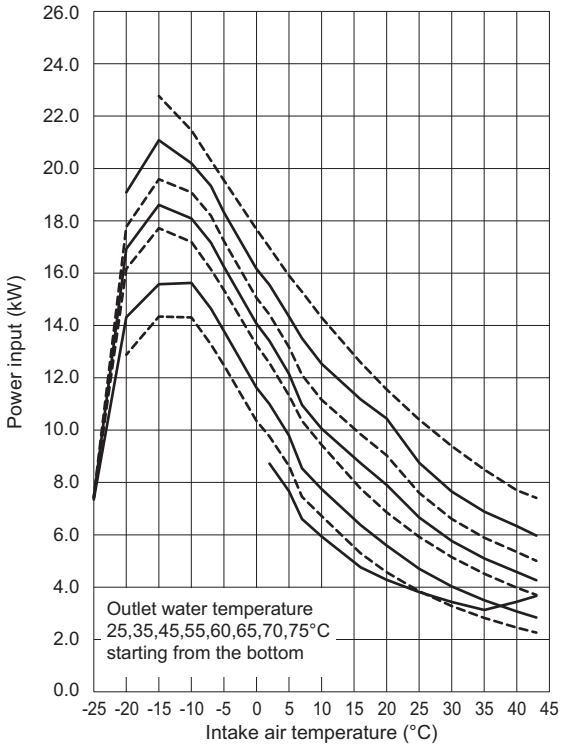
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The difference between the outlet water temperature and the inlet water temperature is 5°C.
However, if a difference of 5°C cannot be secured, the lower limit flow rate shall be used.

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	-	-	-	-	-	-	-	8.7	7.7	6.6	5.9	4.8	4.3	3.8	3.4	3.1	3.4	3.7
	35	-	12.9	14.3	14.3	13.3	12.5	10.4	9.8	8.6	7.4	6.7	5.3	4.6	3.8	3.3	2.8	2.5	2.3
	45	7.3	14.3	15.6	15.6	14.6	13.8	11.6	11.0	9.8	8.5	7.7	6.4	5.6	4.7	4.0	3.5	3.1	2.8
	55	7.4	16.2	17.7	17.2	16.1	15.3	13.3	12.6	11.3	10.4	9.4	7.8	6.9	5.9	5.1	4.5	4.0	3.7
	60	7.4	16.9	18.6	18.1	17.2	16.2	14.1	13.4	12.1	11.0	10.1	8.7	7.9	6.7	5.8	5.1	4.6	4.3
	65	7.4	17.8	19.6	19.1	18.2	17.2	15.1	14.4	13.2	12.1	11.2	9.8	9.0	7.6	6.6	5.9	5.3	5.0
	70	-	19.1	21.1	20.2	19.3	18.3	16.2	15.5	14.3	13.5	12.5	11.2	10.4	8.8	7.6	6.9	6.3	6.0
	75	-	-	22.8	21.5	20.3	19.5	17.7	17.0	15.9	15.3	14.3	12.6	11.6	10.4	9.4	8.5	7.7	7.4

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.





7. Capacity tables

(3) Operating capacity: 50% = 20.0 kW

Capacity

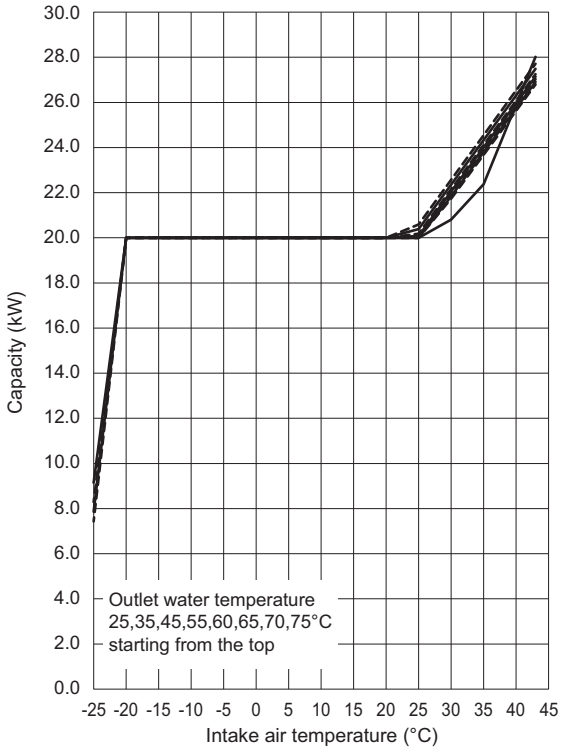
		Intake air temperature °C																		
		-25	-20	-15	-10	-7	-5	0	2	5	7	10	16	20	25	30	35	40	43
Outlet water temperature °C	25	-	-	-	-	-	-	-	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.8	22.4	25.9	28.0
	35	-	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.6	22.6	24.5	26.5	27.7
	45	9.2	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.4	22.4	24.3	26.3	27.5
	55	8.3	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.2	22.2	24.1	26.1	27.3
	60	7.9	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.1	22.0	24.0	26.0	27.1
	65	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	21.9	23.9	25.9	27.0
	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	21.8	23.8	25.7	26.9
	75	-	-	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	21.7	23.7	25.6	26.8

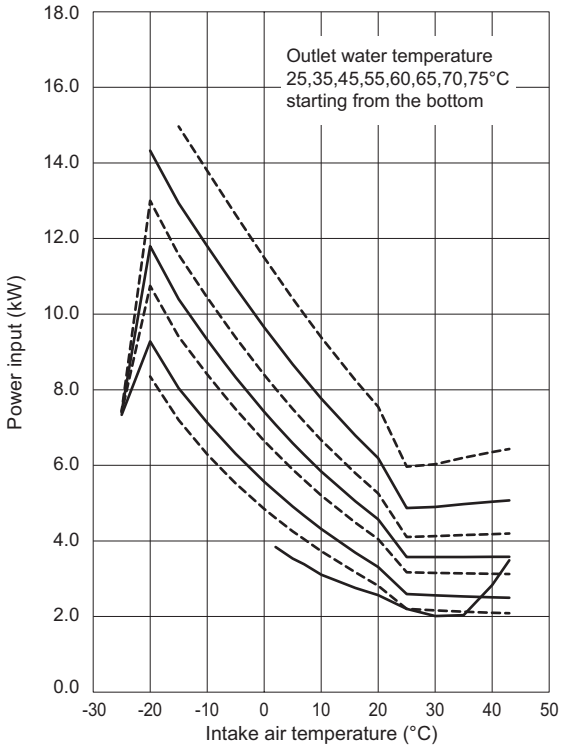
This table shows the capacity when the relative humidity is 85%.
The intake wet-bulb temperature is fixed to 32°C when the intake dry-bulb temperature is 35°C or higher.
The difference between the outlet water temperature and the inlet water temperature is 5°C.
However, if a difference of 5°C cannot 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	-	-	-	-	-	-	-	3.8	3.5	3.4	3.1	2.8	2.6	2.2	2.0	2.0	2.8	3.5
	35	-	8.4	7.2	6.3	5.8	5.5	4.8	4.6	4.3	4.0	3.7	3.2	2.8	2.2	2.2	2.1	2.1	2.1
	45	7.3	9.3	8.0	7.1	6.6	6.3	5.6	5.3	4.9	4.7	4.3	3.7	3.3	2.6	2.6	2.5	2.5	2.5
	55	7.4	10.7	9.4	8.4	7.9	7.5	6.6	6.3	5.9	5.6	5.2	4.5	4.0	3.2	3.2	3.1	3.1	3.1
	60	7.4	11.8	10.4	9.3	8.7	8.3	7.4	7.1	6.6	6.3	5.8	5.1	4.6	3.6	3.6	3.6	3.6	3.6
	65	7.4	13.0	11.6	10.4	9.8	9.4	8.4	8.0	7.5	7.2	6.7	5.8	5.3	4.1	4.1	4.2	4.2	4.2
	70	-	14.3	12.9	11.8	11.1	10.7	9.7	9.3	8.7	8.3	7.8	6.8	6.2	4.9	4.9	5.0	5.0	5.1
	75	-	-	15.0	13.8	13.1	12.6	11.5	11.1	10.4	10.0	9.4	8.3	7.6	6.0	6.0	6.2	6.4	6.4

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.





(4) Operating capacity: Lower limit

Capacity

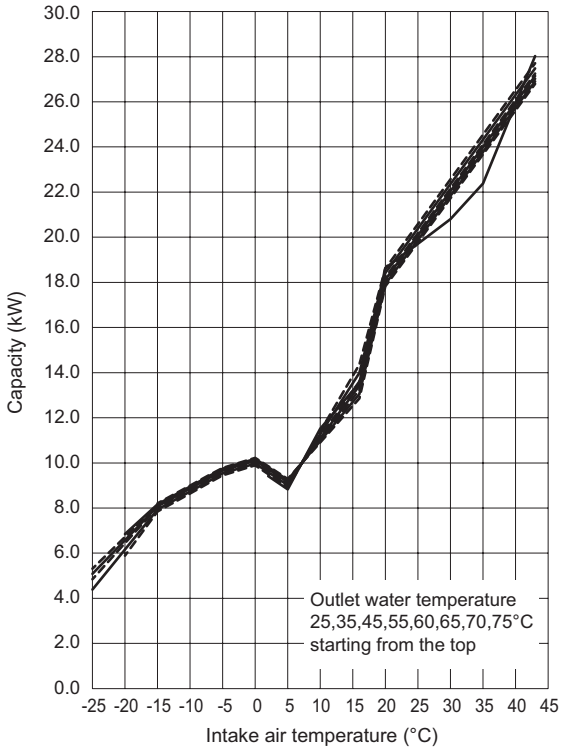
		Intake air temperature °C																	
		-25	-20	-15	-10	-7	-5	0	2	5	7	10	16	20	25	30	35	40	43
Outlet water temperature °C	25	-	-	-	-	-	-	-	9.4	8.8	9.9	11.5	13.5	18.6	19.7	20.8	22.4	25.9	28.0
	35	-	5.9	7.8	8.6	9.1	9.5	9.9	9.5	8.9	9.9	11.4	14.4	18.6	20.6	22.6	24.5	26.5	27.7
	45	4.4	6.2	7.9	8.7	9.2	9.5	10.0	9.6	9.0	9.9	11.3	14.0	18.4	20.4	22.4	24.3	26.3	27.5
	55	4.9	6.4	8.0	8.8	9.3	9.6	10.1	9.7	9.1	9.9	11.2	13.6	18.2	20.2	22.2	24.1	26.1	27.3
	60	5.1	6.6	8.1	8.9	9.3	9.7	10.1	9.7	9.2	9.9	11.1	13.4	18.1	20.1	22.0	24.0	26.0	27.1
	65	5.3	6.7	8.1	8.9	9.4	9.7	10.1	9.8	9.2	9.9	11.0	13.2	18.0	20.0	21.9	23.9	25.9	27.0
	70	-	6.9	8.2	9.0	9.4	9.7	10.2	9.8	9.2	9.9	11.0	13.0	17.9	19.9	21.8	23.8	25.7	26.9
	75	-	-	8.2	9.0	9.5	9.8	10.2	9.9	9.3	9.9	10.9	12.9	17.8	19.8	21.7	23.7	25.6	26.8

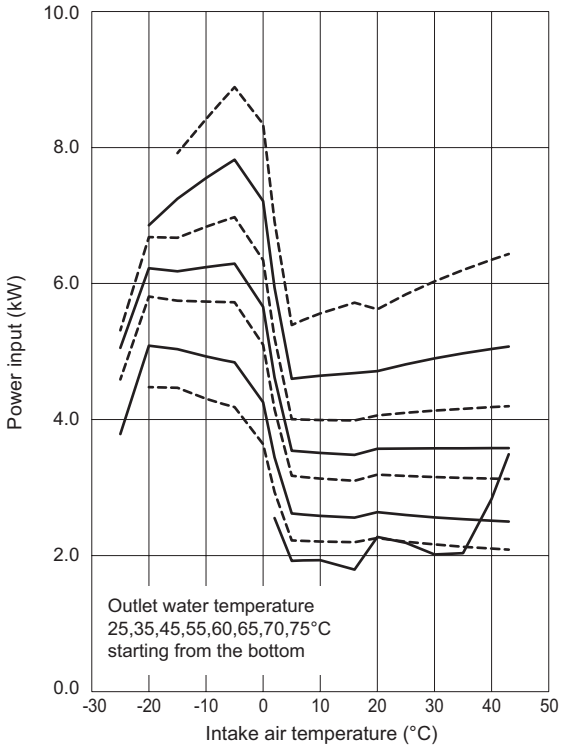
This table shows the capacity when the relative humidity is 85%.
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The difference between the outlet water temperature and the inlet water temperature is 5°C.
However, if a difference of 5°C cannot be secured, the lower limit flow rate shall be used.

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	-	-	-	-	-	-	-	2.6	1.9	1.9	1.9	1.8	2.3	2.2	2.0	2.0	2.8	3.5
	35	-	4.5	4.5	4.3	4.2	4.2	3.6	2.9	2.2	2.2	2.2	2.2	2.3	2.2	2.2	2.1	2.1	2.1
	45	3.8	5.1	5.0	4.9	4.9	4.8	4.3	3.4	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.5	2.5	2.5
	55	4.6	5.8	5.7	5.7	5.7	5.7	5.1	4.2	3.2	3.2	3.1	3.1	3.2	3.2	3.2	3.1	3.1	3.1
	60	5.1	6.2	6.2	6.2	6.3	6.3	5.7	4.6	3.5	3.5	3.5	3.5	3.6	3.6	3.6	3.6	3.6	3.6
	65	5.3	6.7	6.7	6.8	6.9	7.0	6.3	5.2	4.0	4.0	4.0	4.0	4.1	4.1	4.1	4.2	4.2	4.2
	70	-	6.9	7.2	7.5	7.7	7.8	7.2	5.9	4.6	4.6	4.6	4.7	4.7	4.8	4.9	5.0	5.0	5.1
	75	-	-	7.9	8.4	8.7	8.9	8.3	6.9	5.4	5.5	5.6	5.7	5.6	5.8	6.0	6.2	6.4	6.4

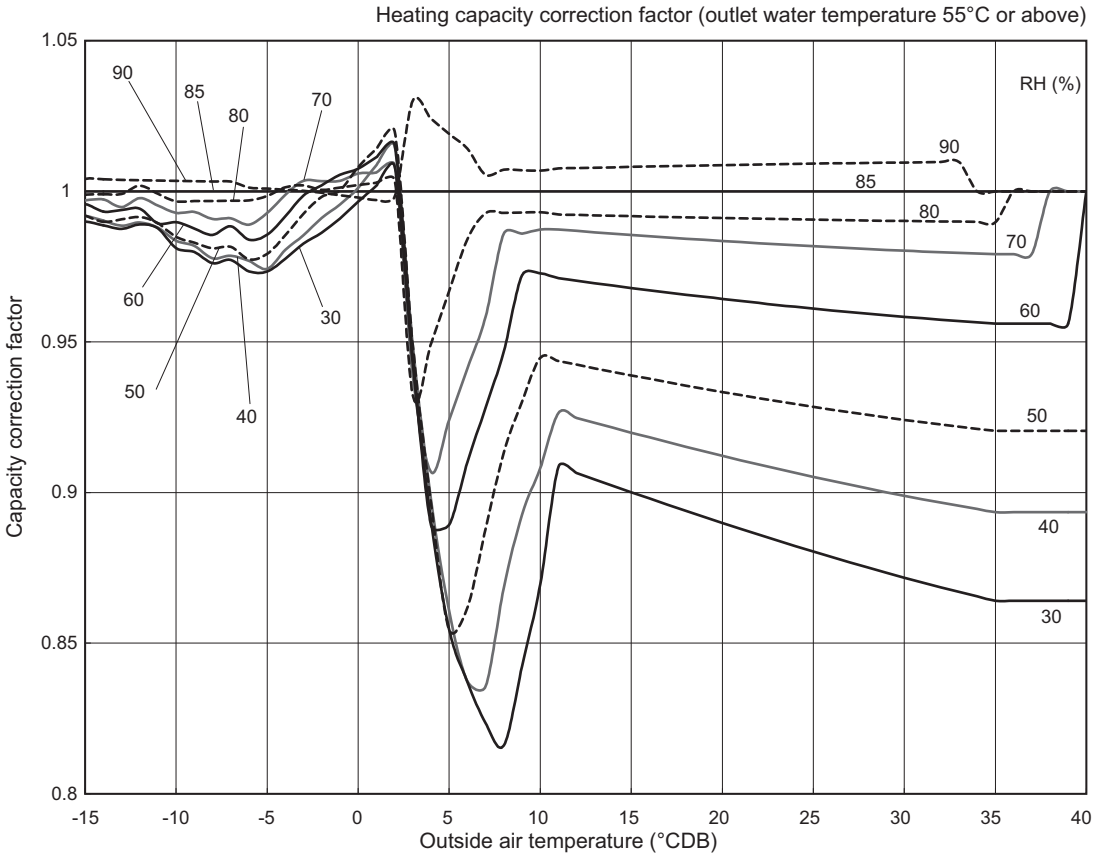
This table shows the power input when the relative humidity is 85%.
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However, if a difference of 5°C cannot be secured, the lower limit flow rate shall be used.





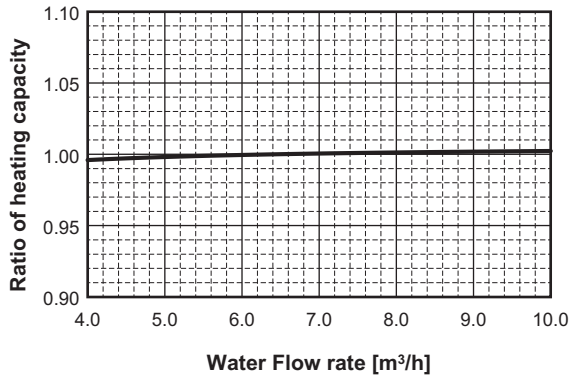
7-2. Correction by relative humidity

CAHV-Z450YA-HPB (-BS)

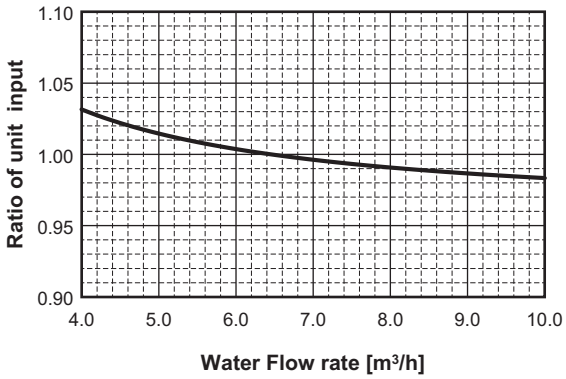


7-3. Correction by water flow rate

CAHV-Z450YA-HPB (-BS)



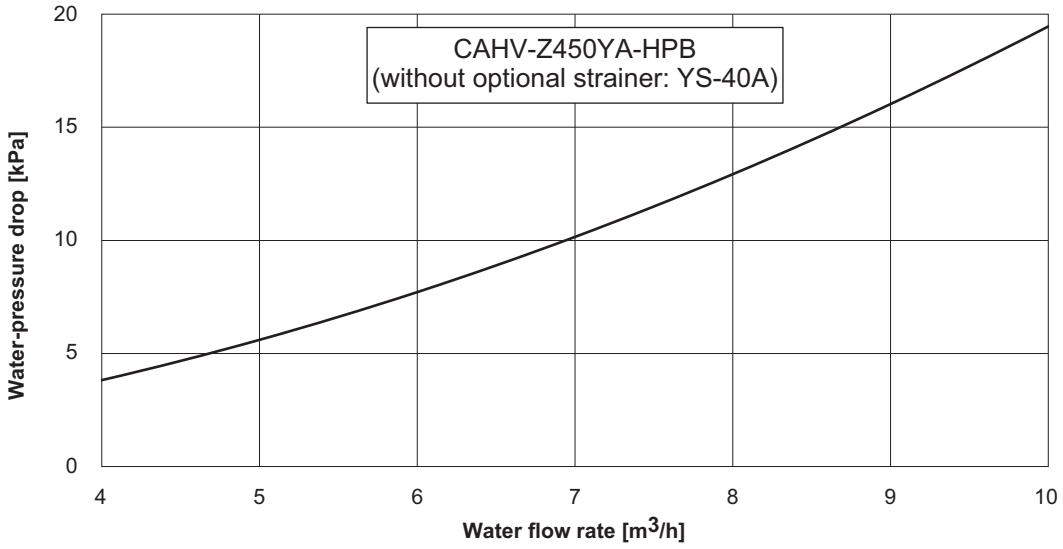
*Conditions Outdoor temperature -5°C
Inlet water temperature 50°C
Frequency of compressor 140Hz

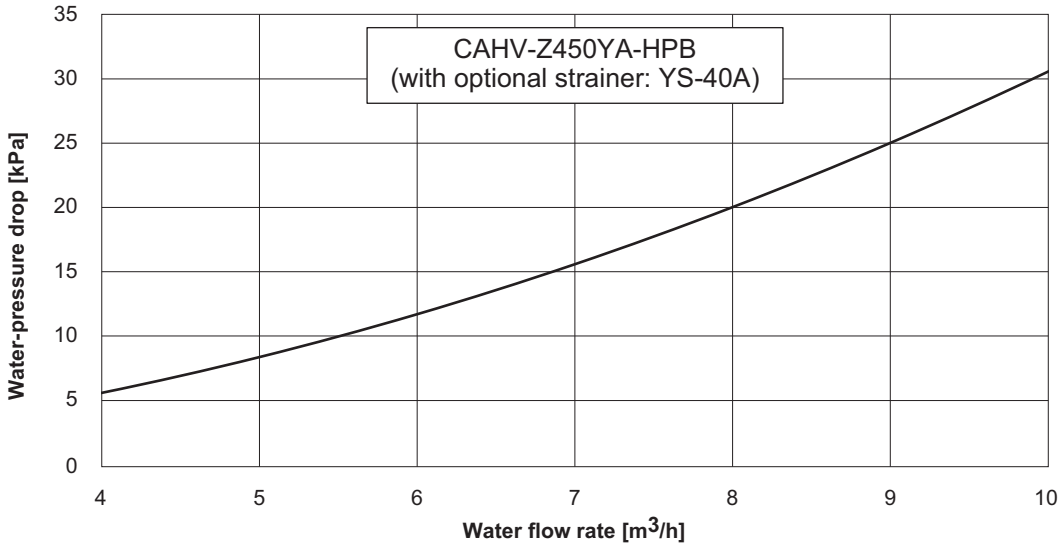


*Conditions Outdoor temperature -5°C
Inlet water temperature 50°C
Frequency of compressor 140 Hz

7-4. Water pressure drop

CAHV-Z450YA-HPB (-BS)



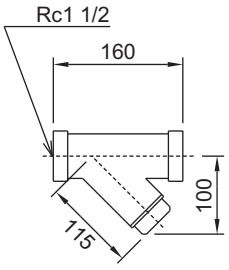


8-1. Strainer

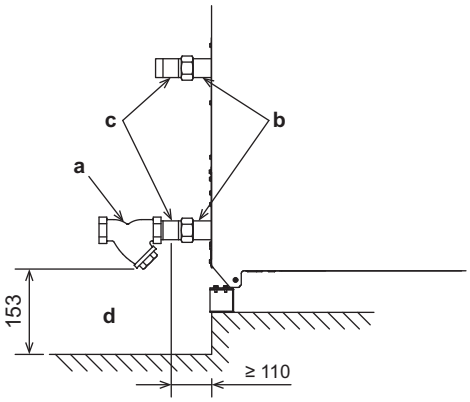
Install an optional strainer near the unit in the inlet water pipe to keep the heat exchanger from clogging and corrosion.
Operating the units with a clogged strainer may cause the units to make an abnormal stop.
Install the strainer for easy cleaning access, and advise the user to clean it regularly.
Consider the installation angle, insulation thickness, and maintenance access space.

- Y-strainer dimensions

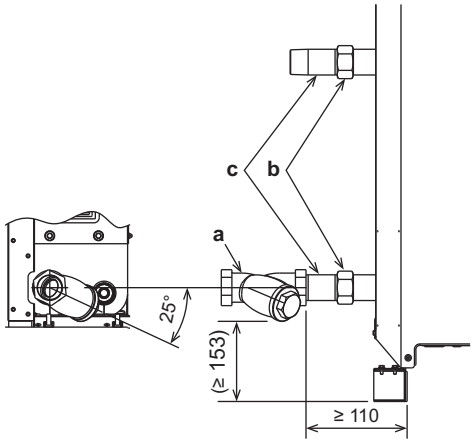
<Unit: mm>



- Space required around the Y-strainer for screwing it in



Example 1



Example 2

a Y-strainer (Option: YS-40A)
b Pipe
c Pipes (not supplied)
d Y-strainer maintenance access space

8-2. Flow switch

Install a flow switch (not supplied) in the water pipe, and connect the flow switch to the contact point on the unit.
The water volume range of the unit is 4.0 - 10.0 m^3/h.

8-3. Installing the external water temperature thermistor

[1] Required parts for installing an external-water temperature thermistor TW-TH16

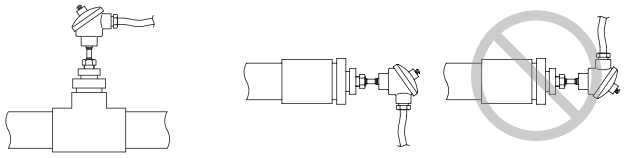
1) External-water temperature thermistor
2) Cable for connecting between the sensor and the unit *1
3) Cable terminal for connecting to the sensor and the unit terminal block *1
(Terminals for M4 screws × 4) *1
*1: 1) and 2) are field-supplied.

Cable specifications

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

[2] Installing an external-water temperature thermistor

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.

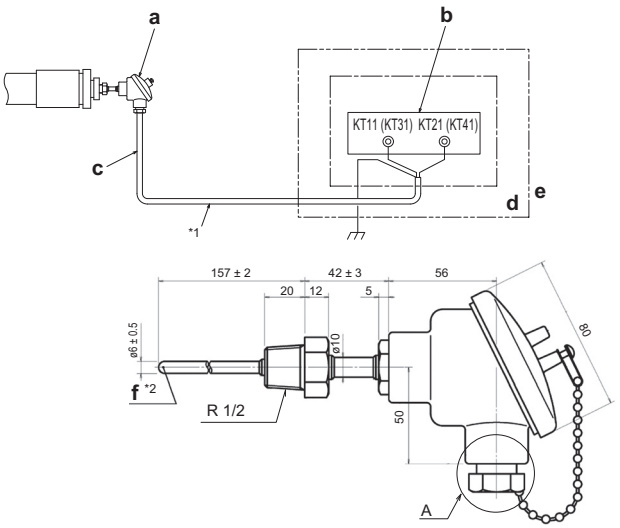


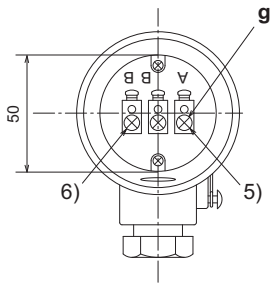
Vertical installation **Horizontal installation**

[3] Wiring for an external-water temperature thermistor

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

Unit: mm





Terminal block on the sensor

a External water temperature thermistor
b Terminal block in the control box on the unit
c Sensor wire
d Control box
e Unit
f Sensor
g 3 - M4 screw (Screw for cable terminal installation)
*1:Install the sensor cable at least 5 cm away from the power cable to which 100 V or higher voltage is applied.
*2:Sensor properties
Resistance: R = 15 KΩ ± 3% (0 °C)
B-constant: 3460 K

8. Optional parts

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

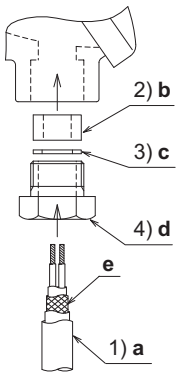
Connect the shielded cable to the ground terminal.

On the sensor side, as shown in the figure below, run the cable through 4), 3), and 2), attach the field-supplied terminals for M4 screws to the cable, and then connect the terminals to the screws 5) and 6) (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 4), and caulk the gap between the tightening screw 4) and cable 1) to prevent water leakage.

*1: In a multiple module connection system, install the temperature thermistor where the cold/hot water from each module is sufficiently mixed to provide a representative temperature.
*2: The temperature thermistor must be installed on a pipe between the outlet of the unit and the entrance to the load-side system.



a Cable (field-supplied)
b Watertight sealing rubber (Inner diameter ø11)
c Washer (Inner diameter ø12)
d Tightening screw (Inner diameter ø15)
e Shielded cable (cut)

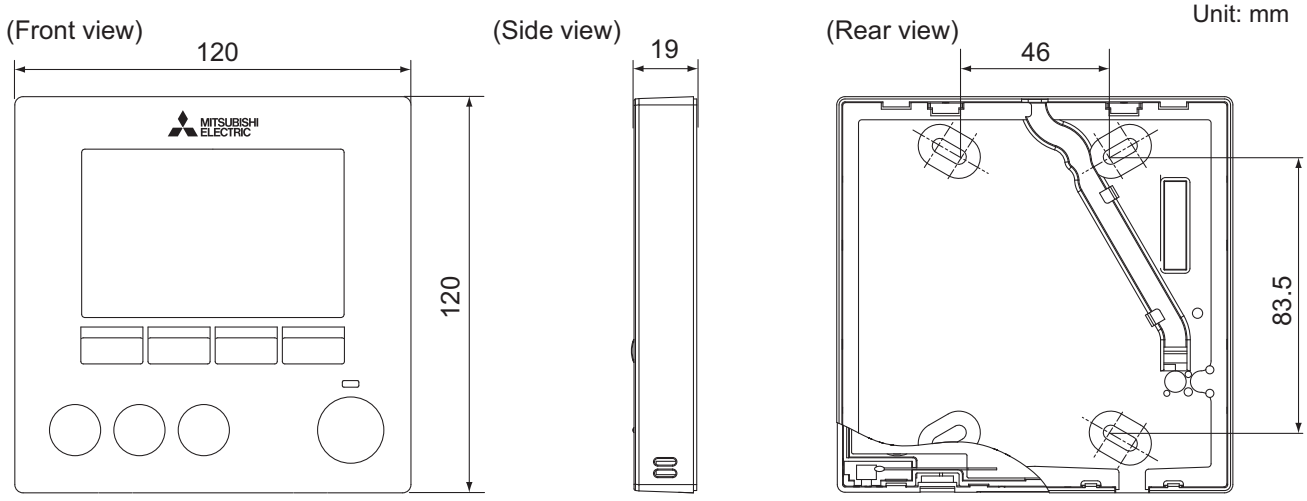
Enlarged view of area A: Cable installation

9. Controller

[1] Remote controller PAR-W31MAA

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 ~ 75°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	○	○

Unit: mm



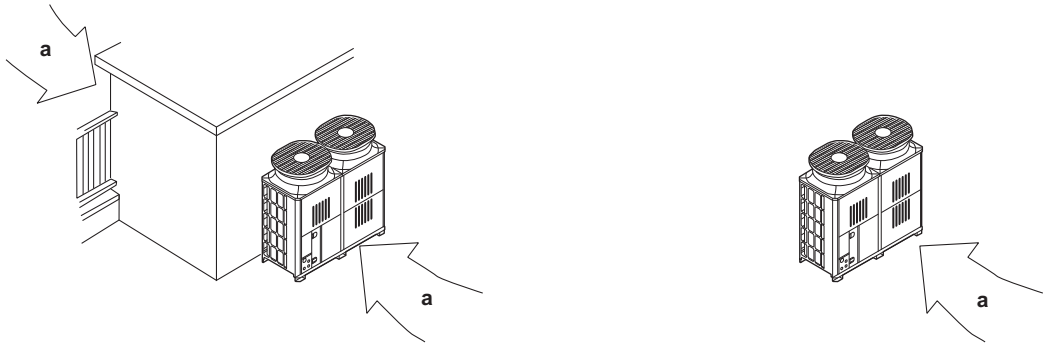
10-1. Installation Conditions

Consult with the client to select an outdoor unit installation site that meets the following conditions:

- The unit is not subject to heat from other heat sources.
- The unit's noise will not be problematic.
- The unit's water can be properly drained.
- The space requirements are met. Refer to the following page(s) for detail. "Space Requirements" (p. 20)

10-1-1. Protection against wind exposure

A unit installed alone is susceptible to wind exposure, so choose a sheltered site (e.g., behind a structure).
If the wind consistently blows from one direction, position the unit so that the outlet is facing away from it.



a Wind

10-1-2. Cold climate installation

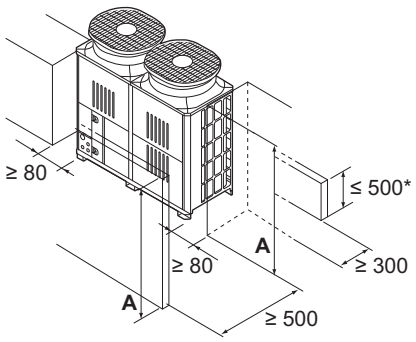
- Choose a sheltered site to minimize exposure to winds, rain, and snow, and to prevent possible damage or injury from falling icicles, particularly when installing on a roof.
- Install snow hoods on both the discharge and suction ducts if the units are exposed to rain, winds, or snow, or if the outdoor temperature can drop to -10°C or below. Use a snow net or snow fence as necessary.
- Install the units on a base approximately twice the height of the expected snowfall.
- If the units are operated continuously in freezing temperatures, install a base heater to prevent water at the unit bottom from freezing.

10-2. Space Requirements

10-2-1. Individual unit installation

[1] No walls surrounding the unit are taller than the unit height, and the wall behind the unit is no higher than 500 mm (* in the figure).

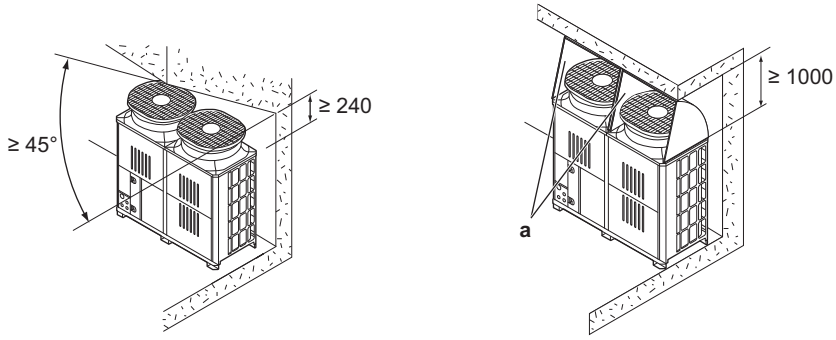
<Unit: mm>



A Unit height

[2] Required distance from the ceiling

<Unit: mm>



a Flow hood (not supplied)

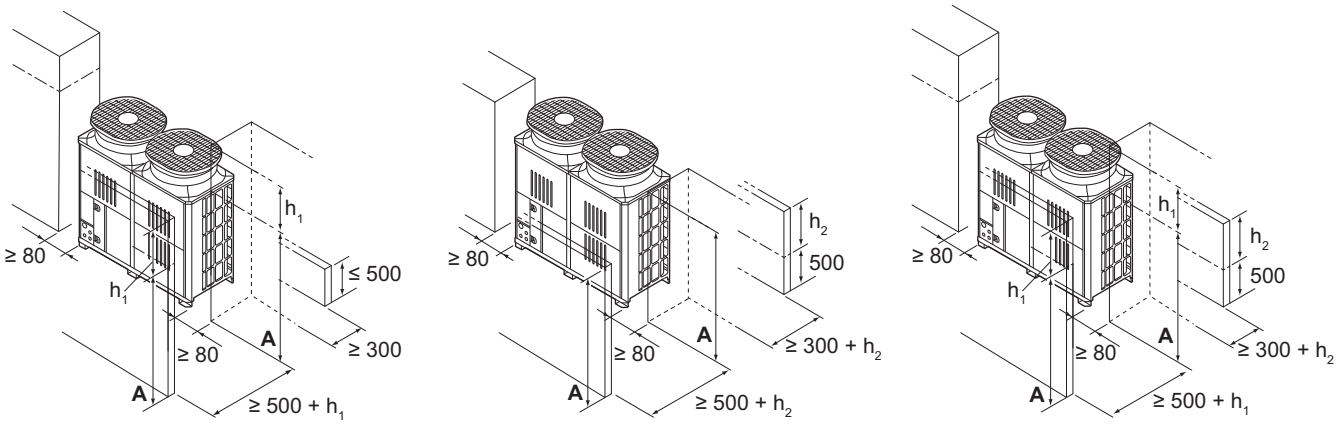
[3] One or more walls surrounding the unit are taller than the unit height, and there is a wall behind the unit.

If the wall(s) surrounding the unit are taller than the unit height, and/or the wall behind the unit is taller than 500 mm, the minimum space requirements will be increased by the amount indicated by h_1 and h_2 in the figures below.

h_1: Height difference between wall and unit

h_2: Wall height minus 500 mm

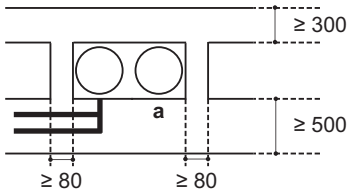
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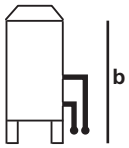
A Unit height

[4] Water piping

Top view



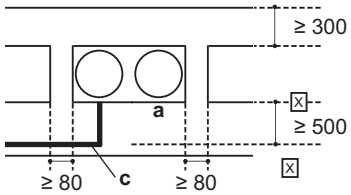
Side view



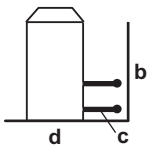
<Unit: mm>

a Front
b Wall

Top view



Side view



<Unit: mm>

a Front
b Wall
c Water pipe
d Foundation

Water pipe must be routed at least 500 mm from the unit, if it is not possible to install the unit on a raised foundation. (See x in the figure.)

10-2-2.Multiple unit installation

-Leave sufficient space for air passage and as a walkway between units as shown below.

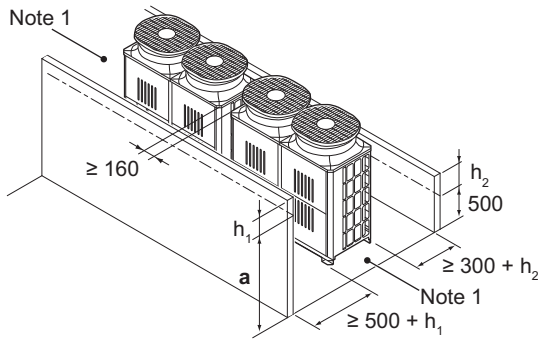
Note 1: Leave both sides of each group of units open.

Note 2: Leave one side of each group of units open.

If the wall(s) surrounding the unit are taller than the unit height, the minimum space requirements will be increased by the amount that the wall exceeds the unit height.

[1] Units installed side-by-side

<Unit: mm>

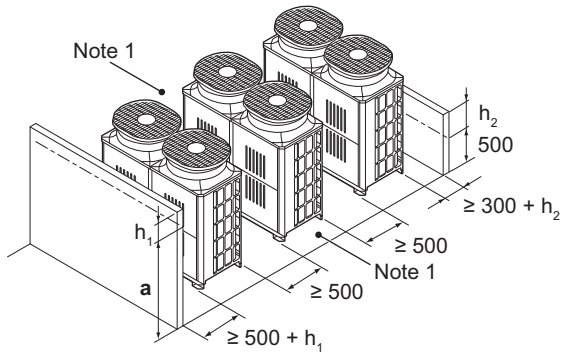


a Unit height

[2] Units installed face-to-face

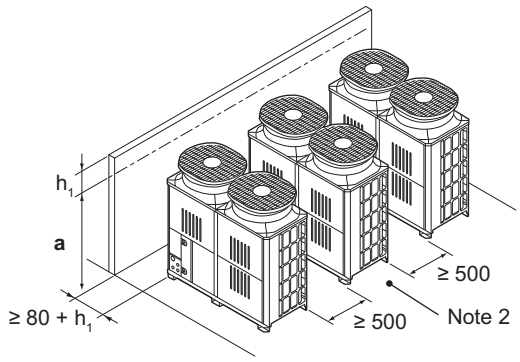
♦ Walls in the back and the front

<Unit: mm>



♦ Wall on one side

<Unit: mm>

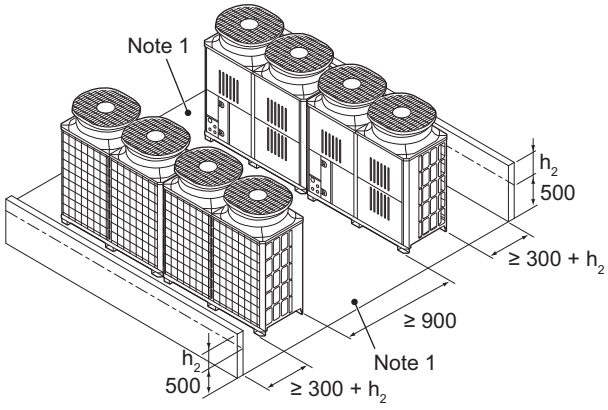


a Unit height

[3] Combination of face-to-face and side-by-side installations

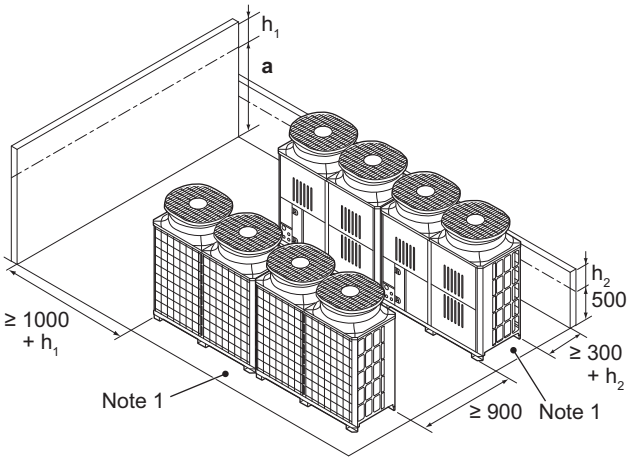
♦ Walls in the back and the front

<Unit: mm>



♦ A wall on one side and either in the front or the back of a given group of unit

<Unit: mm>

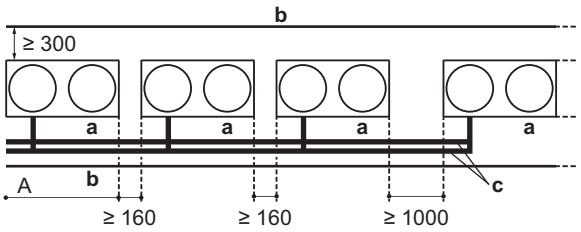


a Unit height

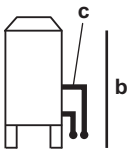
[4] Water piping

(1) Units installed side-by-side

Top view



Side view



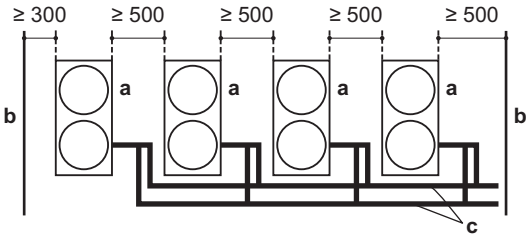
<Unit: mm>

a Front
b Wall
c Water pipe

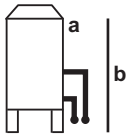
If the product width (labeled A in the figure) times the number of units that are installed side by side exceeds 6 m, leave a space of 1000 mm between each block, which is defined as a group of units that fits within 6 m.

(2) Units installed face-to-face

Top view



Side view



<Unit: mm>

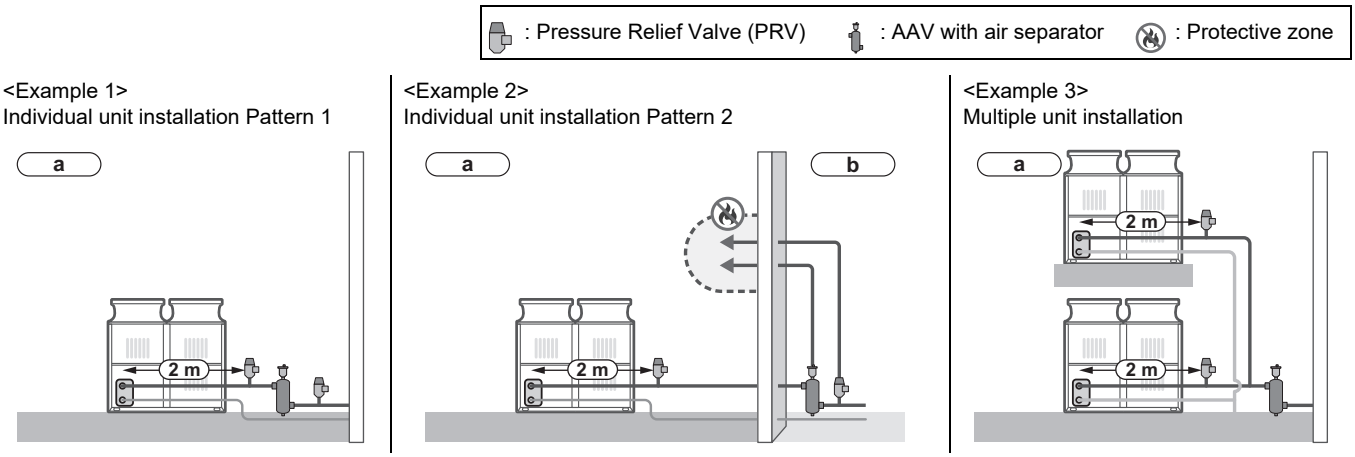
a Front
b Wall
c Water pipe

10-3. Installation Restrictions

To prevent ignition of the refrigerant, follow these instructions[*1] during installation.

*1: Established based on the Mitsubishi Electric's Risk Assessment Standards.

10-3-1.System configuration



a Outside
b Machine room

In order to ensure that the safety measures function properly in the event of a refrigerant leakage, Pressure Relief Valve (PRV) and Automatic Air vent Valve with Air Separator (AAV with air separator) must be installed as defined. Mitsubishi Electric strongly recommends that these be installed outdoors to reduce the risk of ignition with the leakage. In that case, they must be located inside the protective zone around the unit, as these open components may discharge flammable refrigerant. Make sure to follow the points below;

<PRV>

All the conditions below must be followed;

1) At least two PRVs that remain opened must be installed in the whole system. (It is acceptable for a greater number of them to be installed.)

2) One of the two PRVs must be located within 2 m of the unit.
One efficiently discharges refrigerant outdoors while the other regulates the water pressure, in the event of rapid refrigerant leakage from the water heat exchanger.

<AAV with air separator>

The condition below must be followed;

1) At least one AAV with an air separator must be installed in the whole system. It efficiently discharges refrigerant outdoors in the event of slow refrigerant leakage from the water heat exchanger.

- It is also acceptable to install an AAV with air separator equipped with a PRV. However, in this case, it must be installed within 2 m of the unit.

The PRV installed within 2 m of the unit and the AAV with air separator must comply with the following specifications;

<PRV>

Regarding the unit installation;

1) Individual unit installation: Discharge capacity must be ≥2,700 NL/min.

2) Multiple unit installation: Each unit must be equipped with a PRV installed within 2 m of the unit (each PRV must be ≥2,700 NL/min.).

Regarding the operating pressure;

1) The PRV must be set at the appropriate point so that it operates first in the event of the refrigerant leakage.

2) The operating pressure of the PRV must be set to the lowest value. Proper consideration of head difference and pressure loss is required to ensure correct operation.

<AAV with air separator>

Regarding the unit installation;

1) Individual unit installation;

- Discharge capacity must be ≥90 NL/min.
- Gas-liquid separation efficiency must be ≥90% at maximum water flow rate of 10.0 m^3/h.

2) Multiple unit installation;

- Discharge capacity must be ≥90 NL/min.
- When installing it on the combined piping system, the gas-liquid separation efficiency must be ≥90% at the water flow rate of (10.0 × number of units) m^3/h.
- When installing it on the pipe of each unit, the gas-liquid separation efficiency must be ≥90% at the maximum water flow rate of 10.0 m^3/h.

Even when PRVs and AAVs with air separator are installed indoors unavoidably, any leaked refrigerant must always be discharged outdoors. Make sure to follow the points below;

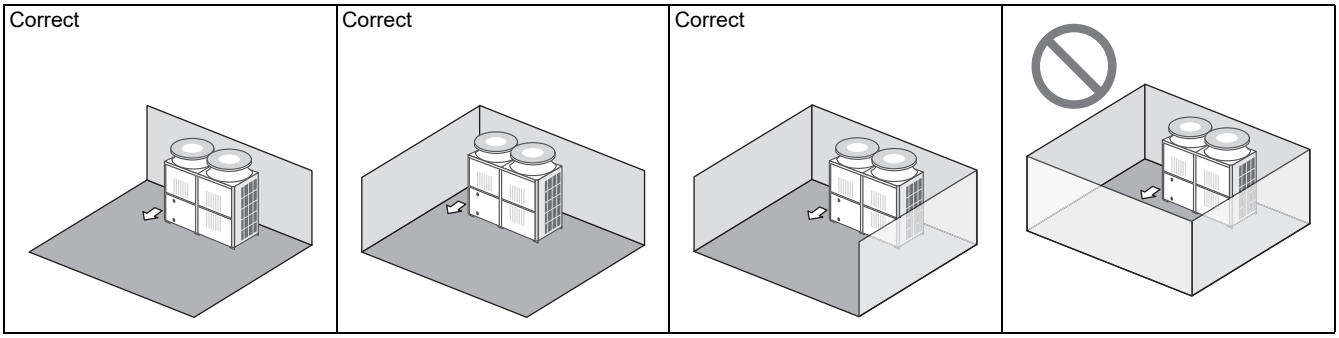
1) If it is necessary to discharge from indoor PRVs or AAVs with air separator, the outlet piping must always be led outdoors because the indoor discharge is not permitted. The protective zone rule also applies to the discharge destination; therefore, no ignition sources should exist at that location. Refer to "Protective Zone" (page 28).

2) When the primary side is isolated from the secondary side by an indirect heat exchanger or a tank with coil, the restrictions above do not apply to the secondary side.

In addition to the above, if there is any mechanism that releases gas throughout the entire system, it is not recommended to leave it open. If it is to be left open, ensure that the outlet piping is led outdoors. In case of heat exchanger failure, a small amount of flammable refrigerant could leak inside the building from it.

10-3-2.Surrounding Conditions for Outdoor Units

Install outdoor units in a place where at least one of the four sides is open or in a sufficiently large space without depressions.



If you unavoidably install a unit in a space where all four sides are blocked or there are depressions, confirm that one of these situations below ([1] or [2]) is satisfied.

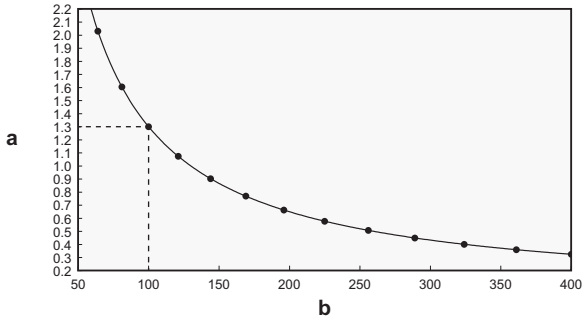
[1] Secure sufficient installation space and follow the restriction of the possible installation height regarding ignition sources.

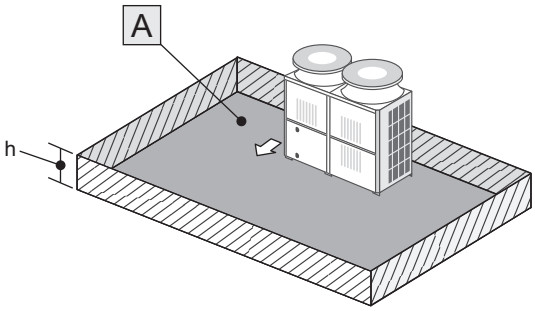
Based on the size of the installation area A (X-axis), find the possible installation height of h (Y-axis) in which ignition sources must not exist (refer to the graph below). Make sure any ignition source must not be placed below h.

However, when h is higher than the height of parapet *1, h can be equivalent to the height of parapet.

*1: Definition of parapet: a low protective wall along the edge of a roof, bridge, or balcony

e.g., When A is 100 m^2, any ignition source cannot be installed below h 1.3 m. (the dotted line on the graph below)



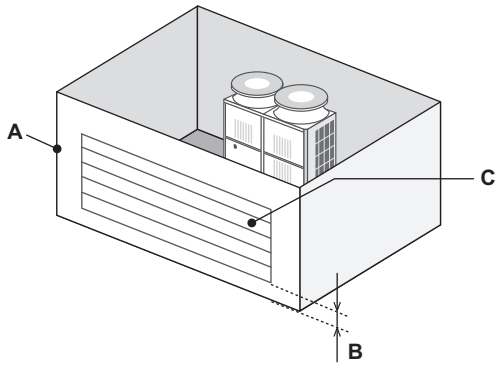


a The possible installation height of ignition sources h (m)

b The installation area A (m^2)

[2] Create an appropriate ventilation open area.

The ventilation open area refers to those that meet all of the following conditions: it starts at a height of 0.125m or less from the ground (condition **B**), the vertical length of the sides is at least 80% of longitudinal direction of the wall on which it is placed (**A**), and the area must occupy more than 75% of the total area of the wall (condition **C**).
If one side of the walls out of four sides satisfies that, the installation rules of Fig. 6 are applied, and when 2 sides/3 sides of the walls satisfy that, that of Fig. 5/4 are applied.



(Example: space with a louver)

A Longitudinal direction
B Height from the ground to an opening ≤ 0.125 m
C Opening:
- Must occupy 80% of the longitudinal side of a space.
- Must have an opening ratio of 75% or higher.

NOTE

- These countermeasures ([1] or [2]) are for keeping safety not for specification guarantee.
- In addition to the restriction of ignition sources, people are not allowed to enter the installation area where four surfaces are closed.
  In case qualified personnel enter for maintenance/removal, refer to "Safety Precautions" in the Installation/Operation Manual.

10-4. Protective Zone

In the event of a refrigerant leakage, it must be ensured that no one is endangered outdoors or in adjacent buildings, and no refrigerant can get into the building. For this purpose, safety-relevant protective zone are specified below.

- There must not be any building openings, entrance to the basement, grooves, or into the wastewater system in this area.
- The protective zone must not extend to adjacent buildings or public traffic areas.
- Ignition sources must not be present in this area, either permanently or for a short period of time.
- When the unit is installed in an open area (e.g., on the ground), prepare a fence around the unit so that people cannot enter easily.
  The unit is not accessible to the general public.
- When the unit is installed on the roof, make sure to lock the entrance so that only authorized personnel can enter.

Protective zone

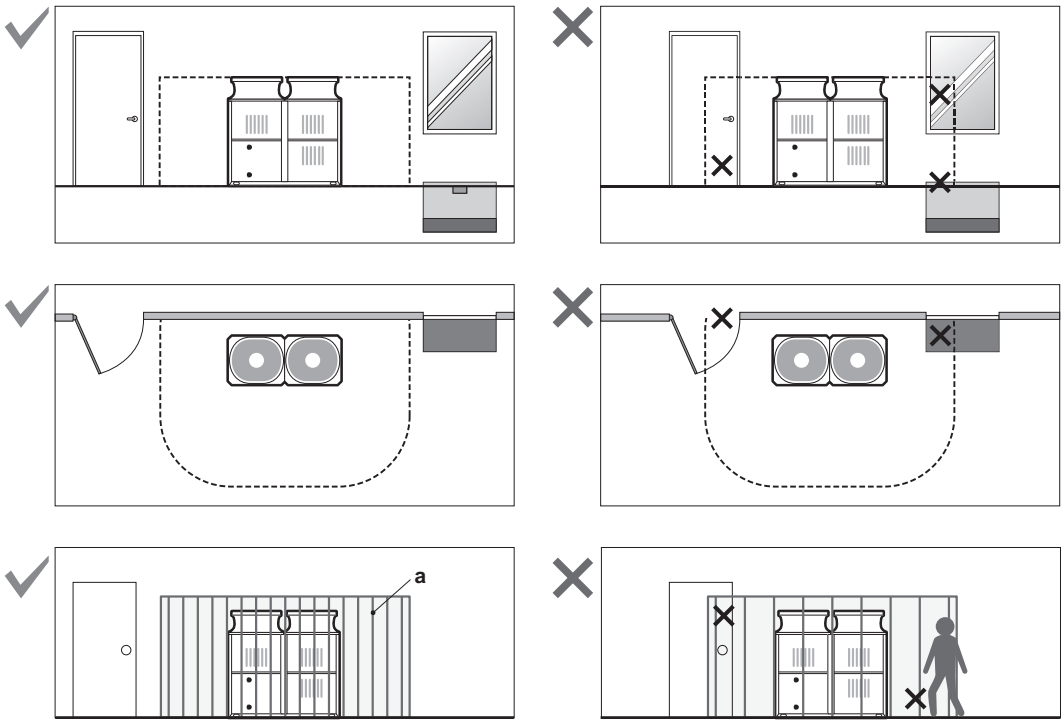


Fig. 1

a fence

NOTE

- In case qualified personnel enter for maintenance/removal. Refer to "Safety Precautions" in the Installation/ Operation Manual.

Specific dimensions of the protective zone are specified for each installation condition.
Refer to the figures for each case.

An object is considered to indicate the presence of a surface (or wall) when all of the following criteria are met:

- Its height is greater than 0.125 m and its width exceeds that of the unit.
- The opening ratio is less than 75%.
- It is within 5 m of the nearest side of the product enclosure.

[1] When installed in a location with an open around (Fig2, Fig3)

Define the protective zone as follows:

- 2 m around of the unit

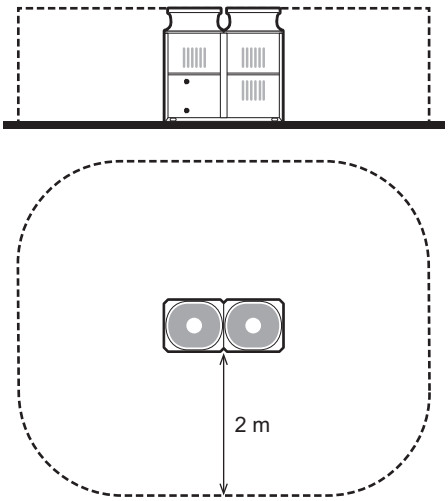


Fig. 2

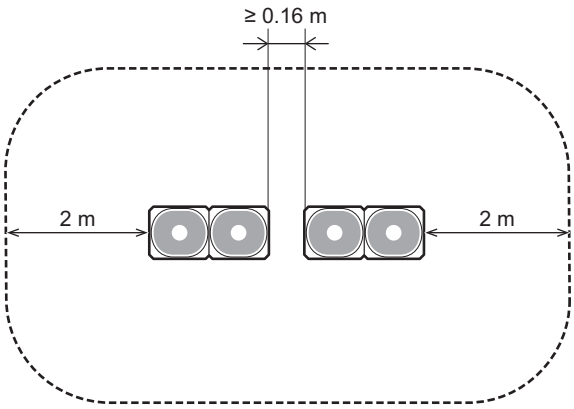


Fig. 3

[2] When installed in a location with 3 surfaces opened

- The open side distance from the unit x_l and x_r must be above 2 m.
- Calculate the forward distance y_{f1} and backward distance y_b to the unit with the table below.

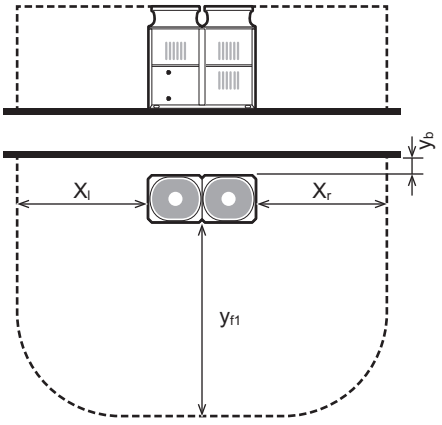


Fig. 4

(Unit: m)

y_b	y_{f1}
0.3	3.2
1.0	2.5
2.0	2.0
3.0	2.0

[3] When installed in a location with 2 surfaces opened (where the distance between one side of the unit and the wall is 0.3 m or more but less than 5 m)

- The open side distance from the unit x_l must be above 2 m.
- The forward distance from the unit y_{f2} must follow the table below. It depends on the distance l, which is defined by the smaller of the distances between x_r and y_b.

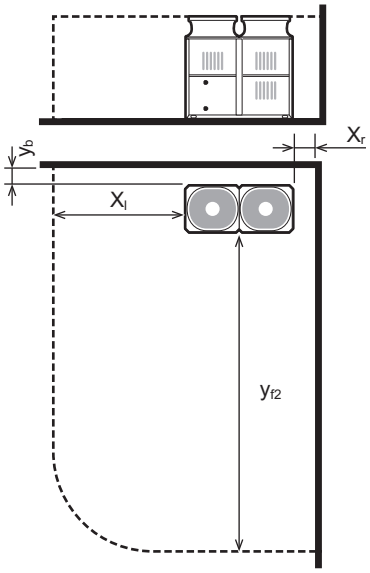


Fig. 5

(Unit: m)

l = min. (x_r, y_b)	y_{f2}
0.3	5.0
1.0	3.4
2.0	2.0
3.0	2.0

[4] When installed in a location where only the front opened

- The backward distance from the unit y_b must be above 0.3 m.
- The forward distance y_{f3} must follow the table below depending on the total side distance $x_l + x_r$.

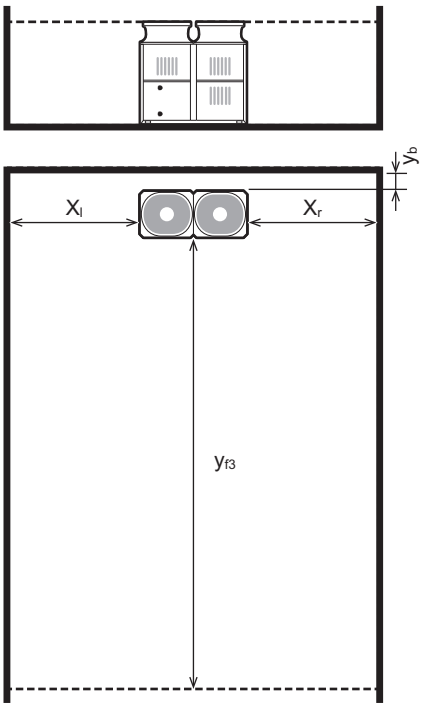


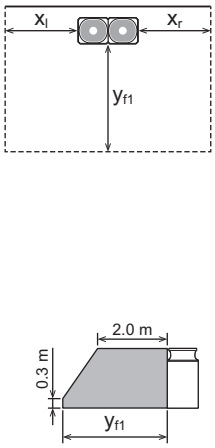
Fig. 6

(Unit: m)

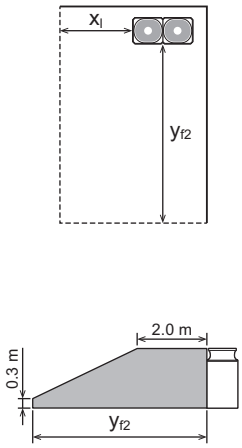
$x_l + x_r$	y_{f3}
2.0	12.0
4.0	7.5
6.0	5.3
8.0	4.0
10.0	3.1

Protective zone (Side view)

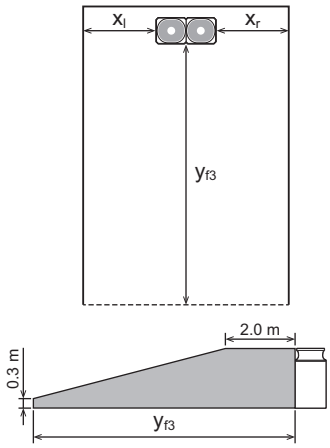
3 surfaces opened



2 surfaces opened



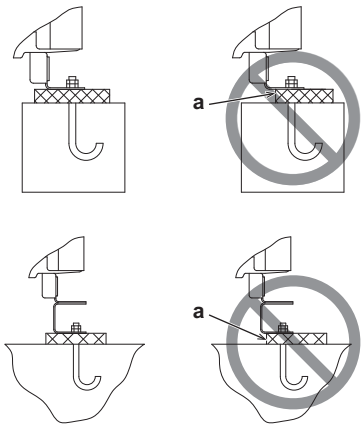
1 surface opened



11-1. Installation on foundation

Units must be properly installed by personnel certified by Mitsubishi Electric, following the installation instructions. Improper installation can cause the unit to topple or fall, leading to serious injuries. For safety measures against earthquakes and strong winds, consult local specialists.

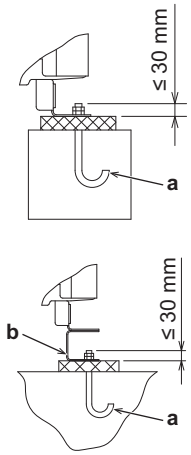
Install the unit on a foundation made of concrete or iron that can withstand its weight, and secure it with bolts. Ensure the foundation properly supports all corners of the installation legs as shown in the figures below. If the corners of the legs are not properly supported, the legs may bend. Build a foundation by considering the routes for drainage, piping, and wiring.



a Leg corner is not properly seated.

To prevent noise, pipe damage, and refrigerant gas leakage caused by vibrations from the unit being transmitted to floors and walls, take appropriate vibration control measures (e.g., rubber pads that cover the entire width of the legs).

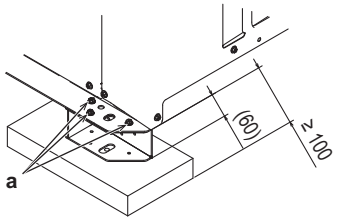
The projecting length of the anchor bolt must be 30 mm or less. The unit cannot be installed using hole-in anchor bolts unless brackets support the corners.



a M10 anchor bolt (not supplied)
b Detachable leg

The legs of the unit (two each in the front and back) can be detached by loosening the three screws on each leg. Repaint the finish coat if damaged. When installing units without using the detachable legs and routing pipes and wires underneath the unit, ensure the foundation does not block the piping access holes. To route the pipes under the unit, the foundation height must be at least 100 mm.

(Unit: mm)



a Unscrew to detach legs

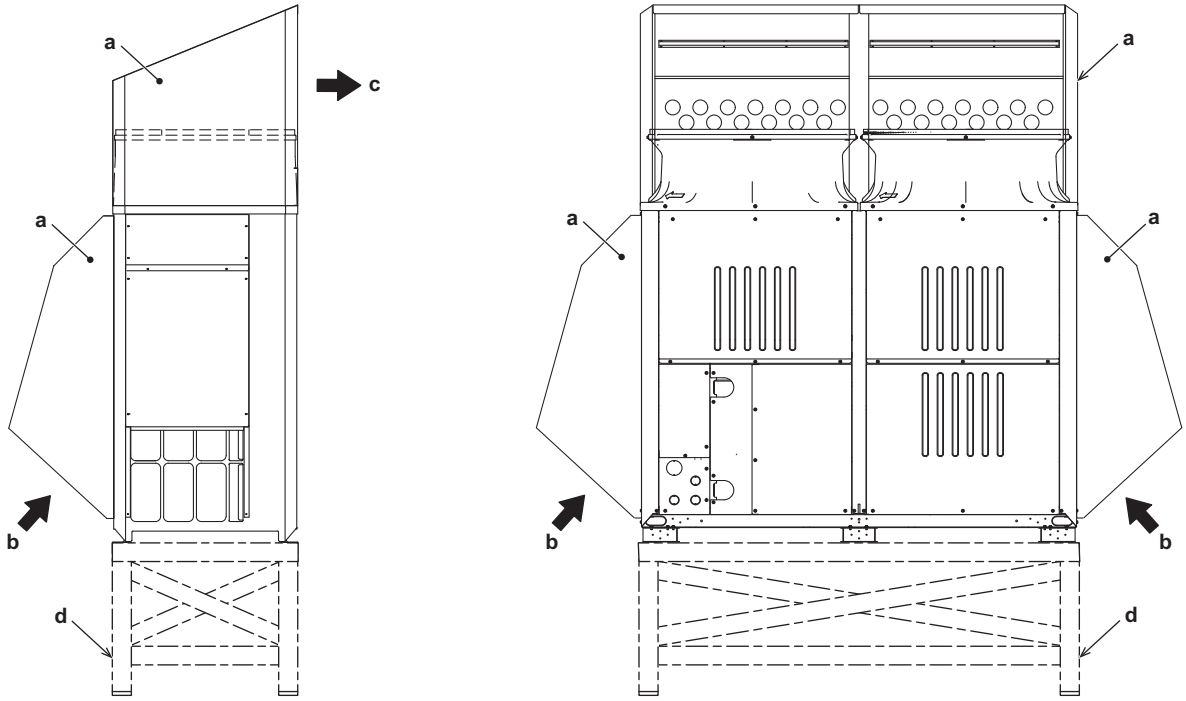
11-2. Installing the unit in a snow area

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 -10ºC 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-Z450YA-HPB (-BS)



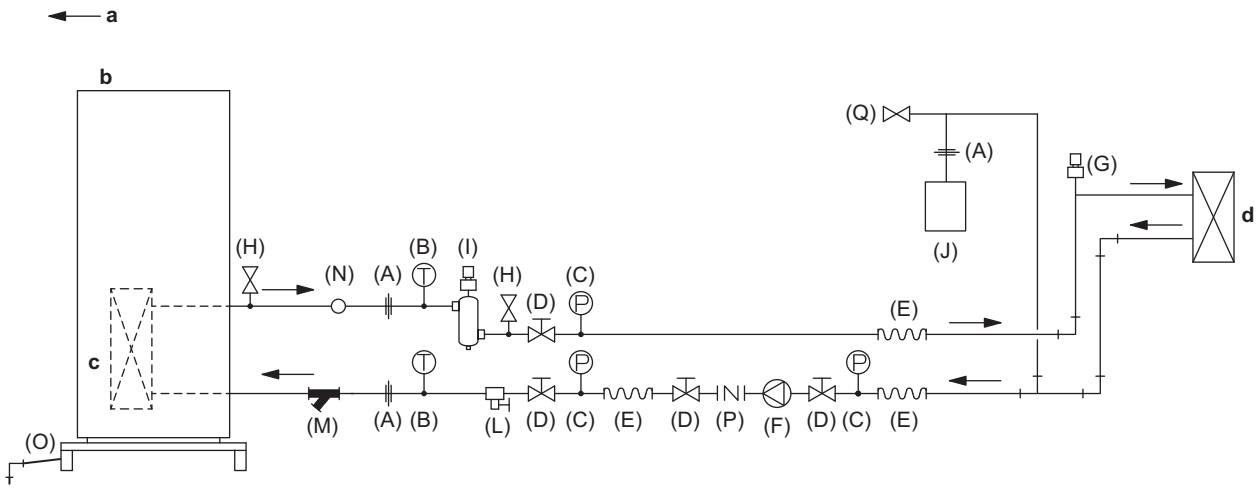
<Side view> <Front view>

a Snow hood
b Inlet
c Outlet
d Raised base

NOTE

- Install the unit so that the outlet/inlet faces away from the wind. Secure enough space around the unit to avoid a short cycle.
- 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.
- Refer to the figure above when installing the base on site.

12-1. Piping System Schematic



a Water flow direction
b Outdoor unit
c Water heat exchanger
d AC units, floor heater, etc.

(A)	Union joints/flange joints	Allows for equipment replacement
(B)	Thermistor	For performance check and unit operation monitoring
(C)	Water pressure gauge	For operation status monitoring (recommended)
(D)	Valve	Allows for replacement/cleaning of flow adjuster
(E)	Flexible joint	Reduces the noise and vibration from the pump from being transmitted (recommended)
(F)	Pump	Must be large enough to accommodate the total water pressure loss and capable of supplying sufficient water to the unit
(G)	Automatic air vent valve (AAV)	To be installed where air tends to accumulate
(H)	Pressure relief valve (PRV)	For addressing a refrigerant leak from water heat exchanger and regulating water pressure. The PRVs are to be field-supplied. Refer to the following page(s). "System configuration" (p. 24)
(I)	AAV with air separator	For addressing a refrigerant leak from water heat exchanger. The AAV with air separator is to be field-supplied. Refer to the following page(s). "System configuration" (p. 24)
(J)	Closed expansion tank	Accommodates expanded water supplies
(K)	Water pipe	Use pipes designed for easy air purging, and ensure proper insulation. Ensure that gaps between water pipe and the unit are filled. (e.g. Racking)
(L)	Drain valve	For draining water for servicing
(M)	Strainer	To be installed near the unit to keep debris from entering the water heat exchanger
(N)	Flow switch	Ensures sufficient water flow
(O)	Drain pipe	Install the drain pipe at a downward slope between 1/100 and 1/200. To keep drain water from freezing, install the pipes at a downward angle and minimize horizontal sections. For cold climate installation, take an appropriate measure (e.g., drain heater) to prevent the drain water from freezing.
(P)	Check valve	Prevents water backflow
(Q)	Safety valve	To be installed near the closed expansion tank

12-2. Maintaining Water Quality

12-2-1.Water quality control

Poor-quality circulating water can corrode or scale up the water heat exchanger and compromises its performance. Proper water quality control and regular water treatment are required. During installation, remove debris (e.g., welding and sealant fragments, rust) out of the pipes.

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

When using an open heat storage tank, install a water-to-water heat exchanger, and use a closed-loop circuit on the hot water heat pump unit side. When using a water supply tank, minimize air exposure, and maintain dissolved oxygen levels in the water at or below 1 mg/ℓ.

(1) Water quality standard

Item			Lower mid-range temp. water system Water Temp. ≤ 60ºC		Higher mid-range temp. water system Water Temp. > 60ºC		Corrosive tendency	Scale-forming tendency
			Circulating water	Make-up water	Circulating water	Make-up water		
Standard	pH	(25°C)	7.0 – 8.0	7.0 – 8.0	7.0 – 8.0	7.0 – 8.0	○	○
	Electrical conductivity	(mS/m) (25°C)	≤ 30	≤ 30	≤ 30	≤ 30	○	○
		(μs/cm) (25°C)	≤ 300	≤ 300	≤ 300	≤ 300		
	Chloride ion	(mg Cl^-/ℓ)	≤ 50	≤ 50	≤ 30	≤ 30	○	
	Sulfate ion	(mg $SO4^{2-}$/ℓ)	≤ 50	≤ 50	≤ 30	≤ 30	○	
	Acid consumption	(pH4.8) (mg $CaCO_3$/ℓ)	≤ 50	≤ 50	≤ 50	≤ 50		○
	Total hardness	(mg $CaCO_3$/ℓ)	≤ 70	≤ 70	≤ 70	≤ 70		○
	Calcium hardness	(mg $CaCO_3$/ℓ)	≤ 50	≤ 50	≤ 50	≤ 50		○
	Ionic silica	(mg SiO_2/ℓ)	≤ 30	≤ 30	≤ 30	≤ 30		○
Reference	Iron	(mg Fe/ℓ)	≤ 1.0	≤ 0.3	≤ 1.0	≤ 0.3	○	○
	Copper	(mg Cu/ℓ)	≤ 1.0	≤ 0.1	≤ 1.0	≤ 0.1	○	
	Sulfide ion	(mg S^{2-}/ℓ)	Undetectable	Undetectable	Undetectable	Undetectable	○	
	Ammonium ion	(mg NH_4^+/ℓ)	≤ 0.3	≤ 0.1	≤ 0.1	≤ 0.1	○	
	Residual chlorine	(mg Cl/ℓ)	≤ 0.25	≤ 0.3	≤ 0.1	≤ 0.3	○	
	Free carbon dioxide	(mg CO_2/ℓ)	≤ 0.4	≤ 4.0	≤ 0.4	≤ 4.0	○	
	Ryznar stability index		–	–	–	–	○	○

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

(2) Consult a water quality control specialist before using anti-corrosive solutions.

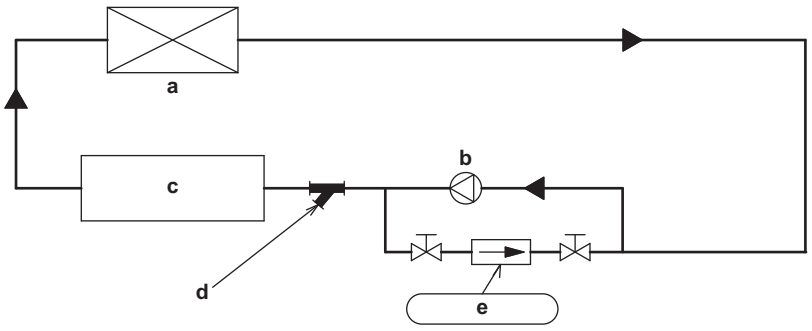
(3) Before replacing the hot water heat pump unit (or only the heat exchanger), analyze the water quality to see if the water is the problem.

Note that corrosion can suddenly occur in water systems with no obvious signs of corrosion. If improving the water quality solves the problem, there is no need to replace the unit.

(4) Debris Removal

Debris and corrosive substances in water can damage or corrode the heat exchanger surface. Install a 20 mesh or finer strainer at the inlet of the unit.

Consider installing a settlement tank or a bypass strainer capable of handling two to three percent of the circulating water to remove debris from the water system.



a Air-conditioning unit
b Water pump
c Heat pump unit
d 20 mesh or finer strainer
e Bypass strainer

12-3. Connecting Pipes of Different Materials

The contact surface of different types of metals will corrode. Install an insulating material between pipes of different materials to keep them out of direct contact.

12-4. Minimum Water Volume Requirements for Water Circuits

(1) Required water volume

Insufficient water in the water circuit may shorten unit operation time, cause drastic temperature fluctuations, or impair defrost function during heating. Refer to the table below for minimum water volume requirements. If the pipe is too short to hold sufficient water, install a cushion tank to ensure sufficient water volume.

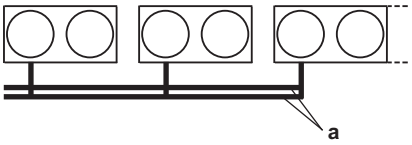
Model	Min. water volume (ℓ)
CAHV-Z450YA-HPB(-BS)	525

Minimum water volume requirement for units that are installed in series under the condition with the outlet water temperature of 55ºC or higher: 360 × number of units.

(Ex. 360 × 3 = 1080 ℓ)

Up to 7 units can be installed within the same water circuit.

a Water pipe



(2) Calculating the necessary water volume for water circuits

Calculation formula

(Necessary amount of water in the water circuit) = (water capacity of water pipes) + (water capacity of heat source unit) + (water capacity of load-side unit)

Water capacity of water per meter (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 (ℓ/m)	0.60 (ℓ/m)	0.99 (ℓ/m)	1.36 (ℓ/m)	2.20 (ℓ/m)	3.62 (ℓ/m)

Water capacity of heat source unit (ℓ)

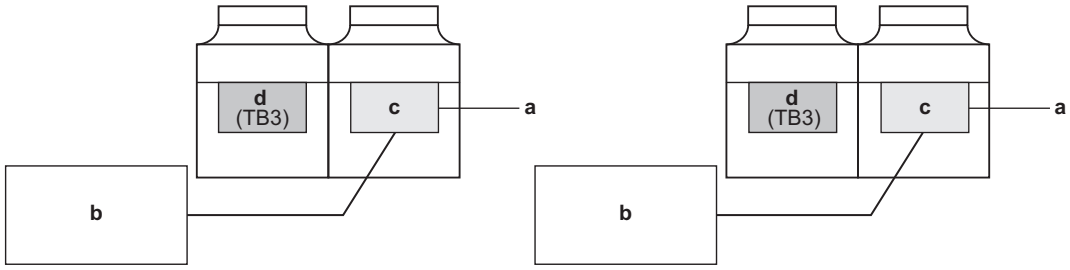
CAHV-Z450YA-HPB(-BS)
4.4

(3) Inlet/Outlet pipe fitting size

Model	Inlet	Outlet
CAHV-Z450YA-HPB(-BS)	40A, Rc 1-1/2B	40A, Rc 1-1/2B

13-1. Schematics of Individual and Multiple Systems

13-1-1.Schematics of individual and multiple systems

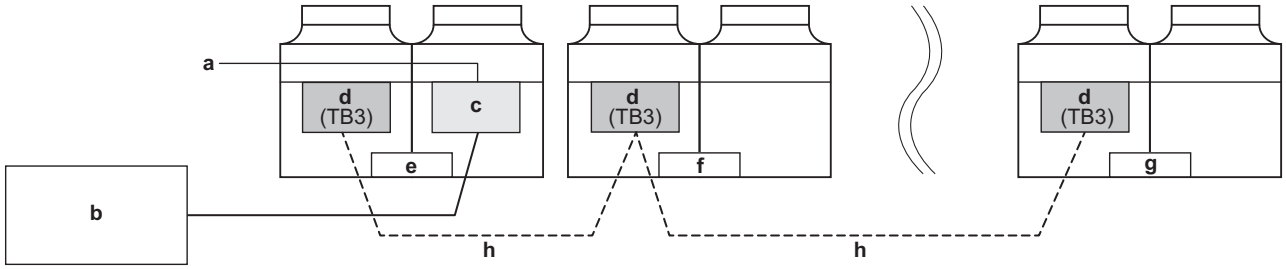


a External water temp. thermistor
b Dry contact switch/relay or remote controller (not supplied)
c Sub control box
d PCB

13-1-2.Multiple system

For 2 ~ 7 units

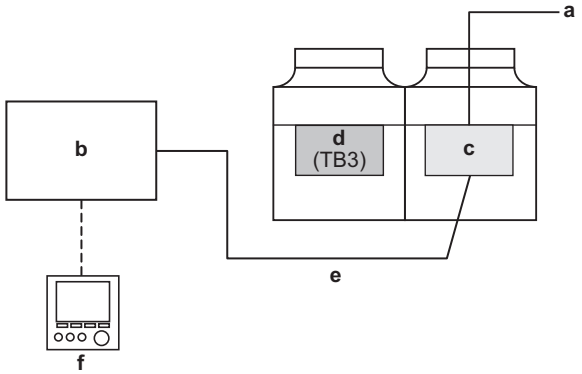
Consists of one main unit that connects to an external water temp. thermistor and a dry contact switch/relay, and up to 6 sub units that are operated collectively



a External water temp. thermistor
b Dry contact switch/relay or remote controller (not supplied)
c Sub control box
d PCB
e Main unit
f Sub unit
g Sub unit(s)
h Inter-unit wiring (M-NET)

13-1-3.Individual system with FTC connection

Each unit connects to a primary FTC unit.



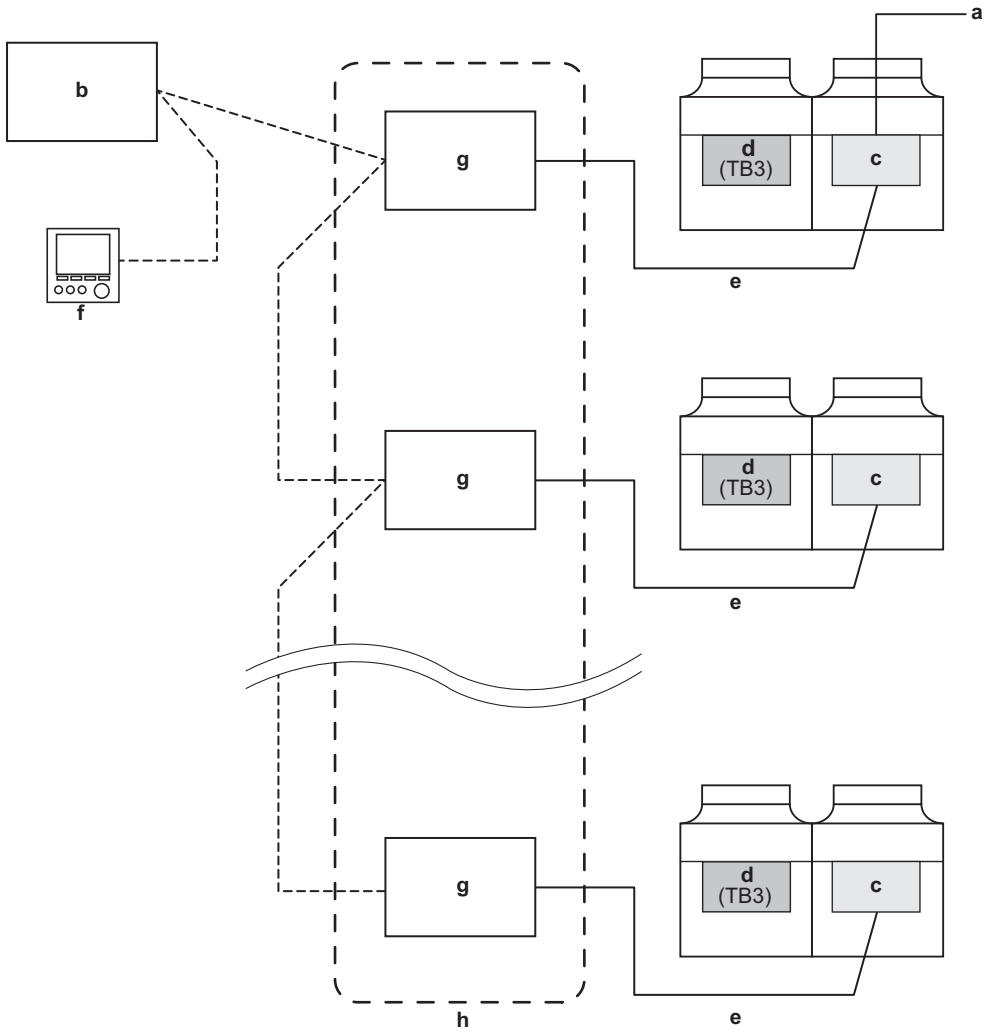
a External water temp. thermistor
b FTC (Primary)
c Sub control box
d PCB
e Outdoor unit
f Main RC

See the FTC manual for information about FTC.

13-1-4.Multiple system with FTC connection

For 2 ~ 6 units

Consists of one main FTC that connects to the main remote controller, and up to six units, each with connection to a secondary FTC. The unit connected to an external temp. thermistor is the main unit.



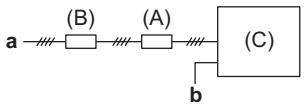
a External water temp. thermistor
b FTC (Primary)
c Sub control box
d PCB
e Outdoor unit
f Main RC
g FTC (Secondary)
h Max. six secondary FTCs

See the FTC manual for information about FTC.

14-1. Power Supply, Breaker, and Cable Requirements

Wiring schematic

a 3N~380–415 V
L1, L2, L3, N
b PE (Protective Earth)



(A) Current breaking switch
(B) Earth leakage breaker (ELB)
(C) Outdoor unit

Wire size, switch capacity, and system impedance

Model	Min. wire size (mm^2)			ELB	Local switch (A)		Overcurrent breaker (A)	Max. permissive system impedance
	Main	Branch	Ground		Capacity	Fuse		
CAHV-Z450YA-HPB	14	-	14	50 A 100 mA 0.1 sec. or less	50	50	50	0.15 Ω

To minimize the risk of electrical leakage, electric shock, noise interference, malfunction, overheating, smoke, or fire, electrical work must be conducted only by a certified electrician, following all relevant local wiring regulations and the instructions detailed below and in this manual. Consider the ambient conditions, and consult the power company as necessary.

Power supply

- This equipment complies with IEC 61000-3-12, provided the short-circuit power S_{SC} at the interface point is greater than or equal to the S_{SC} value (MVA) of 3.93.
  Ensure the equipment is connected only to a power supply with a short-circuit power S_{SC} greater than or equal to this value.

- Ensure each unit has its own dedicated power supply and is individually wired.
- Connect this device to a power supply system that has a maximum permissible system impedance at the user's supply interface point as shown in the table.
- Maintain a power supply voltage drop of no more than 10%. The table provides the minimum wire size for use with a metal conduit. If voltage drop is a problem, consider increasing the wire size.

Breaker/ground

- Only use properly rated breakers and fuses, including an earth leakage breaker, a local switch (switch + fuse), or an overcurrent breaker that matches the unit capacity, leakage current limit, and current breaking threshold.
- Use breakers with at least 3.0 mm contact separation in each pole.
- When using an earth leakage breaker without an overcurrent breaker, combine it with a local switch and a molded case circuit breaker.
- Install an earth leakage breaker for each unit's power supply.
- For INV circuits, use a Mitsubishi Electric NV-S series earth leakage breaker or its equivalent.
- A large electric current due to malfunction or faulty wiring can trigger the earthleakage breakers on both the unit side and the upstream side of the power supply. Either separate the power supply system or coordinate breaker protection to provide higher protection.
- Some installation sites may require an additional earth leakage breaker for the inverter.
- Provide proper grounding, avoiding connections to gas pipes, water pipes, lightning rods, or telephone wires.

Cable/connector

- Only use standard power supply cable of sufficient capacity.
- For outdoor use, power supply cables should be no lighter than polychloroprene sheathed flexible cord (design 60245 IEC57).
- Include some slack in the power supply cable.
- Replace the power supply cable immediately if damaged.
- Grounding wire should be longer than the power supply cable.
- Use specified cables and avoid straining terminal connections.
- Tighten all terminal screws to the specified torque.

Misc.

Avoid installing a phase advancing capacitor on the motor as it could cause damage and potentially start a fire.

14. Electrical Wiring Installation

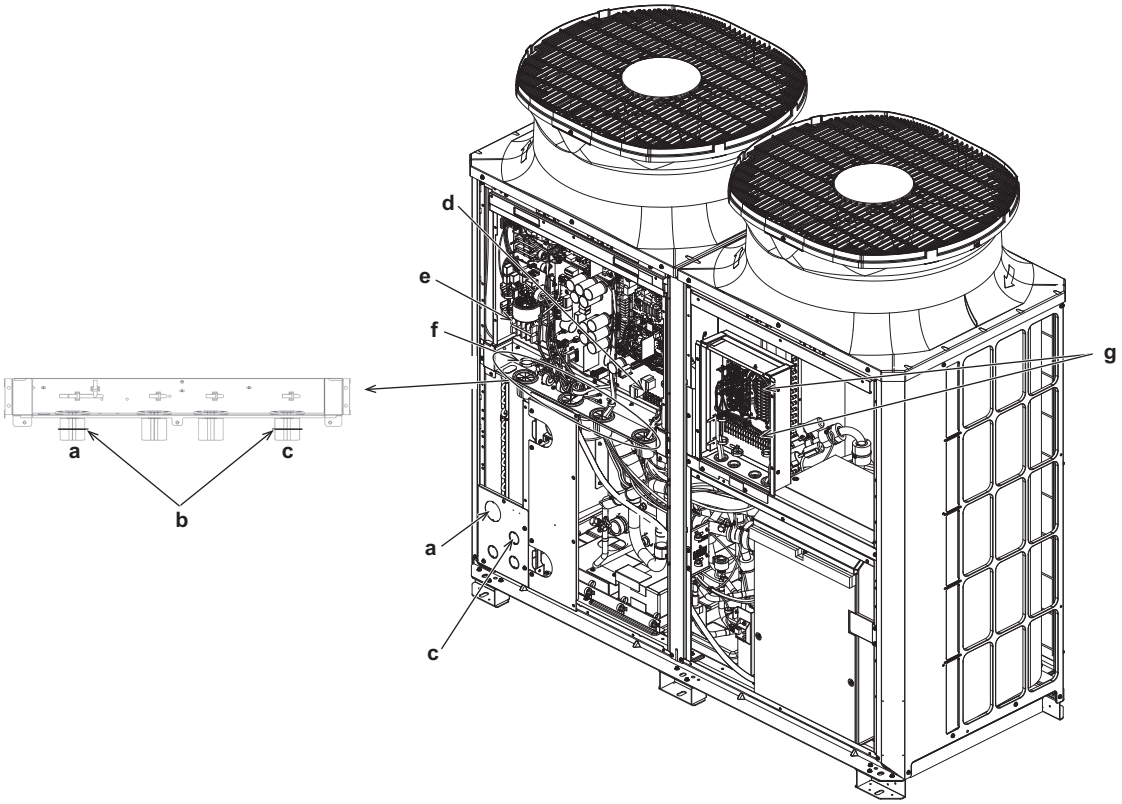
[1] Control cable specifications

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

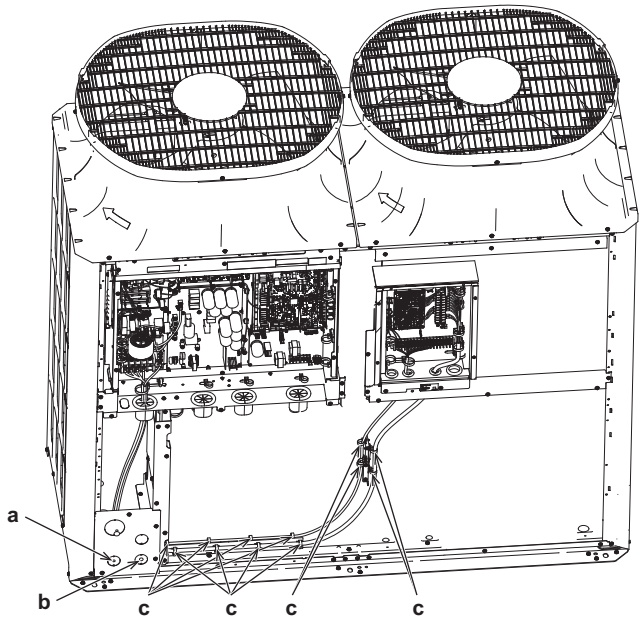
*1:Use a CVVS or CPEVS cable if a source of noise interference is nearby.
*2:With at least 1-mm-thick supplementary insulation

14-2. Schematics of a Unit and Its Terminal Blocks

Front panels of the control box are removable by unscrewing the four screws and pulling the panels forward and down.



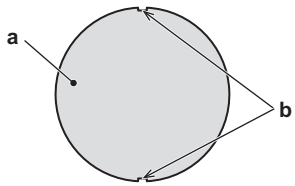
a Power wire
b Fasten with cable ties
c Transmission cable
d Transmission terminal block
e Power supply terminal block (TB1)
(Power supply cables larger than 25 mm^2 are not connectable to TB1. Use a pull box to connect them.)
f Cable tie
g Control terminal block (TB5,TB6)



a < 24 V
b > 100 V
c Cable tie

14-3. Wire Knockout Hole and Conduit

- Punch out the wire knockout hole at the bottom of the front panel with a hammer.
- Consider using a conduit if damage to wires by animals is a concern.
- If not using a conduit, deburr the knockout hole, and wrap the wires with protective tape.
- If damage from animals is a concern, use a conduit tube to narrow the opening.

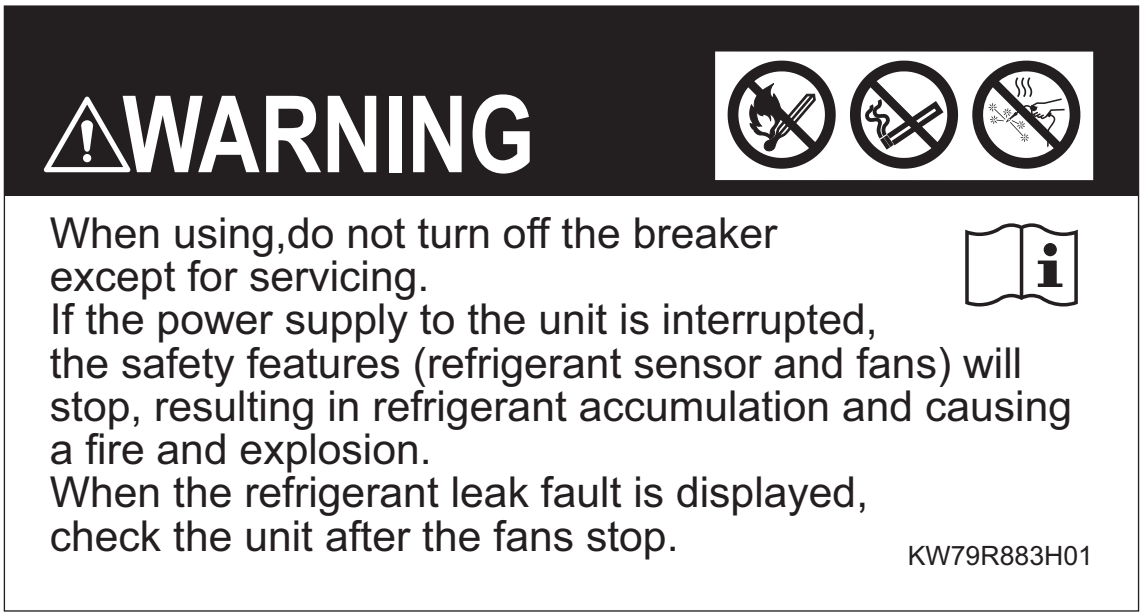


a Knockout hole
b Burr

14-4. Breaker Tag Installation

Do not turn off the breaker except for servicing.

- This unit is equipped with the refrigerant sensor and electrically powered safety measures.
- To be effective, the unit must be electrically powered at all times after installation, other than when servicing.
- To prevent the power from being switched off, attach the provided the caution tag to the local breaker to alert personnel.



15-1. Handing over to the user

Explain the following items to the end user.

- How the unit operates.
- The particular risks, the protective zone and rules of conduct that are associated with R290 refrigerant.
- How the unit is avoided from frozen damage when stopping the unit.
- Ask a dealer or an authorized technician to carry out work on the unit.
- Keep the Installation/Operation Manual so that don't lose them.
- Recommend that regular maintenance be performed.
  Ask a dealer to perform it.

15-2. Inspection and maintenance

Refer to the Service Handbook for maintenance.

15-3. Repair and service

Repairs must be carried out in accordance with the Service Handbook.

15-3-1.Preparing repair and service work on the refrigerant circuit

- Work on the refrigerant circuit with flammable refrigerant in safety group A3 may only be carried out by authorised contractors. These contractors must be trained in accordance with EN 378 Part 4 or IEC 60335-2-40 Annex HH.
- Work on electrical equipment may only be carried out by a qualified electrician.
- Use only spare parts authorized by the manufacturer.

⚠ WARNING

Do not fill the unit with more refrigerant than the specified amount.

- **Failure to follow this instruction may result in unit failure or fire hazard.**

15-4. Decommissioning

15-4-1.Temporarily decommissioning the unit

- Switch off all of the isolators to which the unit is connected in the building.
- Disconnect the unit from the power supply.
- If there is a risk of frost damage, drain the heating water from the unit.

15-4-2.Permanently decommissioning the unit

Have a authorised contractor permanently decommission the unit.

15-5. Recycling and disposal

15-5-1.Disposing of the packaging

The competent person who installed the unit is responsible for the disposal of the packaging.
Dispose of the packaging correctly.
Observe all relevant regulations.

15-5-2.Disposing of the unit

Do not dispose of the unit with the household waste.
According to the laws and ordinances of each country, hand in the unit to a collection center for waste electrical or electronic equipment or to a authorized recycler.

⚠ WARNING

Refrigerant must be recovered and disposed properly only by an authorised competent person.

15-5-3.Transportation of the unit for disposal

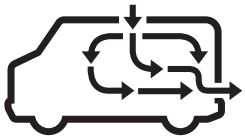
⚠ WARNING

Be sure to observe the following safety requirements when transporting the unit.

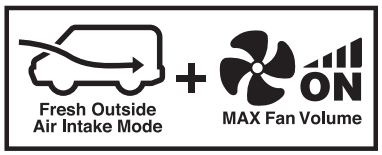
(1) Do not use a source of ignition during transportation, which includes: naked flames, sparks, static electricity, objects with high surface temperature (>370°C).
Do not smoke.
Do not use the electric devices, heater, lights, etc.



(2) Vehicles with ventilation in the cargo area should be used.
Like below image.



If vehicles are not equipped with a special ventilation system, fresh outside air intake mode and MAX fan volume operation are mandatory.



(3) Be sure to carry the R290 detector and keep it working properly.

(4) Do not open the packaging of the unit that is charged with R290 during delivery.
CAHV-Z450YA-HPB(-BS) is not charged with R290 refrigerant when shipping from factory.

⚠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 hot water heat pump units contain a flammable gas, R290.

MITSUBISHI ELECTRIC CORPORATION

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