



TECHNICAL MANUAL

AIR TO WATER HEAT PUMP

**Q-ton Natural refrigerant CO₂ water heater
Including hot water recirculation system**

ESA30EH2-25

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● Compatibility

Compatibility with previous models

Function		Overview	This model	Previous models					
			ESA30EH2-25	ESA30EH-25	ESA30E-25				
			-	-	/F	/C	/B	/A	/I
Space heating	Heating weekly timer	Weekly timer for heating operation	○	○	×	×	×	×	×
Water heating	Weekly timer with HW temperature setting		○	○	×	×	×	×	×
	Weekly timer		×	×	○	×	×	×	×
	User setting memory		○	○	×	×	×	×	×
	Anti-legionella control		○※1	○	○	×	×	×	×
	Return hot water control		○	×	×	×	×	×	×
General	Application setting	Usage setting function to accompany the added heating operation	○	○	×	×	×	×	×
	Priority setting	Priority setting of space heating and water heating function to accompany the added heating operation	○	○	×	×	×	×	×
	Silent mode		○	×	×	×	×	×	×

Connectability of remote control

Due to differences in communication specifications, the combination of remote control and heat pump unit is limited as shown in the table below.

Connectability of remote control and heat pump unit

		Heat pump unit		
		ESA30EH2-25	ESA30EH-25	ESA30E-25
Remote control	RC-Q1EH2	○	○※2	×
	RC-Q1EH	×	○	×
	RC-Q1E	×	×	○

(Notes)

1. Function available on RC-Q1EH2

2. Some functions will show as invalid when connected to ESA30EH-25

1. GENERAL DESCRIPTION

1.1 Mechanism of CO₂ heat pump water heater for commercial use

- The CO₂ heat pump water heater for commercial use is a water heater that is composed of a heat pump unit with natural refrigerant such as CO₂ which can produce hot sanitary water with heat pump technology and a hot water storage unit which can store hot water. A touch panel type remote control applied to this heat pump water heater can control up to 16 units of heat pump units.

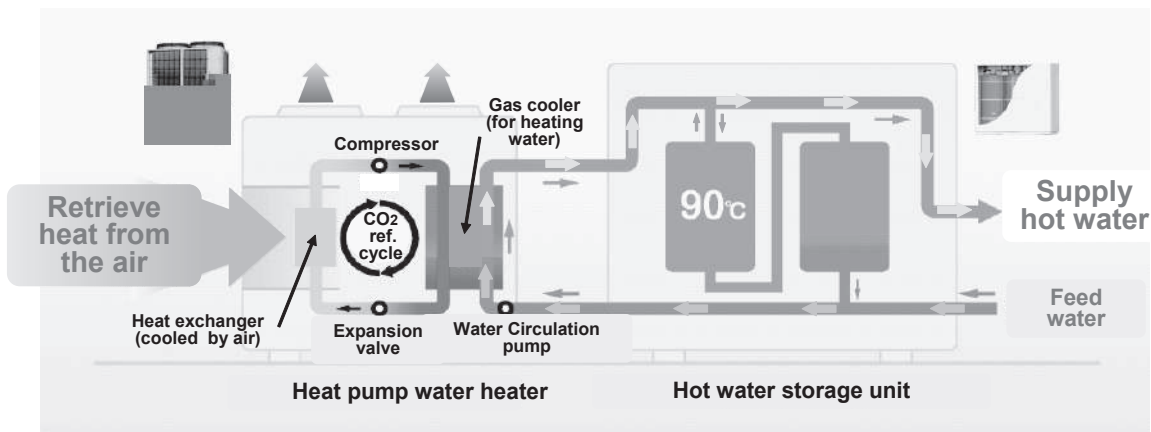
- The way to produce hot water with this heat pump water heater is that the heat energy retrieved from the outdoor air through the air to refrigerant heat exchanger of heat pump unit heats up the refrigerant and such refrigerant is increased its temperature and its pressure much higher through the compressor and is transferred to the gas cooler (the refrigerant to water heat exchanger). In the gas cooler, the refrigerant releases its heat to increase the water temperature and is returned to the air to refrigerant heat exchanger after depressurized through expansion valve in order to evaporate easily.

On the other hand, the water stored in the hot water storage unit is circulated by the water circulation pump to the heat pump unit through the connection pipe between the hot water storage unit and the heat pump unit. In the gas cooler, the water exchanges the heat from the high temperature refrigerant and is heated up to higher temperature. Such hot water is returned to the hot water storage unit and stored in the hot water storage unit.

The hot water in the hot water storage unit is distributed to the end of hot water supply system for utilizing.

- The power actually consumed is the power supplied to the compressor, fan and water circulation pump only. However the total energy added to produce hot water is the power actually consumed and the heat retrieved from the outdoor air so that the consumed energy efficiency (COP=Coefficient of Performance) can be more than 1 (one). In other words, this system allows very high efficiency operation. As for this unit, the nominal COP can achieve 4.3 under the condition of outdoor air temperature 16°C DB/12°C WB, water inlet temperature 17°C and water outlet temperature 65°C.

- This heat pump water heater does not need any acceptance of notification by local authority due to exempt of regulation.



<Merit of CO₂ as refrigerant>

- The global warming potential (GWP)=1 (it is good for ecology)

*R410A : GWP=1975 (Based on Regulation (EC) No.842/2006)

- It has following advantage.

Hot water at 90°C can be produced efficiently.

The size of hot water cylinder can be minimized.

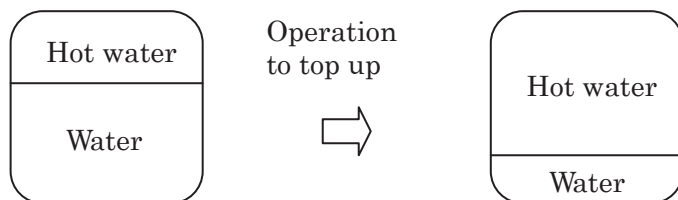
The storage of heat can be controlled by adjusting storage water temperature.

The hot water can be used for washing.

1.2 As for hot water storage unit

Heat pump water heater can be connected to an unvented hot water storage cylinder and it is applicable to various type of hot water supply system.

Unvented hot water storage cylinder



What is the unvented hot water storage cylinder?

The storage cylinder is unvented and is pressurized by fully filled hot water.

- The hot water can be supplied by the pressure in the cylinder.
- It is sanitary because the hot water is not exposed to the air.
- It is good for retaining heat
- It is good for supplying hot water to upper floors.

1.3 About ECO MODE

Q-ton provide "ECO MODE" for the solution of energy saving.

The hot water in the storage tank is used effectively to limit the time to start filling up.

This function can be canceled if it does not suit the user's condition.

This function is automatically canceled from next time, when fill up operation start after the HW lower amount limit is reached.

How to cancel "ECO MODE"

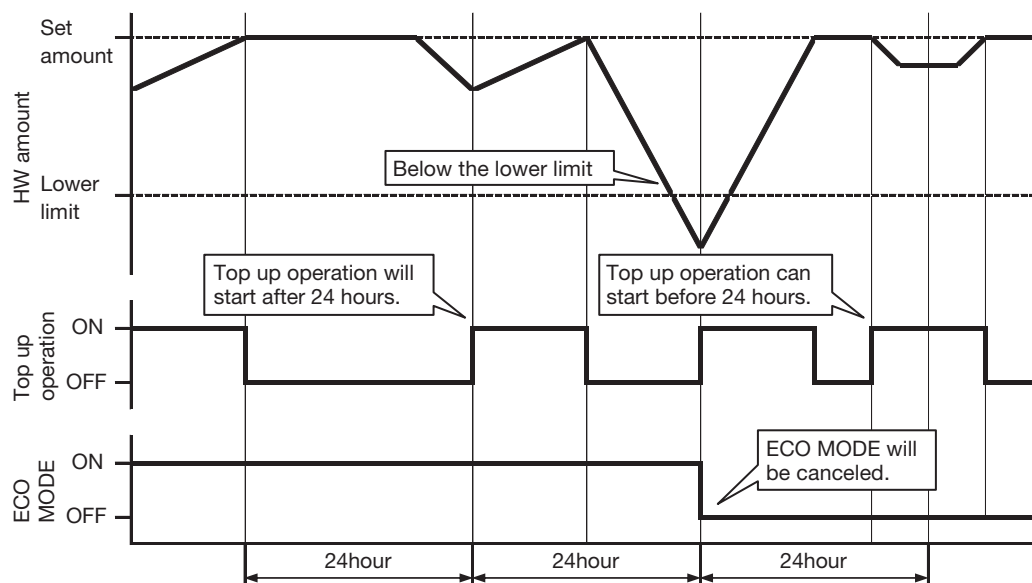
Change software switch setting [P99] from "1" to "0".

How to change the lower HW amount limit

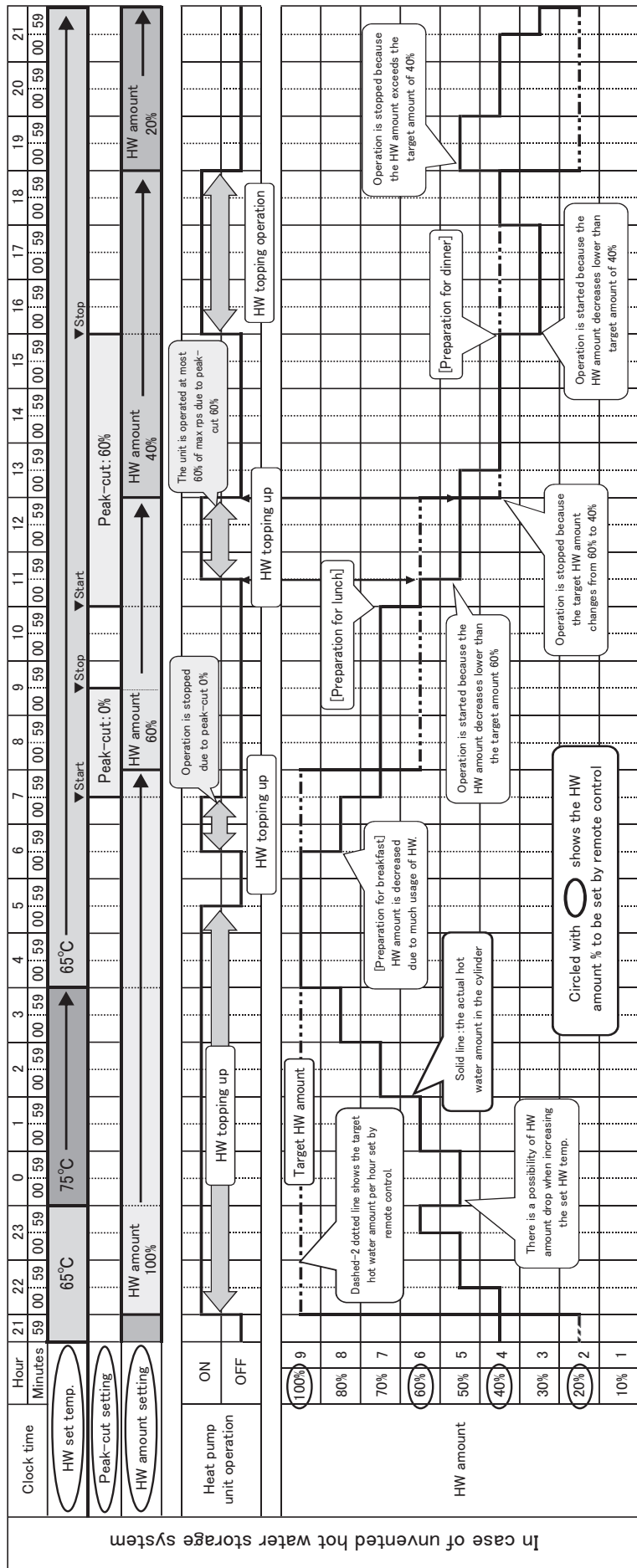
Change software switch setting [P07] to suitable value (%).

About the procedure of changing software switch setting, please see the "INSTALLATION MANUAL for DHW system" 8-(4).

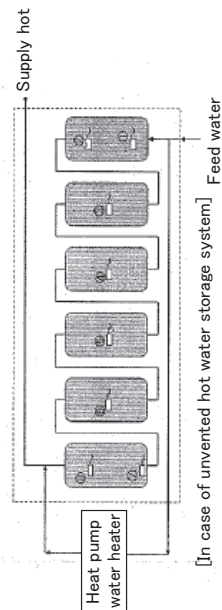
• Operation image of ECO MODE



1.4 CO₂ heat pump water heater: Operation chart (Ex1. In case of unvented hot water storage system)



Example: If the sensor No.3 detects [(Set temp.)-(15°C)] or higher, heat pump unit judges the HW amount is 30%.
And if the sensor No.3 detects [(Set temp.)-(20°C)] or lower, heat pump unit judges the HW amount is less than 30%.



Weekly schedule (HP)

Mon	Time	HW ant.	HW temp.
5	10:00	60%	65°C
6	13:00	40%	65°C
7	16:00	40%	65°C
8	19:00	20%	65°C

Start from 22:00 on previous day
Set 100% from 22:00 up to 8:00

Target HW amount is changed from 100% to 60% at 8:00

Weekly schedule (HP)

Mon	Time	HW ant.	HW temp.
1	22:00	100%	65°C
2	0:00	100%	75°C
3	4:00	100%	65°C
4	8:00	60%	65°C

Start from 22:00 on previous day
Set 100% from 22:00 up to 8:00

Target HW amount is changed from 100% to 60% at 8:00

Storage volume setting by remote control

Mon	Set	Change	Next	Back
1	Valid	7:30	0%	Back
2	Valid	11:00	60%	Back
3	Invalid			Back
4	Invalid			Back

Select a line and tap [Change]

Peak-cut timer

Mon	Set	Start time	End time	Ratio
1	Valid	7:30	9:30	0%
2	Valid	11:00	15:00	60%
3	Invalid			
4	Invalid			

Select a line and tap [Change]

[Peak-cut ratio changed by remote control]

1.5 Feature of natural refrigerant CO₂

(1) General characteristics

The general characteristics of CO₂ is as follows.

Under the atmospheric pressure, since CO₂ is gaseous state and has following characteristics, be careful to handle it.

- It is colorless and odorless gas, but when interacting with water, it produces mild acidity and irritating odor.
- When dissolving it with water, it will be mild acidic and may cause metal to corrode.
- It is heavier than air and remains on the floor in the unvented room.
- In case of high density, it may have a risk for addiction or suffocation.
- Carbon oxide gas is effective for fire extinction because of noncombustible and nonflammable gas.
- Liquefied carbon oxide is ordinarily stored in the bomb at -20°C under the pressure of 2MPa. It is clear and colorless and when releasing it into the air, it will be solid “Dry Ice Snow (frozen carbon oxide)” and CO₂ gas.
- Solid carbon oxide is so called “Dry Ice” which is solidified “Dry Ice Snow” mentioned above. Since it has very low temperature of -78.5°C under the atmospheric pressure, it may have a risk for frostbite when touching it with one’s bare hands. And if it gets into someone’s eye, it may have a risk for loss of one’s eyesight. Therefore when releasing it, especially be careful to handle it.

Table 1.1 General characteristics of CO₂

Appearance	Gas: Colorless Liquid: Clear and Colorless Solid: Milky white If releasing the liquid CO ₂ into the air, it will be a low-temperature solid. (Dry Ice)
Smell	Odorless (When interacting with water, it produces mild acidity and irritating odor.)
Absolute vapor pressure	1.967MPa (-20°C) 3.485MPa (0°C) 5.733MPa (20°C)
Density of gas	1.977kg/m ³ (0°C, 0.1013MPa abs) Since it is heavier than air, it remains on the floor or in the dimple.
Density of liquid	1.030kg/liter (-20°C, 1.967MPa) When varying to gas from liquid, it will expand its volume to roughly 500 times. (At purging to the air)
Density of solid	1.566kg/liter (-80°C) Solid CO ₂ (Dry Ice) has extremely low-temperature at -78.5°C.
Flash point	None
Ignition point	None
Explosion characteristics	None Since it is noncombustible and nonflammable, it can be used as fire extinguishing gas.
Solubility into water	1.713 literCO ₂ /liter H ₂ O (0°C, 0.1013MPa abs) 1.194 literCO ₂ /liter H ₂ O (10°C, 0.1013MPa abs) 0.878 literCO ₂ /liter H ₂ O (20°C, 0.1013MPa abs) CO ₂ is easily dissolved into water and carbonic water can be made by dissolving 1 liter of CO ₂ into 1 liter of water.
Others	The liquid CO ₂ is subject to control by the High Pressure Gas Saving Act.

(2) Characteristics of CO₂ refrigerant

CO₂ refrigerant is so called R744 and its physical property and saturated vapor pressure at each temperature are shown in table 1.2.

For comparison purpose, it is shown in contrast with those of R410A refrigerant generally using for current air-conditioners.

Table 1.2 Physical property and saturated vapor pressure of refrigerant

Item		CO ₂ (R744)	R410A
Composition		CO ₂	R32/R125 (50/50%) Pseudo azeotropic mixed refrigerant
Ozone Depletion Potential (ODP)		0	0
Global Warming Potential (GWP)		1	1975*1
Saturated vapor pressure (MPa absolute)	-20℃	1.97	0.40
	0℃	3.49	0.80
	20℃	5.73	1.44
	25℃	6.40	1.65
	30℃	7.21	1.88
Boiling point (℃)		-78.4	-51.4
Critical temperature (℃)		31.0	71.4
Critical pressure (MPa absolute)		7.38	4.90

*1 Based on Regulation (EC) No.842/2006

The feature of CO₂ refrigerant is natural refrigerant and is the environment-friendly refrigerant whose ODP is 0 and GWP is as low as 1. On the other hand, regarding R410A, its ODP is 0 but GWP is much higher than CO₂. This point of R410A is inferior to CO₂.

However the pressure of CO₂ refrigerant at normal temperature is as high as 6.4MPa that is about 4 times higher than 1.65MPa of R410A. And the critical point of CO₂ refrigerant is 31℃ or higher. Therefore even if increasing pressure, it has a property not to be liquefied.

Above features are suitable for producing hot water by heating up water from low temperature to high temperature at once and are utilized widely for this purpose.

The pressure of CO₂ refrigerant at the temperature above the critical point is decided by the refrigerant temperature and refrigerant charged amount to the heat pump unit and generally is 12 to 15MPa at the highest. Therefore the attention about safety to high pressure is needed much more than that for R410A.

(3) Handling precaution of CO₂ refrigerant

Regarding the safety considerations to high pressure, be careful not to give any damage on the refrigerant circuit piping of heat pump water heater during servicing, and to purge a small amount of the refrigerant gradually by adjusting valve opening properly to a place where there is no person. (See 4.1 (2) Method to purge CO₂ refrigerant)

CO₂ refrigerant itself is harmless, but if sucking the high concentration CO₂ refrigerant, it may exert various influences on the human body.

The influence on the human body exerted by the concentration of CO₂ gas in the atmosphere is shown in the table 1.3.

Table 1.3 The influence on the human body exerted by the concentration of CO₂ gas in the atmosphere

Concentration of CO ₂ gas (vol%)	Influence on human body
0.036	Normal air
0.5	Long-term safety limit (Critical concentration by weighted time average calculated with 8 hours of averaged permissible time)
1.5	It is still endurable for long term without any influence on workability and basic physiological function, but it may exert influence on the metabolism of calcium and phosphorus.
3.0	Workability comes down and alternation of physiological function will emerge as the alternation on weight, blood pressure and heart rate.
4.0	Breathing becomes deeper and breathing rate is increased. It will be the state of slightly gasping that is considerably discomfort feeling.
5.0	Breathing becomes difficult and it will be the state of heavily gasping that will be unendurable for all persons and make them to feel nausea. Exposure for 30 minutes results symptoms of poisoning.
7 to 9	It is the allowable limit. It will be the state of severely gasping and leads to unconsciousness within about 15 minutes.
15 to 20	It produces more serious symptoms, but it is not fatal within 1 hour.
25 to 30	It produces slow respiration, blood pressure reduction, coma, loss of reflex action and paralysis. It leads to death within a few hours.

As shown in the table 1.3, when the concentration of CO₂ becomes 3% or more, it leads to the alternation of physiological function and at 7 to 9% it leads to unconsciousness within about 15 minutes and at 25 to 30% it leads coma and then to death. Therefore be careful for handling it.

Since CO₂ refrigerant is heavier than air and is likely to remain at the lower place, when CO₂ refrigerant may leak or is released, be careful to work with taking a measure to prevent from remaining CO₂ on the floor by ventilating or such ways.

The emergent measures at following states are mentioned below.

a) When sucking high concentration CO₂ gas.

Move the victim immediately to the place filled with fresh air and warm up him and keep him at rest.

If he is unconscious, loosen his clothing, clear his air way and give artificial respiration and then make him received treatment by medical doctor promptly.

b) When liquid CO₂ stays on the skin

In case of mild frostbite, it is OK to rub down the affected area. However in case of severe frostbite, warm up the affected area with lukewarm water and wrap it with gauze softly and then make him received treatment by medical doctor promptly.

c) When liquid CO₂ gets into one's eye

Flush the eye with freshwater immediately and then make him receive treatment by medical doctor promptly.

2. SPECIFICATIONS

2.1 Specifications of product

(1) Heat pump water heater

Item			Model	ESA30EH2-25
Power source			—	3 Phase 380V±5%, 400V±5%, 415V±5%, 50/60Hz
Operation to top up (In intermediate season)* ¹	Heating capacity	kW	—	30.0
	(Water amount)	L/min	—	8.97
	(Power consumption)	kW	—	6.98
	COP	—	—	4.30
Operation to top up (In cold season)* ²	Heating capacity	kW	—	30.0
	(Water amount)	L/min	—	5.06
	(Power consumption)	kW	—	10.73
	COP	—	—	2.80
Operating sound pressure (In intermediate season)* ^{1, 3}			dB(A)	58
Operating sound power (In intermediate season)* ¹			dB(A)	70
Exterior dimensions	Height	mm	—	1690
	Width	mm	—	1350
	Depth	mm	—	720 + 35 (Water pipe connection)
Current	Max	A	—	21
	Starting	A	—	5
Unit weight			kg	375 (During operation 385)
Color			—	Stucco white (4.2 Y 7.5/1.1approx.)
Compressor	Type×Pcs.	—	—	Hermetic inverter compressor×1
	Nominal output	kW	—	6.4
Refrigerant	Type	—	—	R744 (CO ₂)
	Charged amount	kg	—	8.5
Refrigerant oil	Type	—	—	MA68
	Charged volume	cc	—	1200
Crankcase heater			W	20
Anti-freezing heater	for water pipe	W	—	21×3
	for drain pan	W	—	40×2
	for drain hose	W	—	16×3
Heat exchanger ,Air side			—	Copper pipe straight fin type
Heat exchanger ,Water side (Gas cooler)	Type	—	—	Copper pipe coil, indirect heat exchanger
	Possession quantity of water	kg	—	10
Fan	Type	—	—	Axial flow type (direct coupled motor)×2
	Output×Pcs	W	—	386×2
	Air volume	m ³ /min	—	260
	External static pressure	Pa	—	50
Water pump	Type×Output	—	—	Non-self-suction spiral type inverter pump×95W
	Materials contacting to water	—	—	PPS, SUS 306
	Actual pump head	m (kPa)	—	5m(49kPa) @17L/min
Usage temperature range	Outdoor air temperature	℃	—	-25 to+43
	Feed water inlet temperature	℃	—	Top up 5-35, Warm up 35-63
	Hot water outlet temperature	℃	—	60-90
Water pressure range			kPa	500 or lower (Keep water pressure more than 0kPa at the inlet of heat pump water heater)
Defrost			—	Hot gas type
Vibration and sound proofing devices			—	Compressor ;placed on anti-vibration rubber and wrapped with sound insulation
Protection devices			—	High pressure switch, over current protection, power transistor overheat protection and anomalous high pressure protection
Pipe connection	Feed water inlet	—	—	Rc3/4 (Copper 20A)* ⁴
	Hot water outlet	—	—	Rc3/4 (Copper 20A)* ⁴
	Drain water outlet	—	—	Rc3/4 (Copper 20A)* ⁴
Electric wiring	Earth leakage breaker	—	—	30A, 30mA, 0.1sec
	Power cable size	—	—	□8mm ² ×4 (Length70m)
	Molded-case circuit breaker	—	—	Rated current 30A, switch capacity 30A
	Grounding wire size	—	—	M6
	Remote control wire size	—	—	0.3mm ² ×2 cores shielding wire (MVVS)
Design pressure			MPa	High pressure; 14.0 Low pressure; 8.5
IP code			—	IP24

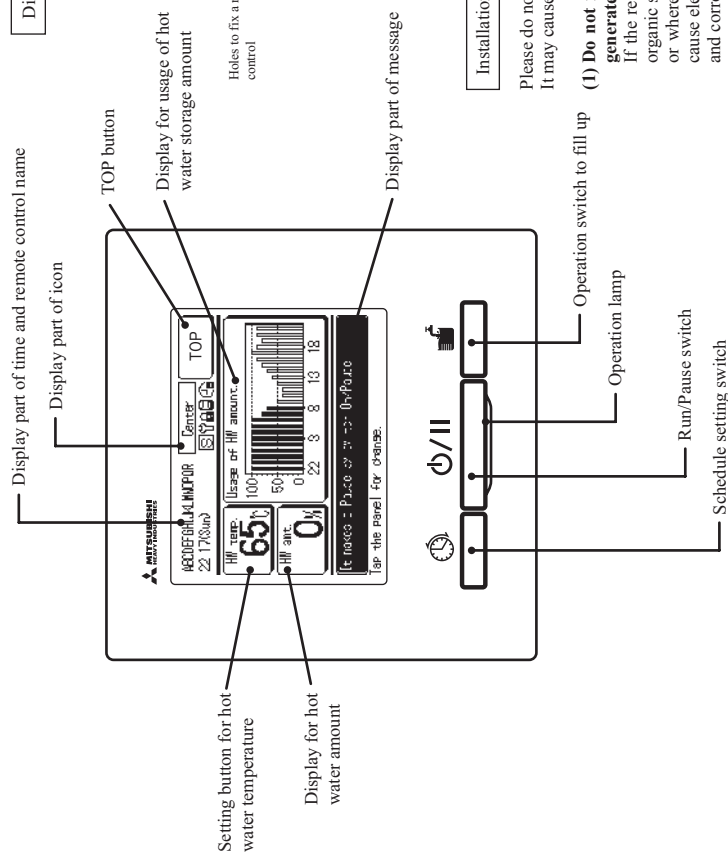
(Notes)

1. Performance of operation to top up in intermediate season shows the capacity measured under the conditions that outdoor air temperature is 16°C DB/12°C WB, water inlet temperature is 17°C and hot water outlet temperature is 65°C .
2. Performance of operation to top up in cold region shows the capacity measured under the conditions that outdoor air temperature is -7°C DB/-8°C WB, water inlet temperature is 5°C and hot water outlet temperature is 90°C excluding heater for anti-freezing water (191W).
3. Operating sound shows a value measured at 1m in front of the unit and 1m above the floor in anechoic room where the sound is resonated a little. Accordingly if the unit is installed on actual site, it is normal that the measured sound there is higher than the value shown above, because it is influenced by surrounding noise and echo in the room.
4. Pipe size 20A=DN20=20mm=3/4in
5. The actual hot water outlet temperature may vary $\pm 3^{\circ}\text{C}$ from target temperature according to the change of outdoor air temperature and water inlet temperature And then if feed water inlet temperature is 30°C or higher and outdoor air temperature is 25°C or higher, hot water outlet temperature may be controlled not to increase too high.
6. Please use the clean water. The water quality should follow the standard which MTH specifies. If the water quality is out of the standard, it may cause troubles such as scale buildup and/or corrosion.
7. These articles mentioned above may vary without any notice according to the development status.
8. Electrical installation work must be performed by an electrical installation service provider qualified by a power provider of the country. Electrical installation work must be executed according to the technical standards and other regulations applicable to electrical installations in the country.

(2) Remote control for heat pump water heater (Model : RC-Q1EH2)

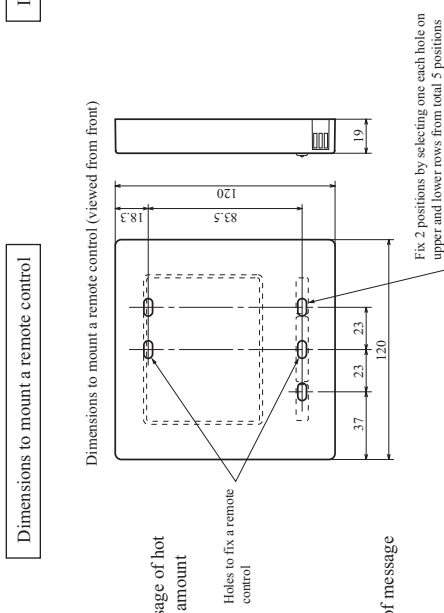
NOTE: Please use ESA30EH2 together with the remote control "RC-Q1EH2".

(a) Outline dimensional drawing



In this figure, all information are displayed on the LCD at the same time for explanation, but, actually, only the necessary information is displayed at that time.

*As for the function of switches, buttons and displayed icons, please refer the user's manual of remote control RC-Q1EH2 for details.



Installation of remote control

Please do not install a remote control at the place mentioned below.
It may cause malfunction and deformation of remote control.

(1) **Do not install it at the special surrounding where inflammable gas may generate, intrude, retain or leak.**

If the remote control is used in the place where there are a lot of oil, vapor, organic solvent and corrosive gas (ammonia, sulfuric compound, acid and etc), or where acidic or alkaline liquid solution, or special spray, are used, it may cause electric shock, fire and failure due to remarkable decrease in performance and corrosion.

(2) **Do not install it in the place where much water vapor and/or dew condensation is generated.**

It may cause electric shock, fire and failure

(3) **If installing a remote control in the hospital and telecommunication service office, be sure to take measures against noise.**

Due to the influence of inverter devices, emergency generator, high harmonic medical equipment, wireless communication equipment and etc, it may cause malfunction and failure of the remote control.

On the other hand, due to the influence from remote control to medical equipment and communication equipment, it may cause interference of medical action, interruption of broadcast and harmful effect by noise.

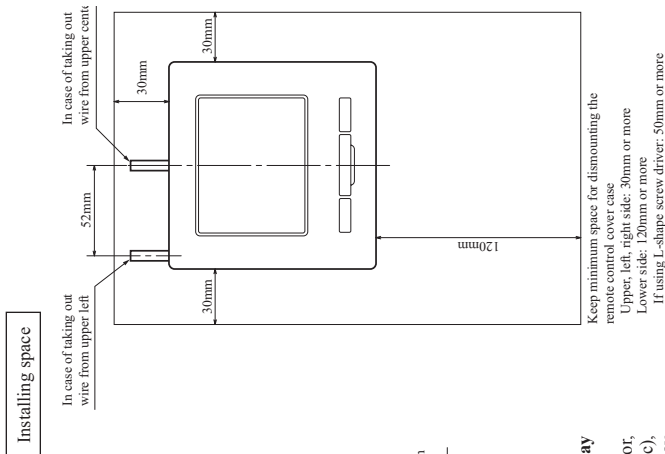
(4) **Do not install it on the place where it is exposed direct sunlight.**

(5) **Do not install it near the equipment to generate heat**

(6) **Do not install it on the flat surface of wall**

(7) **Do not install it on the place where the surrounding temperature can increase to 40°C or higher or can decrease to 0°C or lower.**

It may cause discoloration, deformation, malfunction and failure.



Electric wiring specifications

(1) Remote control wire size: $0.3\text{mm}^2 \times 2$ cores
shielding wire (MVVS)
wire length: Available up to 600m

If the wire length exceeds 100m, be sure to change the size mentioned in following table. However the size passing through the inside of remote control should be 0.5mm or smaller at the maximum and be changed to bigger size just after the wire coming out of remote control. When connecting wires, be sure to connect them securely without any contact failure and without getting moisture intruded.

Length (m)	Wire size
100-within 200m	Shielding wire (MVVS) 0.5mm ² × 2 cores
Within 300m	0.75mm ² × 2 cores
Within 400m	1.25mm ² × 2 cores
Within 600m	2.0mm ² × 2 cores

(b) List of setting functions

Setting and display item		Detailed content
1. Remote control network		
1	Multiple heat pump water heater control	Max. 16 sets of heat pump water heaters in one Superlink network can be connected to one remote control and controlled by it. Heat pump water heaters address needs to be set.
2	Main or Sub remote control setting	2 remote controls can be connected to one remote control network. One of them is set "Main" and the other one is set "Sub".
2. TOP screen, switch operation		
1	Menu	Select the item of control, setting, confirm and etc. (See item 4 to 10)
2	Hot water temperature	Set the temperature to top up and the temperature to keep warm
3	Hot water amount	Set the hot water amount. (More/Usual/Less)
4	Hot water amount	Display hot water amount of today and yesterday
5	Run/Pause switch	Start operation or pause operation
6	Schedule setting switch	Set schedule. See item 3 for details
7	Switch for operation to fill up	Set hot water amount 100% and start operation to top up
3. Schedule and function settings		
1	Setting of weekly schedule	Set the operation pattern for one week. Set target hot water amount, time and temperature. ●It is possible to set 8 operation patterns per day ●It is possible to set time at 1 hour intervals. ●It is possible to set all. (Week days/ Saturday & Sunday/All days)
2	Setting of annual operation pattern	Set the operation pattern on a weekly basis ●It is possible to set the driving pattern every week. ●It is possible to set the operation pattern up to one year ahead. ●It is possible to set setting as valid or invalid.
3	Setting of day off	If setting off day, the operation of heat pump water heater to top up becomes invalid. ●It is possible to set off day in every week ●It is possible to set off day for specific period of time ●It is possible to set off day on specific day.
4	Setting of peak cut	Reduce the power consumption by limiting the max. capacity. Set the start/end time of peek-cut and the peak-cut %. ●It is possible to set peek-cut for whole week. ●It is possible to set max 4 patterns per day ●It is possible to set time at 5 minutes intervals ●It is possible to select the peak-out % from 0, 40, 60, 80% ●It is possible to set setting as valid or invalid. ●It is possible to set all. (Week days/ Saturday & Sunday/All days)
5	Setting of silent mode	Reduce the noise level by limiting the max. frequency of compressor and fan. Set the [Start time] and [End time] of the operation to limit the noise level. ●It is possible to set 4 patterns per day.
6	Setting of Legionella mode	Prevents legionella by increasing tank temperature up to at least 70°C. Set the [Starting date] and [Start time] and the frequency of legionella operation. ●It is possible to set operation intervals. (Once/Every week/Every two week/Every month) ●It is possible to set setting as valid or invalid.
4. Initial settings		
1	Clock setting	Set or correct the current date and time ●In case of power failure within 80 hours, the clock runs by the built-in battery for back-up.
2	Date and time display	On/Off, 12H/24H or display position of AM/PM can be set
3	Contrast	The contrast of LCD can be adjusted.
4	Backlight	On/Off and lighting time of backlight can be set.
5	Controller sound	On/Off of beep sound at touch panel operation can be set
6	Priority setting	It is possible to set the priority of HW/Heating.
7	Summer time	Enable/Disable of summer time can be set.

Setting and display item		Detailed content
5. Administrator settings		Administrator password is required
1	Enable/Disable setting	●Permission/prohibition setting of the following operations can be set. [Run/Pause], [Setting of HW temp.], [Change amount of top up], [Manual operation to fill up], [Setting of schedule], [Select the language], [Heating operation], [Heating set temp]
2	Night tariff setting	In order to calculate the power consumption in day/night time, the time zone applied night tariff can be set.
3	HP unit selection	The heat pump water heater to be displayed on RC can be selected.
4	RC display setting	R/C display setting can be set. [Name of R/C], [Name of HP unit], [Defrost operation display], [Status of HW amount], [HW amount display setting]
5	Step size of HW temperature	Step size of HW temperature (at 5°C or 1°C intervals) can be set. (Factory default is 5°C)
6	User environment	By selecting the operation pattern of typical business type, the detailed operation pattern can be set easily.
7	Change administrator password	Administrator password can be changed
8	Operation lamp setting	It is possible to change the color of R/C lamp.
9	Upper limit setting of HW temp.	Set the upper limit value for the hot water storage temperature.
10	Open tank information	Display the detection temperature of open tank temperature sensor.
11	Application setting	Application setting can be changed. (HW, Heating, HW&heating)
12	Cancel weekly schedule (HW)	This function is used when the HP unit is controlled by external control.
6. Installation settings		Service password is required.
1	Installation date	If installation date is registered, next service date is displayed.
2	Company information	Contact company can be registered on the remote control. ●Name of contact company can be registered. ●Phone No. of contact company can be registered.
3	Test run	It is possible to start test run.
	Primary setting of operation	It is possible to start [Primary setting of operation].
	Water pump test run	It is possible to start [Water pump test run].
	Compressor Hz fixed operation	It is possible to operate at a fixed compressor Hz.
7. RC function settings		Service password is required.
1	Main/Sub of RC	Main or Sub remote control setting can be done.
2	External input	When multiple heat pump water heaters are connected, the applicable range of water heaters of CnT input signal can be set.
3	Auto-restart	Control contents after recovering from power failure can be set.
8. Service & maintenance		Service password is required.
1	No. display of unit	Max. 16 sets of heat pump water heaters can be connected to a remote control. The connected heat pump water heaters can be checked.
2	Next service date	Next service date can be registered. On the service date, contact company is displayed on RC.
3	Error display	Up to 14 cases of error history (error code and date of occurrence) can be displayed.
4	Save HP unit setting	Setting contents of heat pump water heaters connected to the remote control can be saved in remote control as backup.
5	Special setting	[CPU reset] [Restore of default setting] [Touch panel calibration]
6	System OFF	All heat pump water heaters in one system can be stopped.
7	Operation data	Status list of connected units and operation status of each unit can be checked.
9. Contact company		Contact company and phone No. are displayed.
10. Check of RC setting		Current setting list of RC and HP water heater can be checked.
11. Select the language		Select the language to be displayed on the R/C.

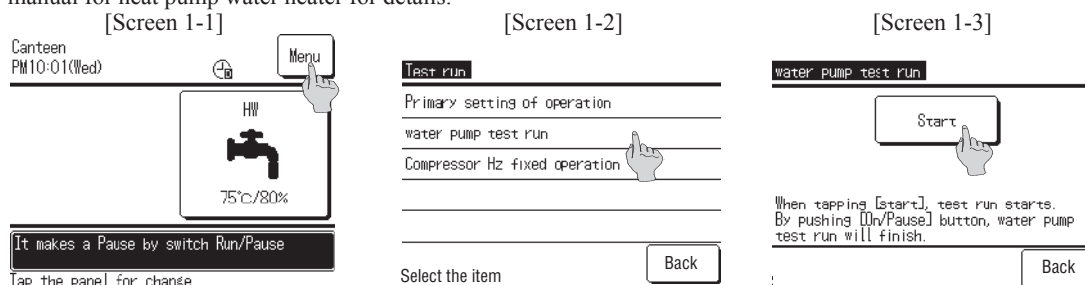
(c) Setting method of remote control for heat pump water heater

[At the initial use]

- 1) After the completion of installation, check that the feed water is surely supplied to the hot water supply system firstly and then turn the power ON.

After the completion of initial setting, TOP screen (Screen 1-1) is displayed on the remote control. *Operation mode is [Pause]
[Menu]→[Installation setting]→[Input the service password (9999)]→[Test run (Screen 1-2)]→[Water pump test run (Screen 1-3)]
From this screen please start test run of water pump.

Complement: The test run of water pump can be started from the control of heat pump water heater as well. Refer to user's manual for heat pump water heater for details.



[Caution 1]

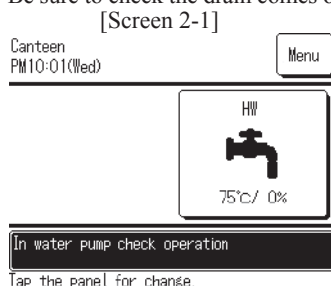
If starting operation by pushing [Run/Pause] switch before the end of water pump test run, the heat pump water heater starts the operation to top up in case that the current hot water amount is less than the set amount.

Since it may cause failure of heat pump water heater, **do not start operation until completion of water pump test run.**

- 2) When starting test run of water pump, the message of "In water pump check operation" is displayed on the TOP screen (Screen 2-1).

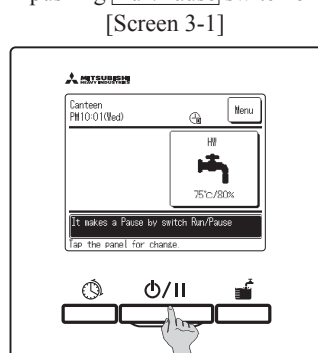
Purge air by operating test run of water pump.

Be sure to check the drain comes out by opening drain valve and air purge valve.



- 3) After completing test run of water pump, stop test run of water pump.

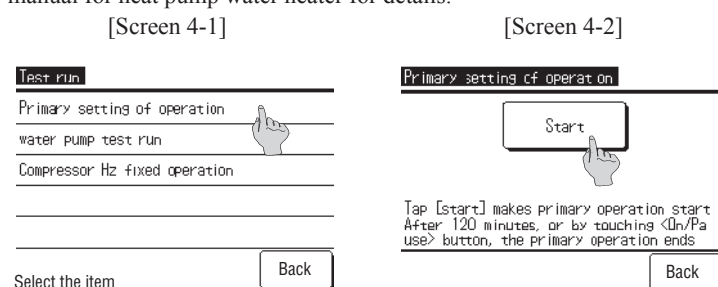
If pushing [Run/Pause] switch on the panel of remote control to stop operation, the water pump test run is stopped. (Screen 3-1)



- 4) Start the "Primary setting of operation" of the heat pump water heater.

[Menu]→[Installation setting]→[Input the service password (9999)]→[Test run (Screen 4-1)]→[Primary setting of operation (Screen 4-2)]
According to these procedures, please start the primary setting of operation.

Complement: The primary setting of operation can be started from the control of heat pump water heater as well. Refer to user's manual for heat pump water heater for details.



- 5) When starting the primary setting of operation, the message of “In Primary operation” is displayed on the TOP screen (Screen 5-1).

When completing the primary setting of operation, the heat pump water heater is stopped and the message of “In primary operation” is disappeared (Screen 1-1).

Be sure to check the drain comes out by opening drain valve and air purge valve.

[Caution 2]

Since the heat pump unit is paused after the end of this operation, the heat pump water heater does not start the operation to top up, even though the current hot water amount is less than the set amount.

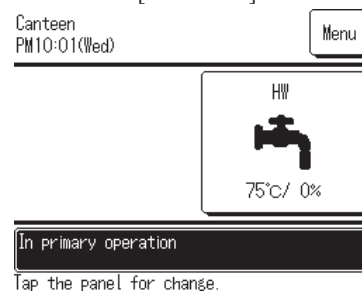
However, for anti-freezing of water in the pipe, water pump and compressor may start operation.

- 6) After completion of primary setting of operation, set the necessary items with the remote control and start operation of the heat pump water heater by pushing [Run/Pause] switch. (Screen 3-1)

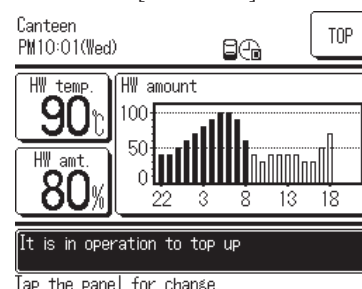
When the heat pump water heater is operating to top up, the message of “It is in operation to top up” is displayed on the TOP screen (Screen 6-1).

Complement: As for the setting method by remote control, please refer to the next item [Setting example] or user's manual.

[Screen 5-1]



[Screen 6-1]



[Setting example]

[Setting method] and [Operation pattern of heat pump water heater] for following setting conditions are shown below.

- ① The hot water temperature is 90°C
- ② The operation to fill up is done from 23:00 to 7:00 of off-peak rate period for business use.
- ③ In order to store at least 30% of full hot water amount by 16:00, the setting of hot water amount is changed to 30% at 13:00.
- ④ The peak-cut timer is set [10:00-13:00] for the operation to top up not to be done during peak-cut period.
- ⑤ Since Sunday is holiday, hot water is not used. (Setting of day off)
- ⑥ In order to consume much more hot water on Saturday, the hot water amount shall be increased.

- 1) Setting method (* Please see user's manual for details)

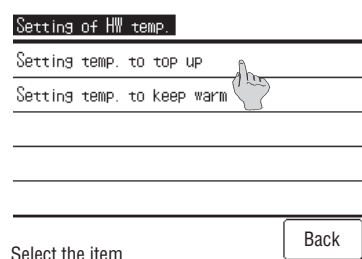
The positions of buttons and switches are shown in the right figure.

The setting of above setting conditions (1) to (6) can be set by pushing the buttons (1) and switches shown in the right figure.

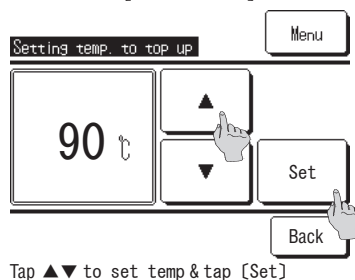
a) Set the hot water temperature at 90°C

- ① When tapping the [HW temp.] button on the TOP screen, the [Setting of HW temp] menu screen is displayed. (Screen ①-1)
- ② When tapping [Setting temp to top up], [Setting temp to top up] screen is displayed (Screen ①-2).
- ③ Set the hot water temperature by tapping ▲▼ buttons and tap [Set] button. (Screen ①-2)

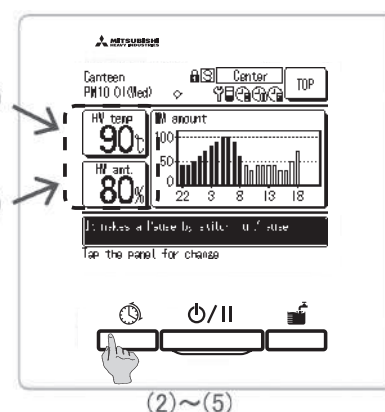
[Screen ①-1]



[Screen ①-2]



Tap ▲▼ to set temp & tap [Set]



b) Set the time period for the operation to fill up

- ① When pushing [Schedule setting] switch, [Setting of schedule] menu screen is displayed. (Screen ②-1)
- ② When tapping [Setting of weekly operation pattern], the [Weekly timer] screen is displayed. Tap [All days] button. (Screen ②-2)
The screen for confirming the set contents is displayed (Screen ②-3)

<Complement> Select the day to be set from [Week days], [Sat, Sun], [All days] and [Each day] buttons.

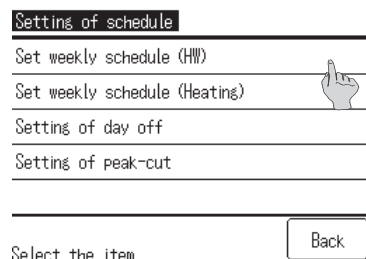
[Week days] Set all days from Monday to Friday

[Sat, Sun] Set the days of Saturday and Sunday

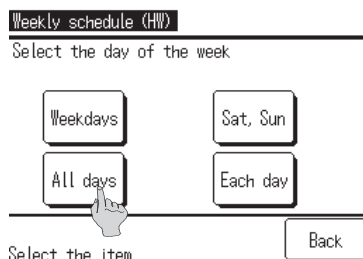
[All days] Set all days from Monday to Sunday

[Each day] Set each day

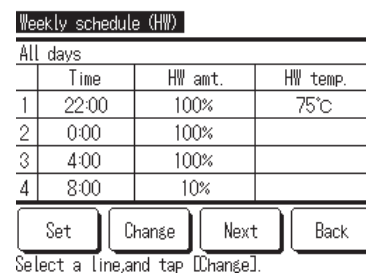
[Screen ②-1]



[Screen ②-2]

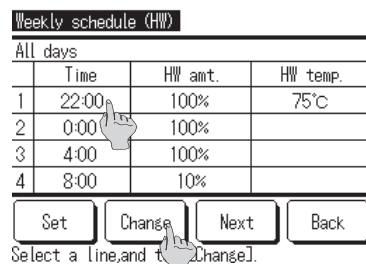


[Screen ②-3]

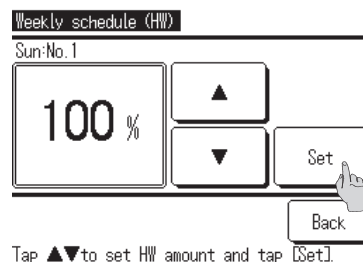


- ③ Change 22:00 of the set item 1 on [Screen ②-3] to 23:00 in order to fill up hot water from 23:00 to 7:00.
When tapping the line of [1/22:00/100%], the column of set item 1 is highlighted in reverse. Tap [Change] button. (Screen ②-4)
- ④ [Hot water amount setting] screen is displayed.
For setting the time, tap [Set] button. (Screen ②-5)
Since [Time setting] screen is displayed, tap [23:00] and tap [Set] button. (Screen ②-6)

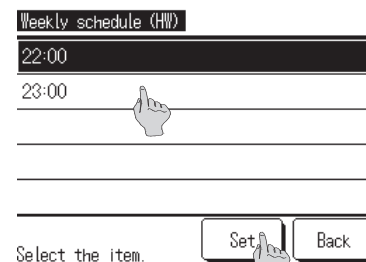
[Screen ②-4]



[Screen ②-5]

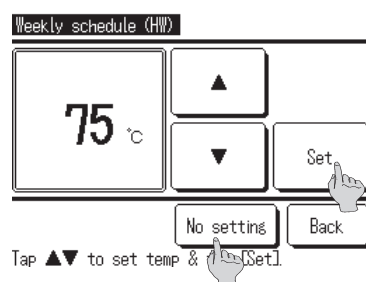


[Screen ②-6]

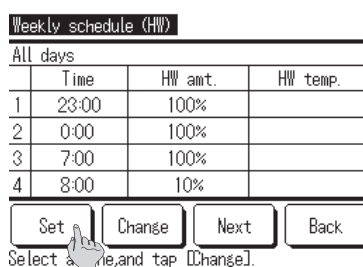


- ⑤ [Hot water temperature setting] screen is displayed. Tap [No setting] button. (No setting means that HP unit operates with the same HW temperature the last action.)
- ⑥ When tapping [Set] button, the screen for confirming the set contents is displayed. (Screen ②-8)
In order to fill up hot water from 23:00 to 7:00, change 4:00 of the set item 3 to 7:00 like as item ③.
- ⑦ After changing the time, tap [Set] button on the screen for confirming the set contents. (Screen ②-8)
- ⑧ Since the acknowledge screen for confirming all set contents is displayed, tap [Yes] to save all settings. (Screen ②-9)

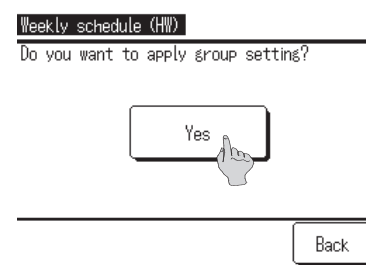
[Screen ②-7]



[Screen ②-8]



[Screen ②-9]



c) Set the hot water amount

- ① Carry out the same procedure as [(2)-① and ②] and display the screen for confirming the set contents. (Screen ②-3)
When tapping [Next] button, the screen for confirming the set content of next time period. (Screen ③-1)
- ② Change the setting of hot water amount at 13:00 to 30% in order to top up to 30% of the full hot water amount until 16:00.
Tap the line of [6/13:00/10%] and then tap [Change] button. (Screen ③-1)
- ③ Since [Hot water amount setting] screen is displayed, set 30% by tapping ▲▼ buttons and tap [Set] button. (Screen ③-2)
- ④ Since the screen for confirming the set contents is displayed, save the settings according to the same procedure as item [(2)-⑧].
(Screen ③-3)

[Screen ③-1]

Weekly schedule (HW)

All days	Time	HW amt.	HW temp.
5	10:00	10%	
6	13:00	10%	
7	16:00	10%	
8	19:00	10%	

Set Change Previous Back

Select a line, and tap [Change].

[Screen ③-2]

Weekly schedule (HW)

All days: No.1

30 %

▲ ▼

Set

Back

Tap ▲▼ to set HW amount and tap [Set].

[Screen ③-3]

Weekly schedule (HW)

All days	Time	HW amt.	HW temp.
5	10:00	10%	
6	13:00	30%	
7	16:00	10%	
8	19:00	10%	

Set Change Previous Back

Select a line, and tap [Change].

d) Set Peak-cut timer

- ① When pushing [Schedule setting] switch on the panel of RC, the [Setting of schedule] menu screen is displayed. (Screen ②-1)
- ② When tapping [Setting of peak-cut] on the screen ②-1, [Peak-cut timer] screen for selecting the day of the week is displayed.
Tap [All days] button. (Screen ④-1)
The screen for confirming the set contents is displayed. (Screen ④-2)
<Complement> Select the day to be set from [Week days], [Sat, Sun], [All days] and [Each day] buttons.
- ③ Set the [Peak-cut %] to 0% in order for the heat pump unit not to be started operation to top up from 10:00 to 13:00.
When tapping the line of [1/Invalid/], the column of set item 1 is highlighted in reverse. Tap [Change] button (Screen ④-2)
- ④ The detail setting screen for setting the contents of Peak-cut timer is displayed. (Screen ④-3)

[Screen ④-1]

Weekly schedule (HW)

Select the day of the week

Weekdays Sat, Sun

All days Each day

Back

Select the item.

[Screen ④-2]

Peak-cut timer

All days	Set	Start time	End time	Ratio
1	Invalid			
2	Invalid			
3	Invalid			
4	Invalid			

Set Change Back

Select a line, and tap [Change].

[Screen ④-3]

Peak-cut timer

All days: No.1

Invalid Start time --:--

Ratio 80% End time --:--

Change

Set Back

Select setting

- ⑤ Set the [Valid/Invalid], [Peak-cut %], [Start time] and [End time] with each button on the detail setting screen.
 - In order to set "Valid", by tapping the [Invalid] button to change to [Valid]. (Screen ④-4)
 - Tap the [Peak-cut %] button and set the "Peak-cut %" to 0% by tapping ▲▼ buttons. (Screen ④-5)
 - Tap the [Change] button and set Start time at 10:00 and End time at 13:00 by tapping ▲▼ buttons. (Screen ④-6)

[Screen ④-4]

Peak-cut timer

All days: No.1

Valid Start time --:--

Ratio 80% End time --:--

Change

Set Back

Select setting

[Screen ④-5]

Peak-cut timer

All days: No.1

Peak-cut

0 %

▲ ▼

Set Back

Tap ▲▼ to set %, & tap [Set].

[Screen ④-6]

Peak-cut timer

All days: No.1

Start time

10:00

▲ ▼

Set Back

Tap ▲▼ to set clock time and tap [Set].

⑥ After the each setting is done, the detail setting screen is displayed. Tap the [Set] button. (Screen ④-7)

⑦ Since the [Setting contents confirmation] screen is displayed, tap the [Set] button. (Screen ④-8)

⑧ Group setting acknowledge screen is displayed. Tap the [Yes] button. (Screen ④-9)

[Screen ④-7]

Peak-cut timer

All days: No.1

Valid	Start time 10:00	Change
Ratio 80%	End time 13:00	

Select setting

Set Back

[Screen ④-8]

Peak-cut timer

All days

Set	Start time	End time	Ratio
1 Invalid			
2 Invalid			
3 Invalid			
4 Invalid			

Select a line, and tap [Change].

Set Change Back

[Screen ④-9]

Peak-cut timer

Do you want to apply group setting?

Yes

Back

e) Set all Sundays to day off

① When pushing [Schedule setting] switch on the panel of RC, the [Setting of schedule] menu screen is displayed. (Screen ②-1)

② When tapping the [Setting of day off] on screen ②-1, the [Setting of day off] menu screen is displayed. Tap the [Set every week]. (Screen ⑤-1)

③ Since the screen for selecting the day is displayed, tap the blank column just below Sunday to be day off. The setting of Sunday is changed to day off and “Ø” is displayed in the blank column just below Sunday. (Screen ⑤-2)

<Complement>

The display in the blank column just below the day to be set day off is changed over “Ø” ⇔ “(blank)” at every tapping.

[Screen ⑤-1]

Setting of day off

set every week

set specific period of time

set specific day

Select the item

Back

[Screen ⑤-2]

Weekly timer

Mon	Tue	Wed	Thu	Fri	Sat	Sun
						Ø

Tap “a day of the week” to change Set. Holiday setting: tap box below day of week.

Select the day of the week

Back

Change over day off “Ø”
⇔ cancel “(blank)”

f) Increase the HW amount uniformly

When setting HW amount “More”, the setting value of HW amount becomes 1.2 times of the usual setting. When setting HW amount “Less”, the setting value of HW amount becomes 0.8 times of the usual setting.

① When tapping [HW amount %] button on the TOP screen (Screen ⑥-2), the [HW amount setting] screen is displayed. (Screen ⑥-1)

② When tapping the blank column just below Saturday to be set “More”, the “More” is displayed. (Screen ⑥-1)

<Complement>

The display in the blank column just below the day to be set is changed over “More” ⇒ “Less” ⇒ “(Blank)”* at every tapping. (* “Blank” means usual setting)

100% is the maximum value to be able to set “More” and 10% is the minimum value to be able to set “Less”.

③ When setting of HW amount is “More” (or “Less”), the message of “Storage amount setting [More] (or [Less])” is displayed on the TOP screen. (Screen ⑥-2)

[Screen ⑥-1]

HW amount setting

Mon	Tue	Wed	Thu	Fri	Sat	Sun
					More	

HW Setting: tap box below day of (More:x1.2 Less:x0.8 Blank:Normal)

Select the day of the week

Back

[Screen ⑥-2]

UNIT01
PM10:00(Wed)

Menu

HW temp. 90℃

HW amt. 80%

Usage of HW amount.

22 3 8 13 18

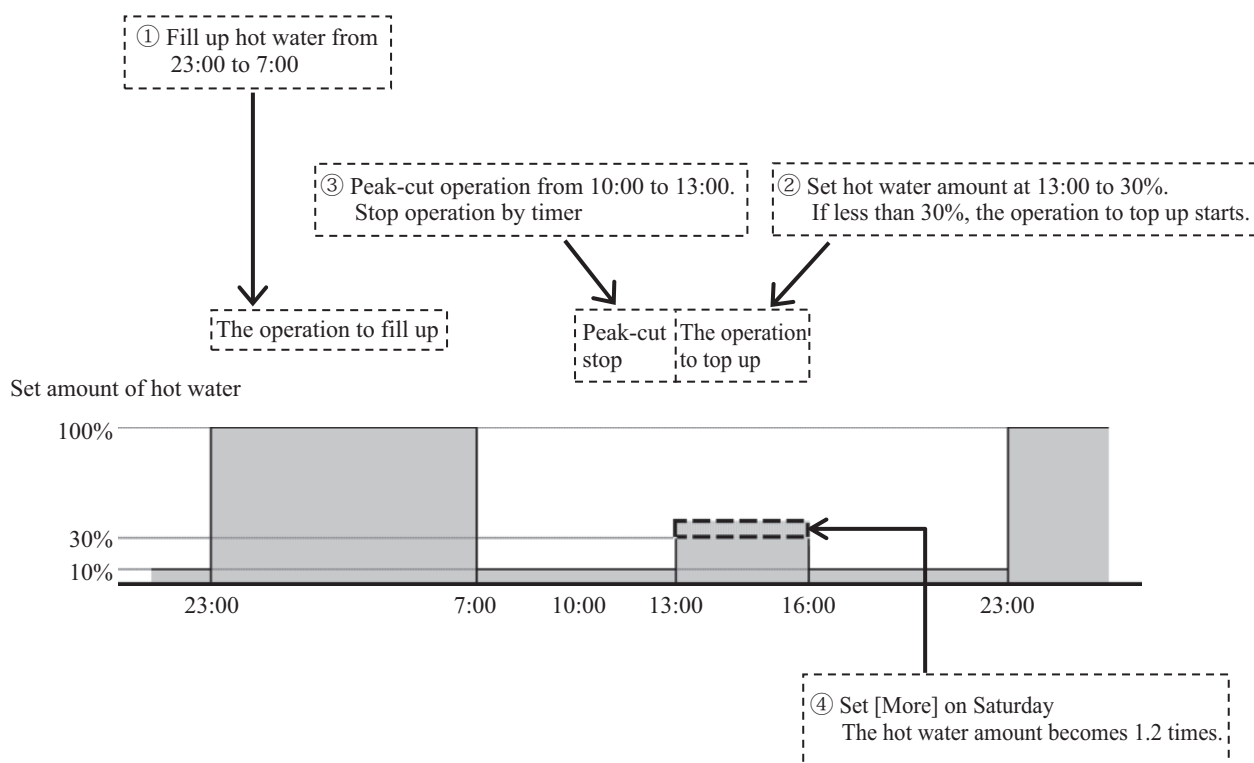
It is in operation by standby.
Storage amount setting [More]

Tap the panel for change.

When “More” or “Less” is set, the message is displayed on the TOP screen like this.

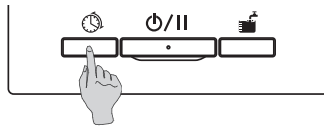
[Operation pattern of heat pump water heater]

When setting like ① to ④ mentioned above, the set hot water amount at each time of the day is shown as follows.

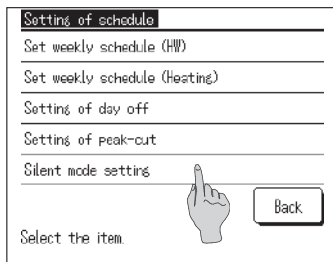


g) Silent mode

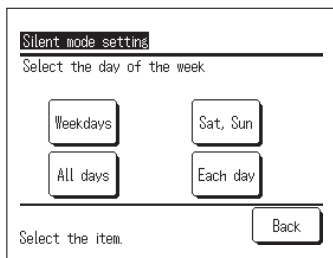
Silent mode on weekly basis can be set.



1. Push the **Schedule setting** switch on the panel.

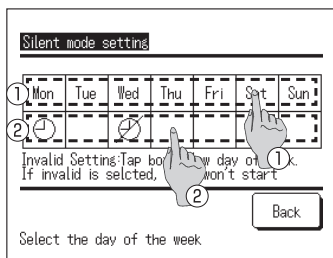


2. The menu screen of [Setting of schedule] is displayed. Tap the [Silent mode setting]

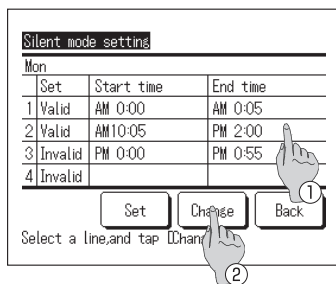


3. The selection screen of [Silent mode setting] is displayed. Tap the item of setting day.

- | | |
|---|-------------|
| ① Weekdays: From Monday to Friday | } (Go to 6) |
| ② Sat, Sun: Saturday and Sunday | |
| ③ All days: From Monday to Sunday | |
| ④ Each day: Go to the [Day selection] screen
(Go to 4) | |



4. Tap the day to be set on the display ①.
The current setting contents of the day tapped are displayed (Go to 6)
5. For the setting Valid/Invalid, tap the blank column on the display ② just below the day.
Switch Valid : [Valid] ⇌ Invalid [Invalid]
On the day set invalid, the Silent mode operation is not done.
Multiple selections of invalid settings are available.

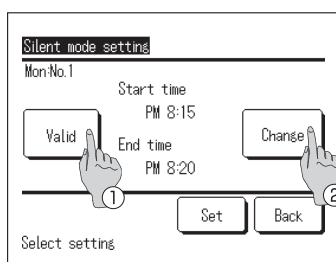


6. The [Checking of current set contents] screen is displayed.

When changing or adding the setting contents, ① select the column of the setting No. to be changed ② and tap [Change] button.

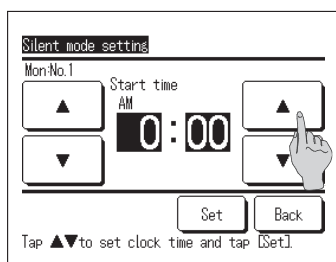
■ The setting contents displayed may differ depending on the set day selected (Go to 3)

- ① Weekdays: Set Silent mode on Monday
- ② Sat, Sun: Set Silent mode on Saturday
- ③ All days in a week: Set Silent mode on Monday
- ④ Each day: Set Silent mode on the day selected



7. The detail screen of [Timer set contents] is displayed.

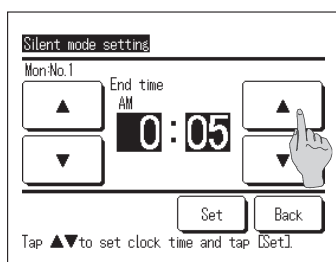
- ① Switch the setting [Valid] $\leftrightarrow$ [Invalid].
by tapping [Valid/Invalid] button
- ② Tap [Change] button. and set [Start time] and [End time]. (Go to 8)



8. Set the [Start time].

Set the Hour/Minute by tapping buttons.
The [Start time] can be set at 5-minute intervals

After setting the time, tap [Set] button. (Go to 9)



9. Set the [End time].

Set the Hour/Minute by tapping buttons.
The [End time] can be set at 5-minute intervals from 5 minutes after the [Start time] up to 24:00.

After setting the time, tap [Set] button. (Go to 10)

Silent mode setting

Mon.No.1

Start time PM 8:15

End time PM 8:20

Valid Change

Select setting

Set Back

Silent mode setting

Mon

Set	Start time	End time
1 Valid	AM 0:00	AM 0:05
2 Valid	AM 10:05	PM 2:00
3 Invalid	PM 0:00	PM 0:55
4 Invalid		

Select a line, and [Change].

Set Change Back

Silent mode setting

Do you want to apply group setting?

Yes

Back

10. The [Checking of set contents] screen is displayed
(☞ Go to 7)

When tapping **Set** button, the set contents are confirmed and [Checking of set contents on the day] screen is displayed. (☞ Go to 6)

11. If changing or adding the setting contents on the same day continuously, please start the work from 6.

12. The [Checking of setting contents] on the day is displayed. (☞ Go to 6)

When saving the setting, tap **Set** button.

① In case of setting all

It shifts to the [All set contents acknowledge] screen
(☞ Go to 13)

② In case of individual setting

Save the setting and shift to the [Day selection] screen (☞ Go to 4)

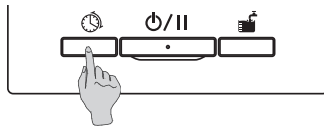
13. [All set contents acknowledge] screen is displayed

Tap **Yes** and save the setting

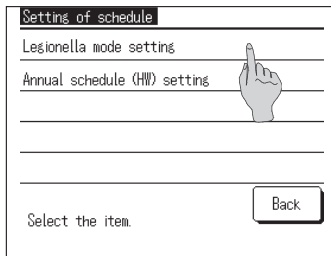
After saving, it returns to the [Day selection] screen

14. If the setting is done by changing the day, please start setting from 4.

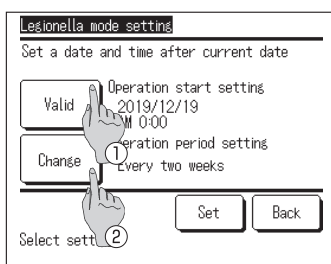
h) Legionella



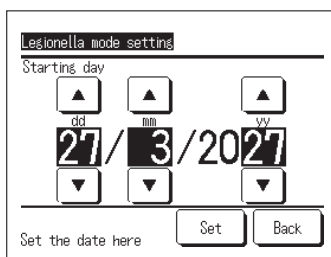
1. Push the **Schedule setting** switch on the panel.



2. The menu screen of [Setting of schedule] is displayed.
Tap the [Legionella mode setting]

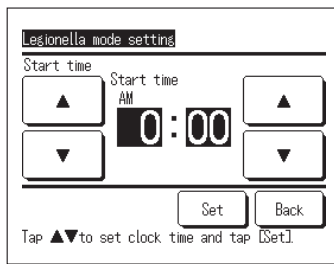


3. The detail screen of [Legionella mode setting] is displayed.
 - ① Switch the setting [Valid] ⇔ [Invalid] by tapping **Valid/Invalid** button
 - ② Tap **Change** button, and set [Start time] and [End time] (→ Go to 4)



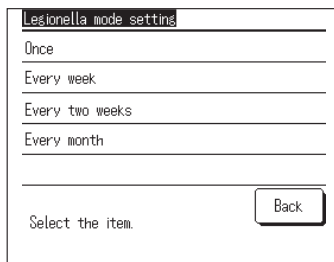
4. Set the [Starting day].
Set the dd/mm/yy by tapping **▲** **▼** buttons.

After setting the date, tap **Set** button.



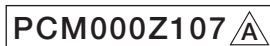
5. Set the [Start time]
Set the Hour/Minute by tapping ▲ ▼ buttons.
The [Start time] can be set at 5-minute intervals.

After setting the time, tap [Set] button.



6. The detail screen of [Legionella mode setting] is displayed.

Tap the desired interval.

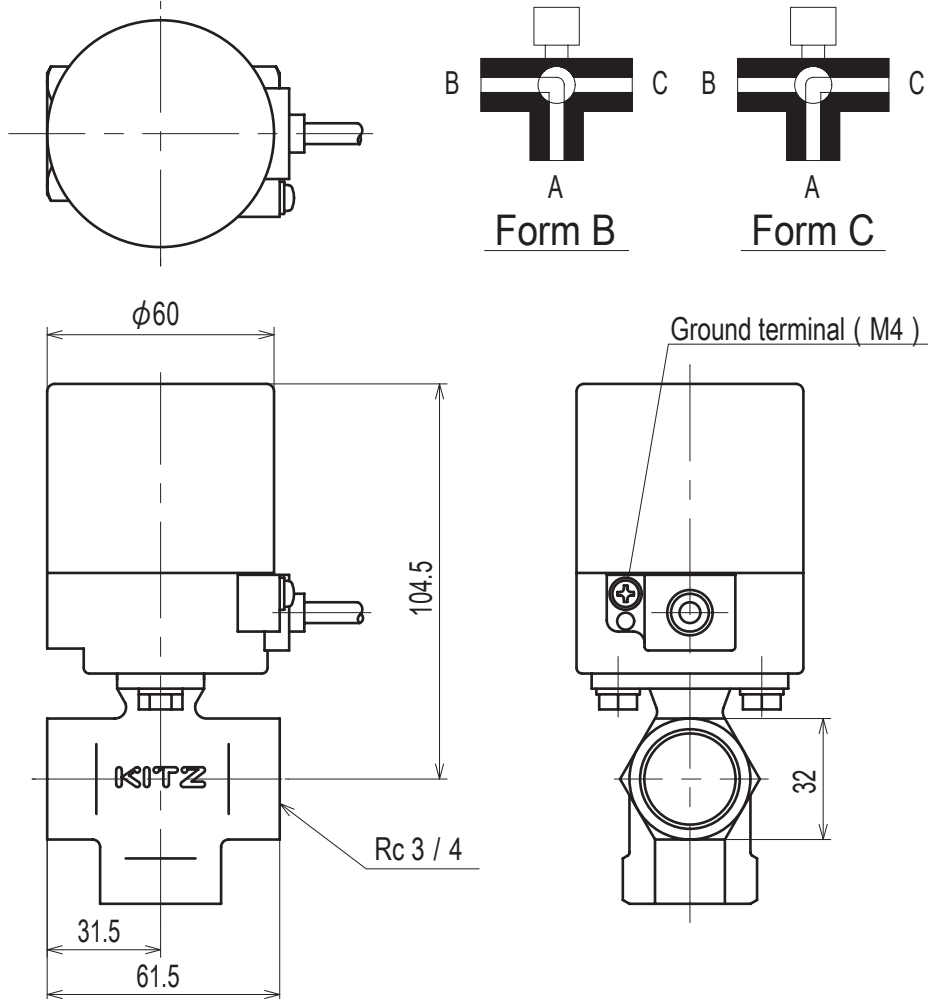


(2) MTH-Q4E,MTH-Q8E (Option part)

PART NAME : 3-WAY VALVE (CWFV2, 3)

MTH-Q4E(CWFV3) : For anti-freezing

MTH-Q8E(CWFV2) : For return hot water control

PART No. : SSA482B052**Nominal Diameter** : 20A(3/4)**IP code** : IP56 (Indoor specifications)**NAME 10K CAST STAINLESS STEEL BALL VALVE 3/4 WITH ELECTRIC ACTUATOR**

Note: MTH-Q8E is used for return hot water control and contains the 3-way valve and connection wiring. See page 68 for details.

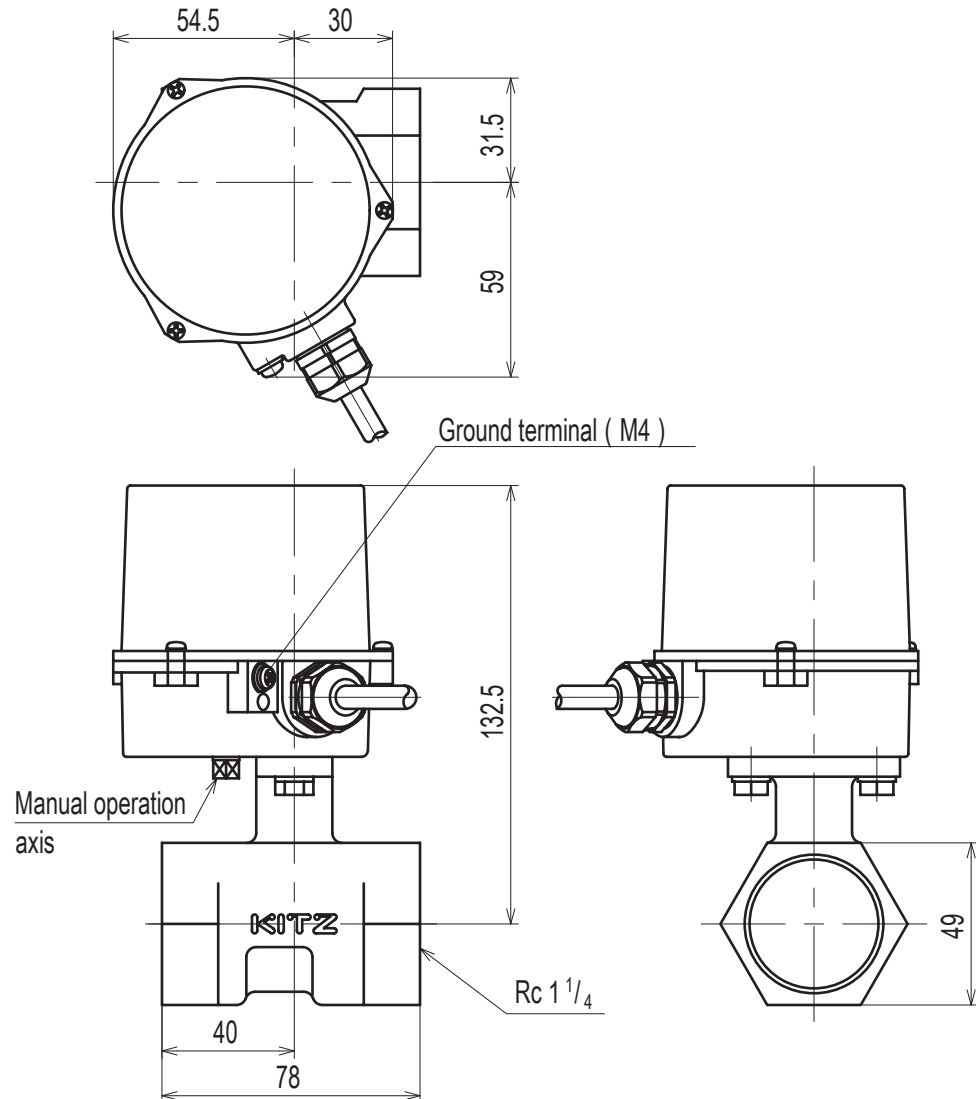
(3) MTH-Q5E

PART NAME : 2-WAY VALVE (CWFV5)

PART No. : SSA482A029

Nominal Diameter : 32A (1 1/4)

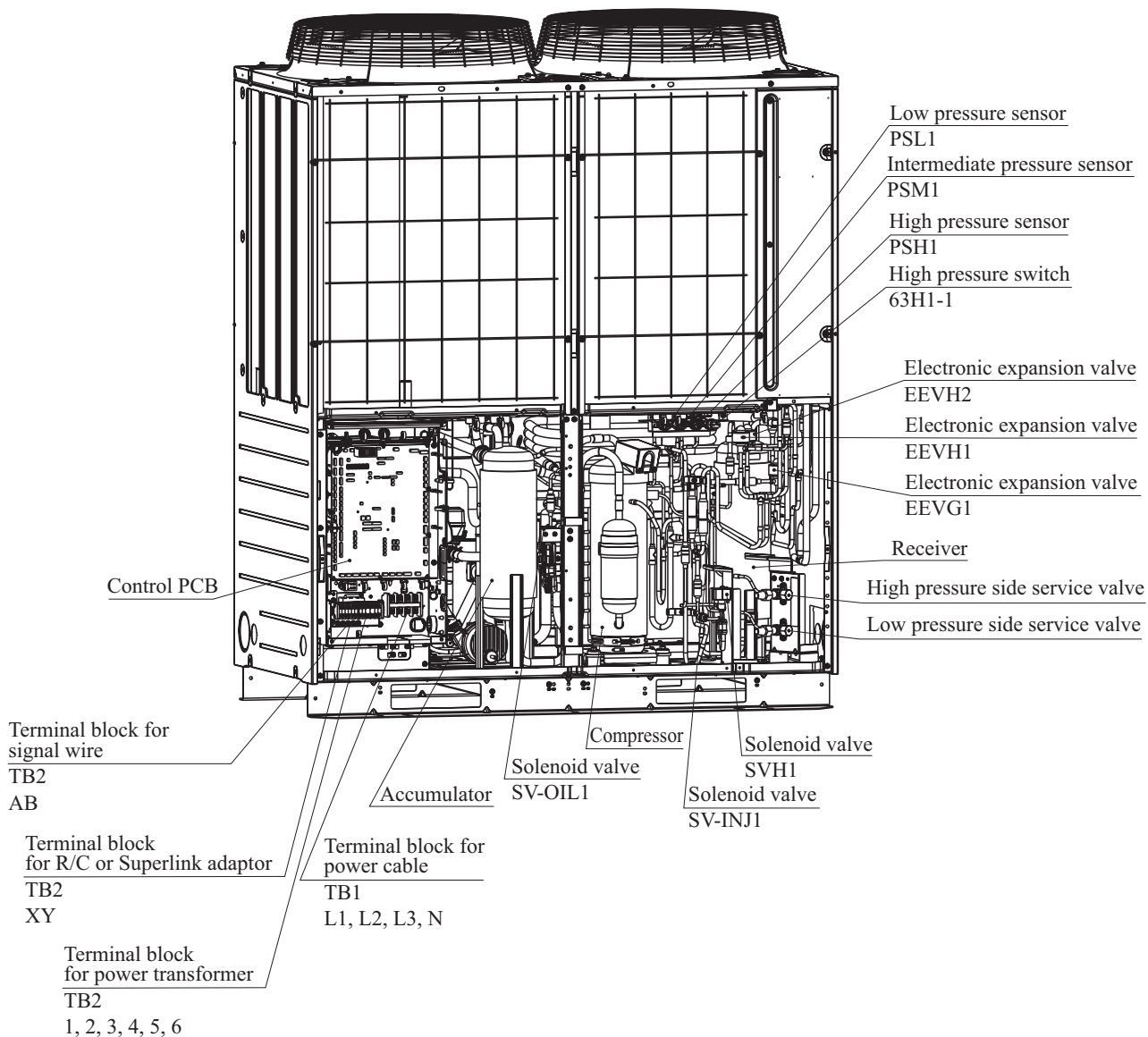
IP code : IP56 (Outdoor use allowed)



NAME 10K CAST STAINLESS STEEL BALL VALVE 1 1/4 WITH ELECTRIC ACTUATOR

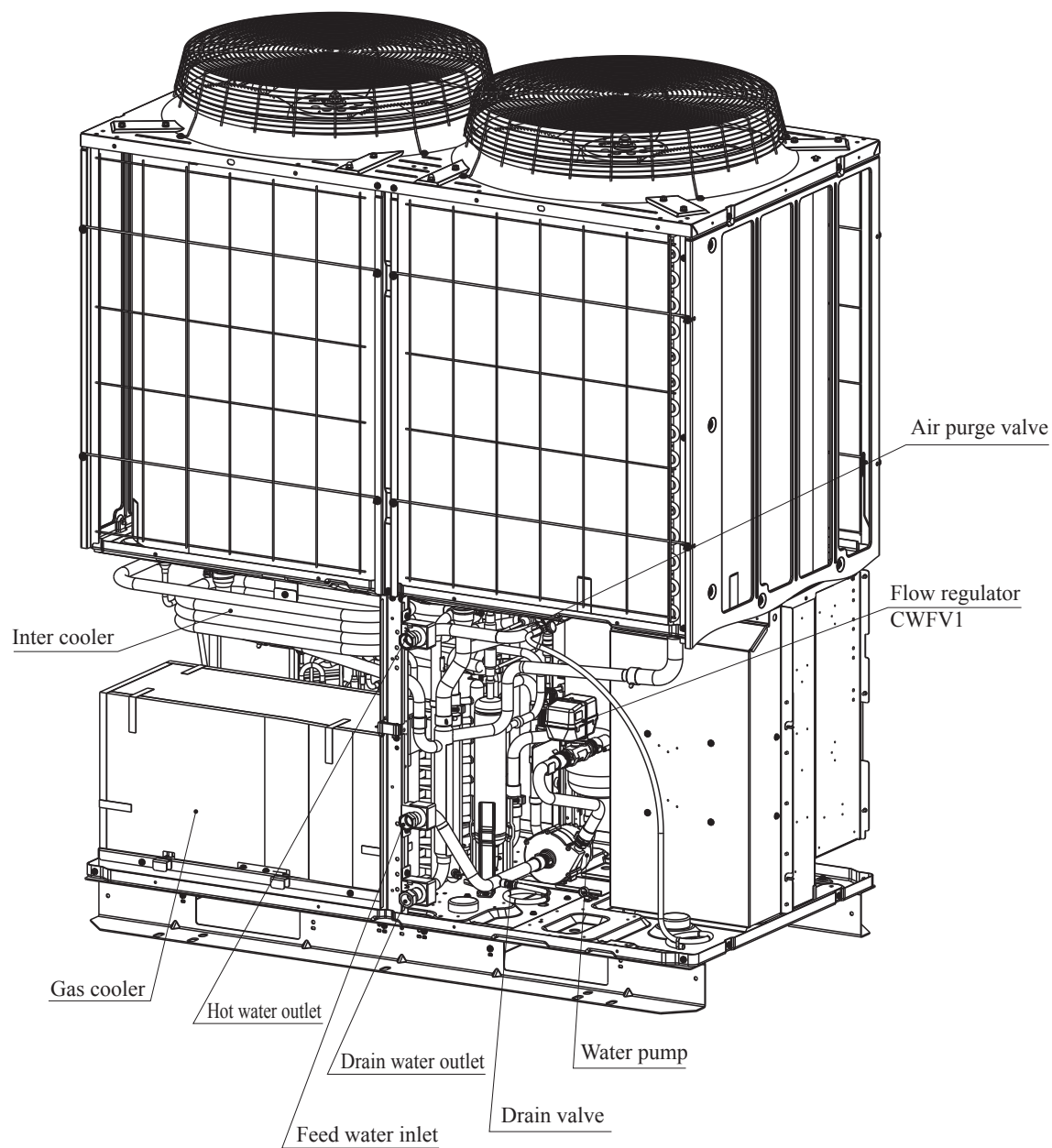
2.3 Inner structure

Heat pump water heater



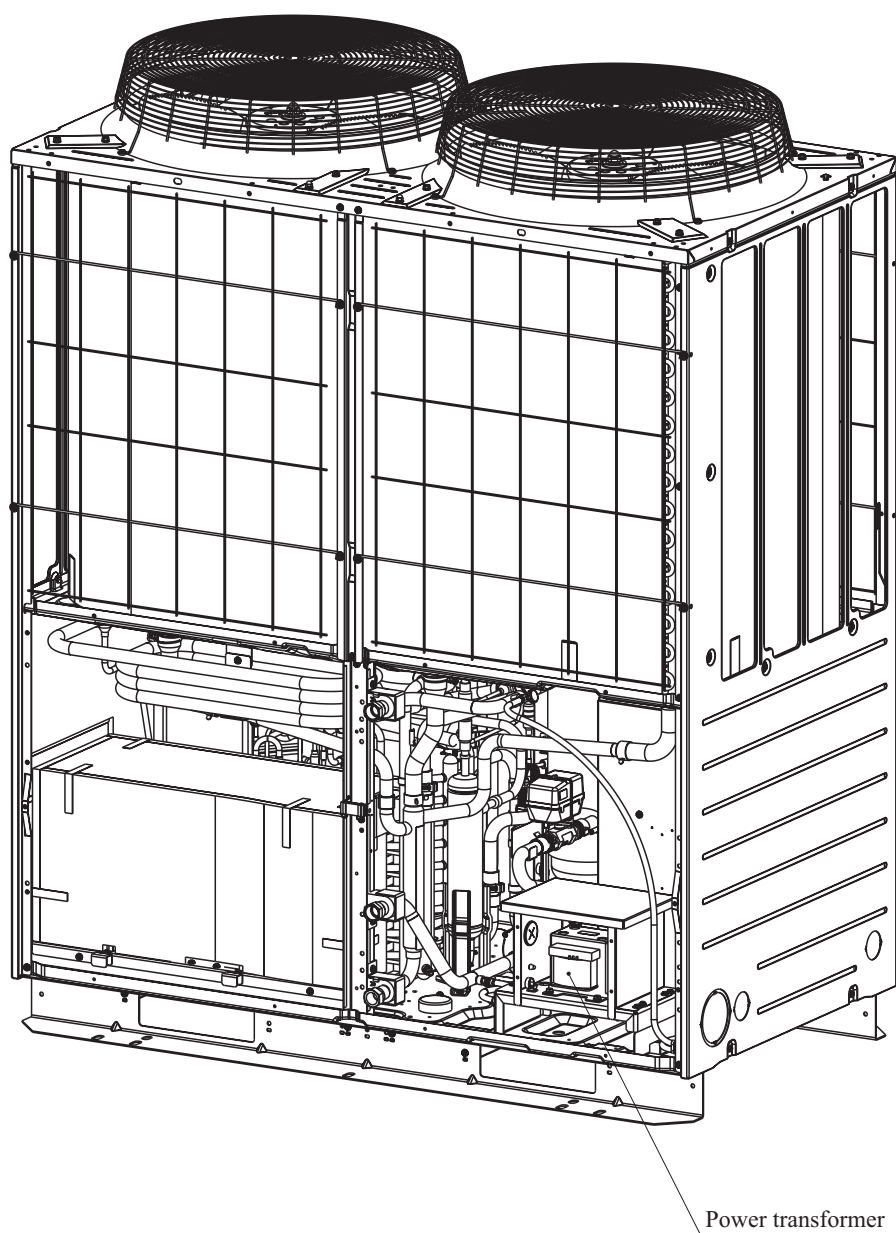
Front view

Without transformer



Rear view

- In this figure, the mounting position of the power transformer is not shown. (Please refer next page.)



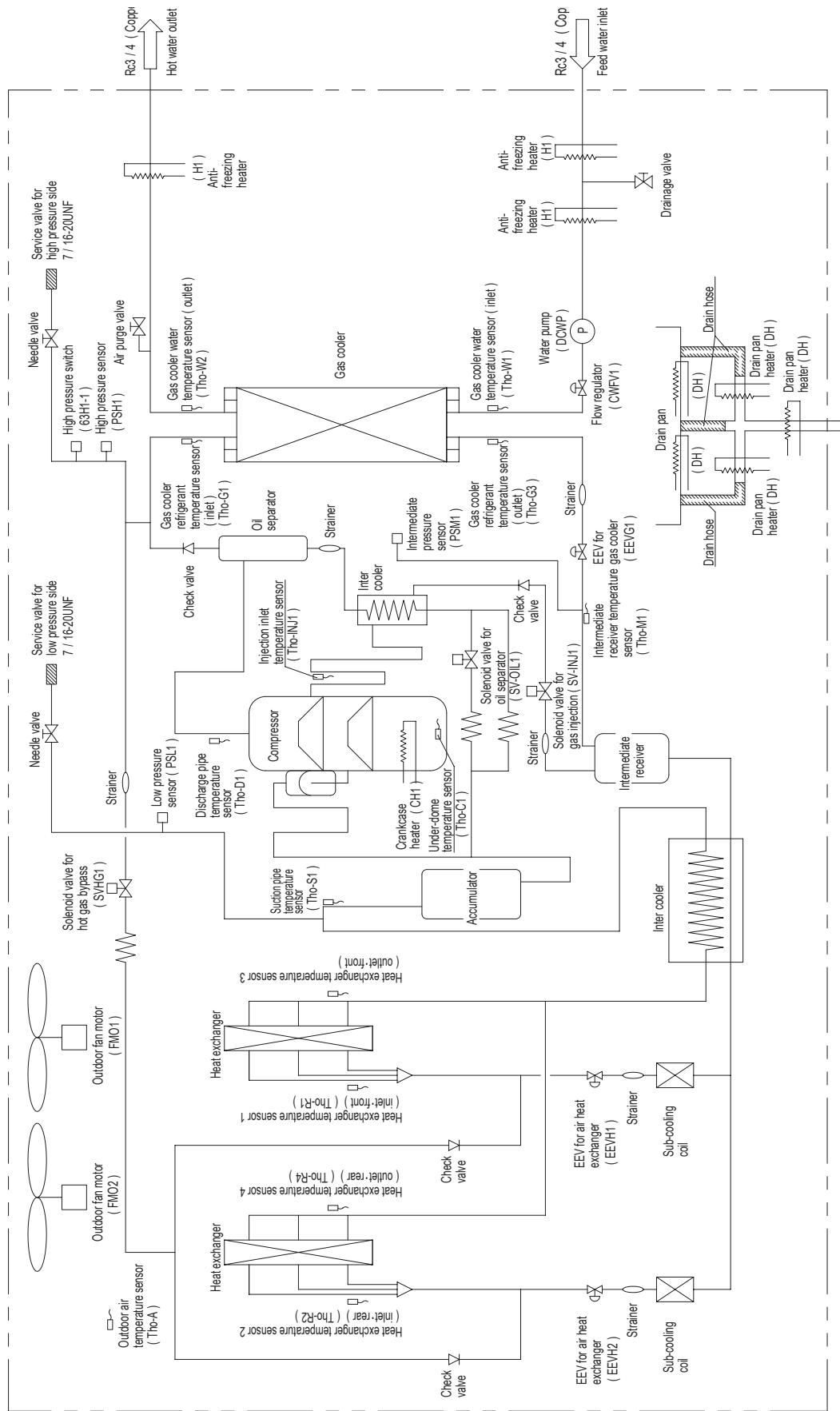
Rear view

- The mounting position of the power transformer is shown in above figure.

2.4 System diagram

(1) Heat pump water heater (Overall view)

ESA30EH2-25



2.5 Electrical wiring

ATTENTION

When raining, be sure to implement the commissioning by attaching the front panels to the unit.



HIGH VOLTAGE

200V to 400V of high voltage is applied. If touching high voltage parts, it may result in electric shock or death. When performing inspection, pay attention not to touch the charging circuit. And when replacing electric parts, be sure to turn off the main power and wait for 3 minutes before touching electric parts.



HIGH TEMPERATURE

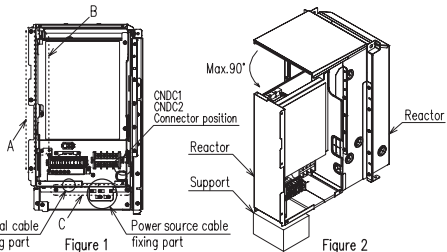
Though the power is OFF, the control has heated parts, especially reactor, so leave it for enough time.

CAUTIONS FOR MAINTENANCE OF THE CONTROL BOX

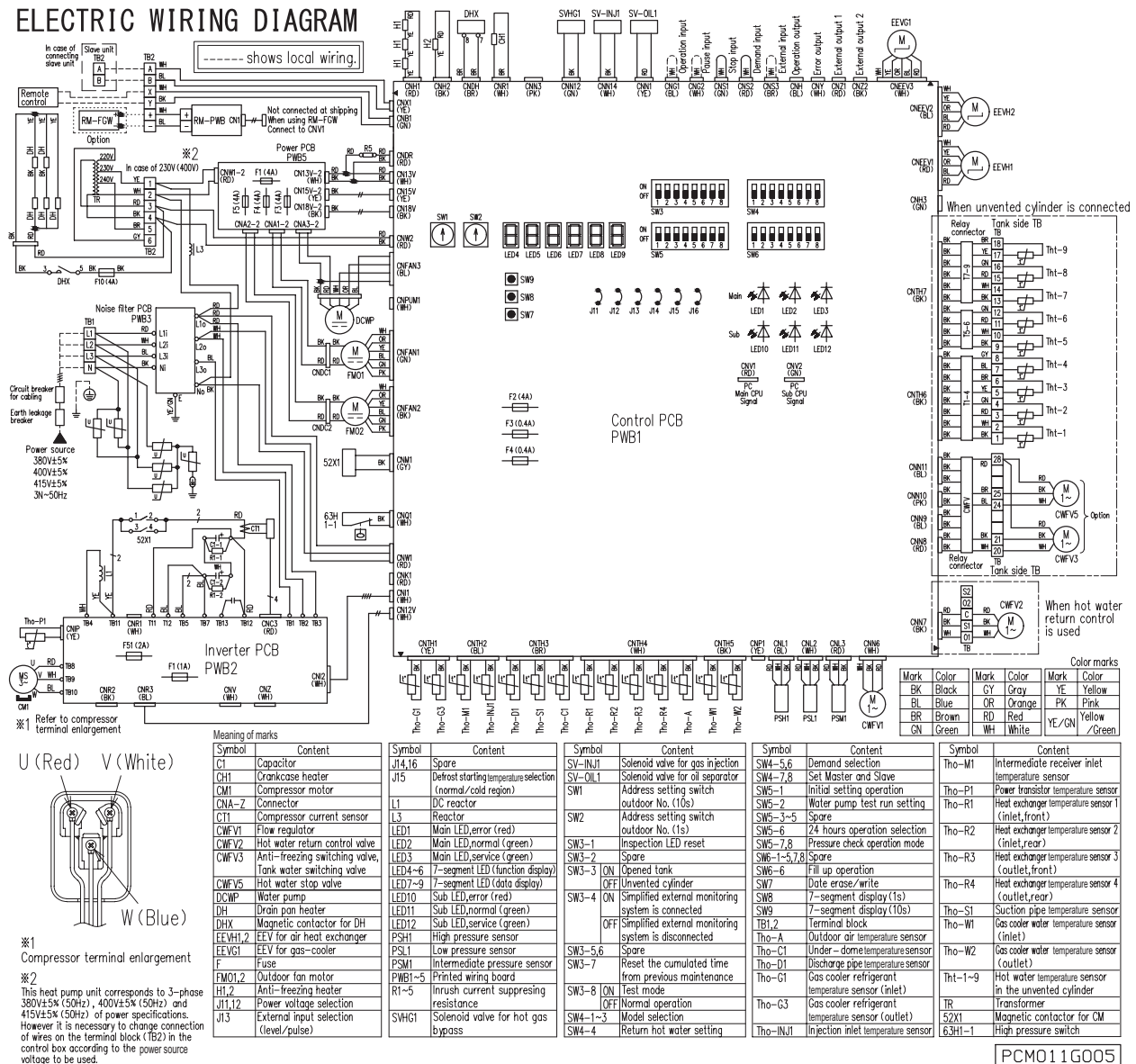
This control box has its front part hinged so as to be able to open and close for maintenance of the inverter. Following cautions must be observed during the maintenance. Always follow the instructions described in the technical manual when implementing the maintenance.

1. Turn off the power source before starting the maintenance.
2. After waiting for minimum 3 minutes after turning off the main power source, measure the DC power source voltage to confirm according to the technical manual that the electricity has been discharged sufficiently. Only then disconnect the power source cable and the signal cable from the terminal board.
3. Remove a total 8 pieces of screws at the sections A, B and C and the cable fixing part in Figure 1.
 - Take care not to drop screws on the PCB, etc. when removing them.
 - Make sure to collect when dropped any.
4. Open the front part of the control box as shown in Figure 2.
 - Don't open the front part more than 90°.

- Avoid exerting undue force on the open front part.
 - Provide a support under the open front part.
5. After opening the front part of the control box, you can access to the inverter. Start the maintenance according to the technical manual.
 - When a tie wrap band has been cut off, fix it firmly at the original position with a new tie wrap band.
 - When a connector has been disconnected from the PCB, insert firmly the connector again at the original position.
 6. When the maintenance is over, close the front part of the control box.
 - Take care not to nip the wiring with the front part.
 7. Reinstall and tighten the 8 screws removed at the sections A, B and C and the cable fixing part.
 - Don't overlook to tighten the screws at the section B particularly.
 - Take care not to drop screws on the PCB, etc. when tightening them.
 - Make sure to collect when dropped any, and tighten them at proper positions.
 8. Confirm visually that all screws have been tightened, and all cables have been connected properly.



ELECTRIC WIRING DIAGRAM



2.6 Hot water system performance table for the operation to top up with recirculation loop

(1) Hot water performance table

(a) Hot water outlet temperature: 60°C

Hot water outlet temperature: 60°C		Heating capacity	Power consumption	COP
Feed water temperature	Outdoor air temperature	kW	kW	—
5°C	25°C	30.0	4.9	6.07
	16°C	30.0	5.7	5.25
	7°C	30.0	6.8	4.44
	2°C	30.0	10.5	2.85
	-7°C	30.0	10.6	2.82
	-10°C	28.5	10.9	2.62
	-20°C	24.0	9.2	2.60
	-25°C	21.0	8.3	2.53
17°C	25°C	30.0	5.5	5.42
	16°C	30.0	6.6	4.55
	7°C	30.0	7.6	3.95
	2°C	30.0	11.4	2.64
	-7°C	30.0	11.5	2.62
	-10°C	28.5	11.8	2.41
	-20°C	24.0	10.1	2.37
	-25°C	21.0	9.0	2.33
24°C	25°C	30.0	5.7	5.30
	16°C	30.0	6.7	4.50
	7°C	30.0	8.2	3.68
	2°C	30.0	11.3	2.65
	-7°C	30.0	11.5	2.61
	-10°C	28.5	12.4	2.30
	-20°C	24.0	10.8	2.23
	-25°C	21.0	9.7	2.17
30°C	25°C	30.0	5.8	5.21
	16°C	30.0	6.7	4.46
	7°C	30.0	8.6	3.47
	2°C	30.0	11.3	2.66
	-7°C	30.0	11.5	2.60
	-10°C	28.5	12.9	2.21
	-20°C	24.0	11.4	2.11
	-25°C	21.0	10.2	2.06

(b) Hot water outlet temperature: 65°C

Hot water outlet temperature: 65°C		Heating capacity	Power consumption	COP
Feed water temperature	Outdoor air temperature	kW	kW	—
5°C	25°C	30.0	5.2	5.72
	16°C	30.0	6.1	4.93
	7°C	30.0	7.1	4.20
	2°C	30.0	10.7	2.80
	-7°C	30.0	10.7	2.80
	-10°C	28.5	10.9	2.62
	-20°C	24.0	9.7	2.47
	-25°C	21.0	9.0	2.33
17°C	25°C	30.0	5.9	5.05
	16°C	30.0	7.0	4.30
	7°C	30.0	8.0	3.73
	2°C	30.0	11.5	2.62
	-7°C	30.0	11.5	2.60
	-10°C	28.5	11.8	2.41
	-20°C	24.0	10.6	2.26
	-25°C	21.0	9.8	2.14
24°C	25°C	30.0	6.5	4.63
	16°C	30.0	7.5	4.01
	7°C	30.0	8.7	3.47
	2°C	30.0	11.8	2.54
	-7°C	30.0	11.9	2.53
	-10°C	28.5	12.4	2.30
	-20°C	24.0	11.3	2.13
	-25°C	21.0	10.4	2.01
30°C	25°C	30.0	6.9	4.32
	16°C	30.0	7.9	3.78
	7°C	30.0	9.2	3.27
	2°C	30.0	12.1	2.48
	-7°C	30.0	12.2	2.46
	-10°C	28.5	12.9	2.21
	-20°C	24.0	11.8	2.03
	-25°C	21.0	11.0	1.91

- Notes
- 1) The data of power consumption in this table do not include the power consumption of anti-freezing heater(191W).
In case of outdoor air temperature $\leq 3^{\circ}\text{C}$, please take account of the power consumption for anti-freezing heater.
 - 2) For the data of the table and the curve the performance decrement of defrost operation are considered.
But heating performance may change in climate condition and installation environment.

(c) Hot water outlet temperature: 70°C

Hot water outlet temperature: 70°C		Heating capacity	Power consumption	COP
Feed water temperature	Outdoor air temperature	kW	kW	—
5°C	25°C	30.0	5.6	5.40
	16°C	30.0	6.5	4.65
	7°C	30.0	7.5	3.98
	2°C	30.0	10.9	2.76
	-7°C	30.0	10.8	2.79
	-10°C	28.5	10.9	2.62
	-20°C	24.0	10.2	2.35
	-25°C	21.0	9.8	2.15
17°C	25°C	30.0	6.3	4.73
	16°C	30.0	7.4	4.08
	7°C	30.0	8.5	3.53
	2°C	30.0	11.6	2.59
	-7°C	30.0	11.6	2.59
	-10°C	28.5	11.8	2.41
	-20°C	24.0	11.1	2.16
	-25°C	21.0	10.6	1.98
24°C	25°C	30.0	7.3	4.11
	16°C	30.0	8.3	3.61
	7°C	30.0	9.1	3.28
	2°C	30.0	12.3	2.44
	-7°C	30.0	12.3	2.45
	-10°C	28.5	12.4	2.30
	-20°C	24.0	11.8	2.04
	-25°C	21.0	11.2	1.87
30°C	25°C	30.0	8.1	3.69
	16°C	30.0	9.1	3.29
	7°C	30.0	9.7	3.09
	2°C	30.0	13.0	2.31
	-7°C	30.0	12.9	2.33
	-10°C	28.5	12.9	2.21
	-20°C	24.0	12.3	1.95
	-25°C	21.0	11.8	1.78

(d) Hot water outlet temperature: 80°C

Hot water outlet temperature: 80°C		Heating capacity	Power consumption	COP
Feed water temperature	Outdoor air temperature	kW	kW	—
5°C	25°C	30.0	7.1	4.21
	16°C	30.0	7.7	3.89
	7°C	30.0	8.4	3.58
	2°C	30.0	11.2	2.68
	-7°C	30.0	10.9	2.76
	-10°C	28.5	10.9	2.62
	-20°C	24.0	10.7	2.24
	-25°C	21.0	10.3	2.04
17°C	25°C	30.0	7.8	3.84
	16°C	30.0	8.6	3.50
	7°C	30.0	9.2	3.26
	2°C	30.0	11.8	2.55
	-7°C	30.0	11.6	2.59
	-10°C	28.5	11.8	2.41
	-20°C	24.0	11.5	2.08
	-25°C	21.0	11.1	1.89
24°C	25°C	30.0	9.0	3.35
	16°C	30.0	9.5	3.17
	7°C	30.0	10.0	3.00
	2°C	30.0	12.5	2.41
	-7°C	30.0	12.3	2.45
	-10°C	28.5	12.4	2.30
	-20°C	24.0	12.1	1.98
	-25°C	21.0	11.7	1.79
30°C	25°C	30.0	9.9	3.02
	16°C	30.0	10.2	2.93
	7°C	30.0	10.7	2.81
	2°C	30.0	13.1	2.30
	-7°C	30.0	12.9	2.33
	-10°C	28.5	12.9	2.21
	-20°C	24.0	12.7	1.90
	-25°C	21.0	12.2	1.72

- Notes 1) The data of power consumption in this table do not include the power consumption of anti-freezing heater(191W).
In case of outdoor air temperature $\leq 3^{\circ}\text{C}$, please take account of the power consumption for anti-freezing heater.
- 2) For the data of the table and the curve the performance decrement of defrost operation are considered.
But heating performance may change in climate condition and installation environment.

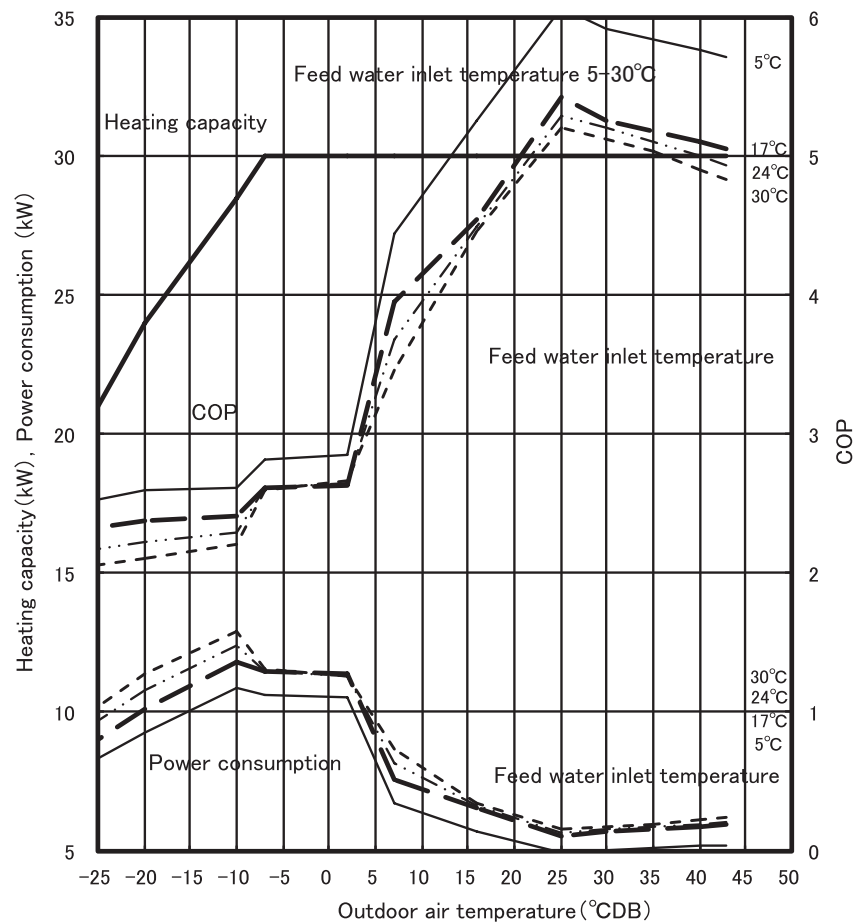
(e) Hot water outlet temperature: 90°C

Hot water outlet temperature: 90°C		Heating capacity	Power consumption	COP
Feed water temperature	Outdoor air temperature	kW	kW	—
5°C	25°C	30.0	8.7	3.46
	16°C	30.0	9.0	3.34
	7°C	30.0	9.2	3.25
	2°C	30.0	11.5	2.61
	-7°C	30.0	11.0	2.73
	-10°C	28.5	10.9	2.62
	-20°C	24.0	11.2	2.14
	-25°C	21.0	10.9	1.93
17°C	25°C	30.0	9.3	3.24
	16°C	30.0	9.8	3.06
	7°C	30.0	9.9	3.03
	2°C	30.0	12.0	2.51
	-7°C	30.0	11.6	2.59
	-10°C	28.5	11.8	2.41
	-20°C	24.0	12.0	2.00
	-25°C	21.0	11.7	1.80
24°C	25°C	30.0	10.6	2.83
	16°C	30.0	10.6	2.82
	7°C	30.0	10.9	2.76
	2°C	30.0	12.6	2.38
	-7°C	30.0	12.3	2.45
	-10°C	28.5	12.4	2.29
	-20°C	24.0	12.5	1.92
	-25°C	21.0	12.2	1.72
30°C	25°C	30.0	11.7	2.56
	16°C	30.0	11.3	2.65
	7°C	30.0	11.7	2.57
	2°C	30.0	13.2	2.28
	-7°C	30.0	12.9	2.33
	-10°C	30.0	12.9	2.21
	-20°C	30.0	13.0	1.85
	-25°C	30.0	12.7	1.66

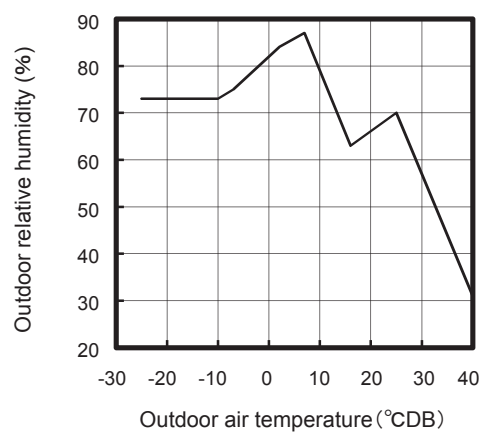
- Notes 1) The data of power consumption in this table do not include the power consumption of anti-freezing heater(191W).
In case of outdoor air temperature $\leq 3^{\circ}\text{C}$, please take account of the power consumption for anti-freezing heater.
- 2) For the data of the table and the curve the performance decrement of defrost operation are considered.
But heating performance may change in climate condition and installation environment.

(2) Hot water performance curve for the operation to top up

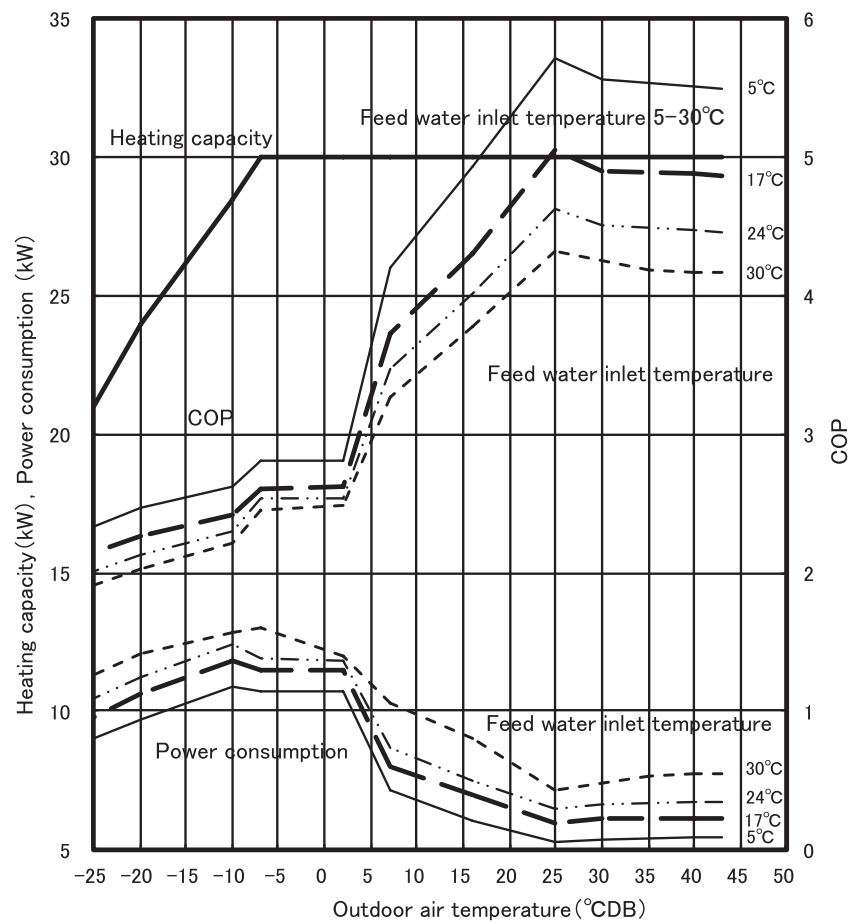
(a) Hot water outlet temperature: 60°C



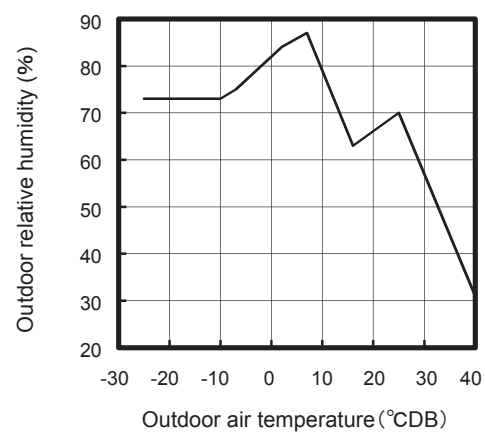
Relative humidity of performance characteristics



- Notes
- 1) Performance characteristics are based on the relative humidity mentioned above.
 - 2) System performance may vary according to climate and system conditions.

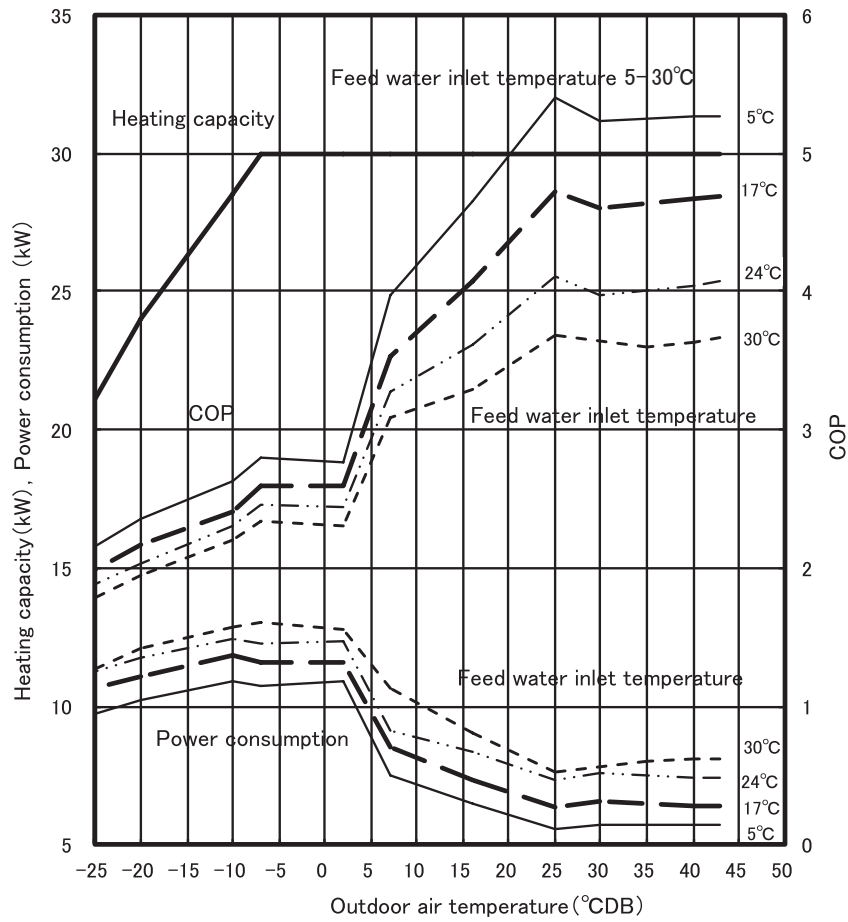
(b) Hot water outlet temperature: 65°C

Relative humidity of performance characteristics

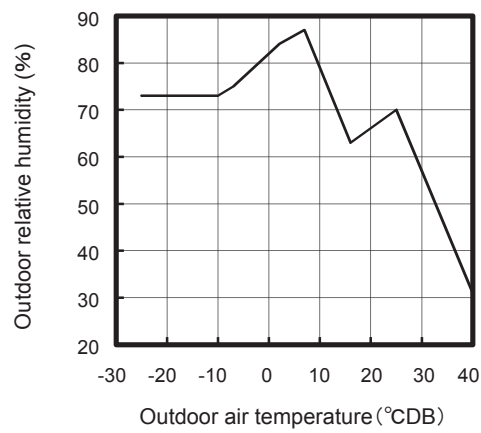


- Notes
- 1) Performance characteristics are based on the relative humidity mentioned above.
 - 2) System performance may vary according to climate and system conditions.

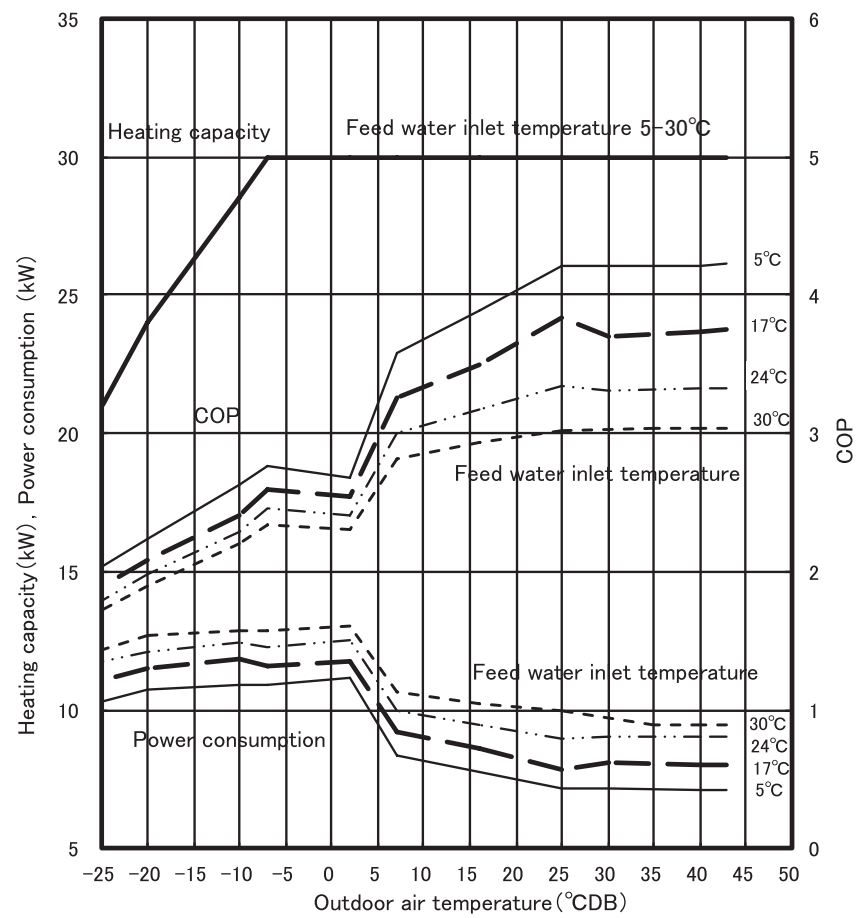
(c) Hot water outlet temperature: 70°C



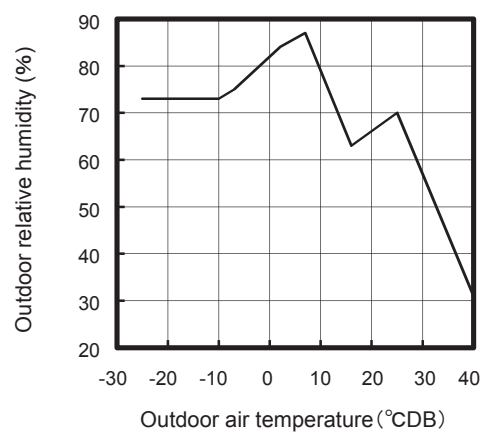
Relative humidity of performance characteristics



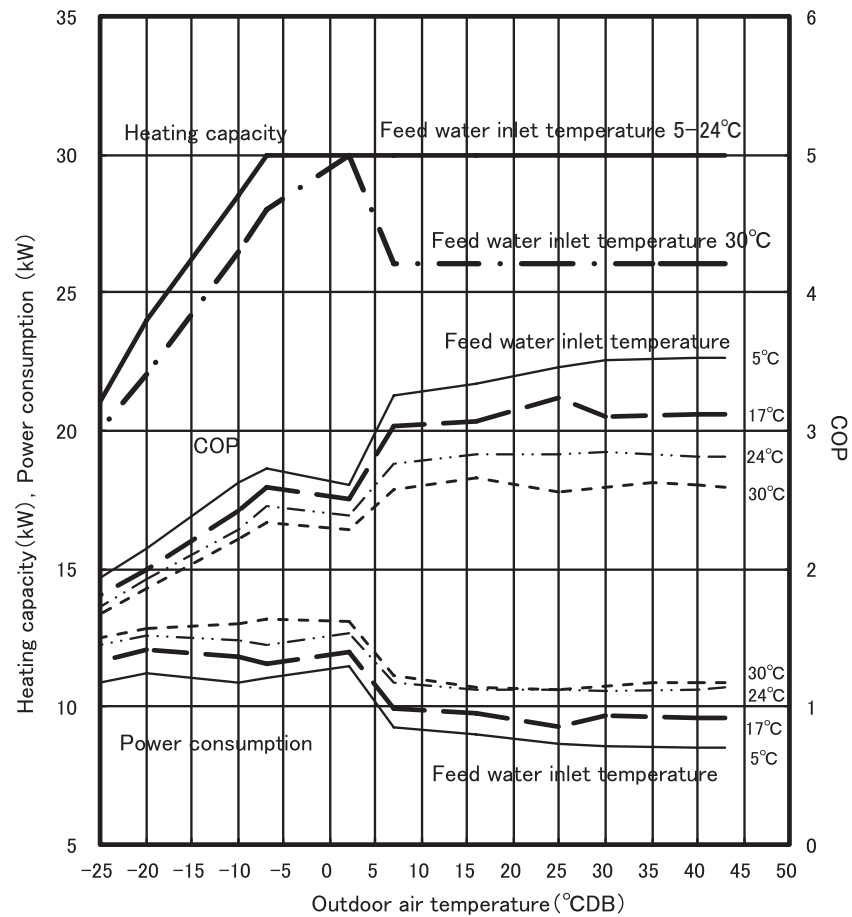
- Notes
- 1) Performance characteristics are based on the relative humidity mentioned above.
 - 2) System performance may vary according to climate and system conditions.

(d) Hot water outlet temperature: 80°C

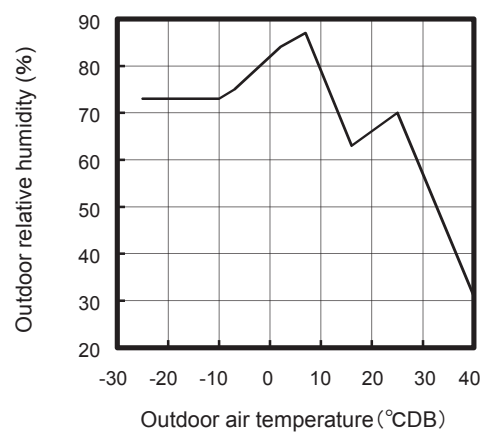
Relative humidity of performance characteristics



- Notes
- 1) Performance characteristics are based on the relative humidity mentioned above.
 - 2) System performance may vary according to climate and system conditions.

(e) Hot water outlet temperature: 90°C

Relative humidity of performance characteristics



- Notes
- 1) Performance characteristics are based on the relative humidity mentioned above.
 - 2) System performance may vary according to climate and system conditions.

(3) Performance table for hot water operation with recirculation loop

For the operation to top up, refer to the hot water performance table in section 2.6 (1) and (2).

In case of systems with recirculation loop there is the risk of having a decrease in capacity due to high inlet water temperature into the heat pump water heater (inlet temp $\geq 40^{\circ}\text{C}$).

In such condition, the hot water performance changes as shown on the table below.

*If the feed water temperature is higher than 40°C , the outlet water temperature may exceed the target temperature under certain conditions. Please see highlighted rows in the table below, also shown by broken line in the following graph.

(a) In case of temperature set to 65°C

Setting temperature: 65°C		Capacity	Power consumption	COP	Water flow volume	Hot water outlet temperature
Feed water inlet temperature	Outdoor air temperature	kW	kW	-	L/min	$^{\circ}\text{C}$
40 $^{\circ}\text{C}$	25 $^{\circ}\text{C}$	14.0	5.4	2.61	8.3	65
	16 $^{\circ}\text{C}$	23.3	8.4	2.78	13.8	65
	7 $^{\circ}\text{C}$	24.8	10.9	2.27	14.7	65
	2 $^{\circ}\text{C}$	24.4	12.3	1.97	14.4	65
	-7 $^{\circ}\text{C}$	19.4	10.3	1.87	11.2	65
	-10 $^{\circ}\text{C}$	19.0	10.6	1.79	11.1	65
	-20 $^{\circ}\text{C}$	9.9	7.7	1.29	5.8	65
	-25 $^{\circ}\text{C}$	5.1	5.1	0.99	2.9	65
50 $^{\circ}\text{C}$	25 $^{\circ}\text{C}$	11.7	5.7	2.07	11.4	65
	16 $^{\circ}\text{C}$	16.8	8.3	2.03	16.6	65
	7 $^{\circ}\text{C}$	19.4	10.6	1.82	17.0	67
	2 $^{\circ}\text{C}$	19.9	12.4	1.61	17.0	67
	-7 $^{\circ}\text{C}$	15.1	10.6	1.42	14.8	65
	-10 $^{\circ}\text{C}$	13.8	10.8	1.28	13.7	65
	-20 $^{\circ}\text{C}$	7.7	8.0	0.96	7.5	65
	-25 $^{\circ}\text{C}$	3.8	5.2	0.72	3.7	65
55 $^{\circ}\text{C}$	25 $^{\circ}\text{C}$	10.4	5.8	1.79	15.2	65
	16 $^{\circ}\text{C}$	14.6	8.5	1.72	17.0	68
	7 $^{\circ}\text{C}$	16.8	10.8	1.56	17.0	70
	2 $^{\circ}\text{C}$	15.7	12.0	1.31	17.0	69
	-7 $^{\circ}\text{C}$	11.7	10.1	1.16	16.7	65
	-10 $^{\circ}\text{C}$	11.7	10.8	1.08	17.0	65
	-20 $^{\circ}\text{C}$	6.8	8.2	0.83	10.0	65
	-25 $^{\circ}\text{C}$	3.4	5.3	0.64	4.9	65
60 $^{\circ}\text{C}$	25 $^{\circ}\text{C}$	9.1	6.0	1.53	17.0	68
	16 $^{\circ}\text{C}$	11.4	8.5	1.35	17.0	70
	7 $^{\circ}\text{C}$	14.4	10.9	1.33	17.0	73
	2 $^{\circ}\text{C}$	13.3	12.0	1.10	17.0	72
	-7 $^{\circ}\text{C}$	10.3	10.5	0.98	17.0	69
	-10 $^{\circ}\text{C}$	10.1	10.8	0.93	17.0	69
	-20 $^{\circ}\text{C}$	6.1	8.4	0.73	17.0	65
	-25 $^{\circ}\text{C}$	3.0	5.3	0.56	8.9	65

* In case that actual water circuit head is more than 5m (49kPa), hot water outlet temperature could exceed the setting temperature.

* For above conditions performance takes into account of defrost operation.

(b) In case of temperature set to 70°C

Setting temperature: 70°C		Capacity	Power consumption	COP	Water flow volume	Hot water outlet temperature
Feed water inlet temperature	Outdoor air temperature	kW	kW	-	L/min	°C
40°C	25°C	13.6	5.5	2.48	6.6	70
	16°C	23.3	8.4	2.78	11.4	70
	7°C	24.8	10.9	2.27	12.2	70
	2°C	24.4	12.3	1.97	11.7	70
	-7°C	19.9	10.2	1.96	9.9	70
	-10°C	18.7	10.6	1.76	9.0	70
	-20°C	9.8	7.7	1.27	4.8	70
	-25°C	5.0	5.1	0.97	2.4	70
50°C	25°C	11.7	5.7	2.07	8.4	70
	16°C	16.8	8.3	2.03	12.3	70
	7°C	19.4	10.6	1.82	14.3	70
	2°C	19.9	12.4	1.61	14.7	70
	-7°C	13.3	9.7	1.37	10.2	70
	-10°C	13.9	10.8	1.28	10.2	70
	-20°C	7.7	8.0	0.96	5.7	70
	-25°C	3.8	5.2	0.72	2.4	70
55°C	25°C	10.5	5.8	1.79	10.0	70
	16°C	14.6	8.5	1.73	14.3	70
	7°C	16.8	10.8	1.56	16.3	70
	2°C	15.7	12.0	1.31	15.5	70
	-7°C	13.1	10.0	1.31	12.2	70
	-10°C	11.7	10.8	1.08	11.5	70
	-20°C	6.8	8.2	0.83	6.7	70
	-25°C	3.4	5.3	0.64	3.3	70
60°C	25°C	9.0	5.9	1.52	13.3	70
	16°C	11.4	8.5	1.35	17.0	70
	7°C	14.4	10.9	1.33	17.0	73
	2°C	13.3	12.0	1.10	17.0	72
	-7°C	11.4	10.4	1.10	15.3	70
	-10°C	10.1	10.8	0.93	14.9	70
	-20°C	6.1	8.4	0.73	9.0	70
	-25°C	3.0	5.3	0.56	4.4	70

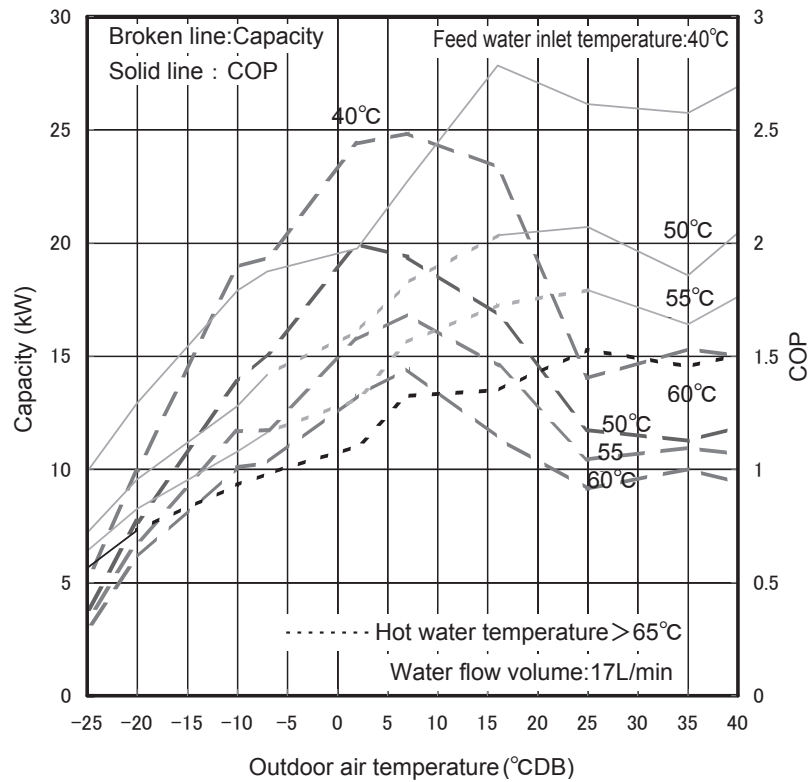
* In case that actual pump head is more than 5m (49kPa), hot water outlet temperature could exceed the setting temperature.

<Caution> The data in this table do not take into account of decreased performance due to, i.e. defrost operation, when snowing or extreme high humidity.

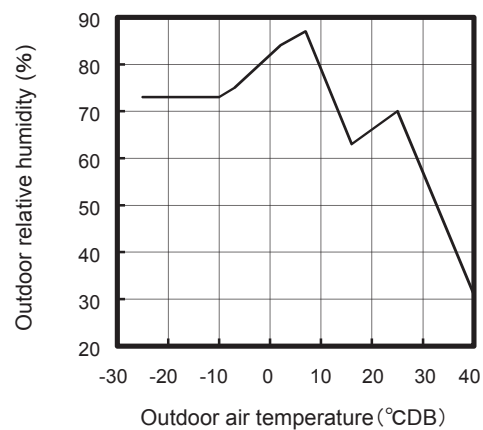
(c) In case of temperature set to 90°C

Setting temperature:90°C		Capacity	Power consumption	COP	Water flow volume	Hot water outlet temperature
Feed water inlet temperature	Outdoor air temperature	kW	kW	-	L/min	°C
40°C	25°C	11.0	5.8	1.90	3.2	90
	16°C	17.2	8.6	2.01	5.0	90
	7°C	22.4	11.0	2.03	6.6	90
	2°C	23.5	12.4	1.90	6.9	90
	-7°C	16.7	10.4	1.60	5.0	90
	-10°C	16.2	10.8	1.50	4.7	90
	-20°C	8.6	7.9	1.09	2.5	90
	-25°C	4.5	5.2	0.87	1.3	90
50°C	25°C	9.9	5.9	1.68	3.7	90
	16°C	14.4	8.5	1.69	5.4	90
	7°C	17.9	10.7	1.67	6.5	90
	2°C	19.2	12.4	1.55	7.2	90
	-7°C	13.4	10.5	1.28	5.0	90
	-10°C	13.2	10.8	1.23	4.9	90
	-20°C	7.3	8.1	0.91	2.7	90
	-25°C	3.7	5.2	0.71	1.3	90
55°C	25°C	9.3	6.0	1.56	4.0	90
	16°C	12.8	8.6	1.50	5.5	90
	7°C	16.3	10.8	1.51	7.0	90
	2°C	15.4	12.0	1.28	6.4	90
	-7°C	10.6	9.7	1.08	4.5	90
	-10°C	11.6	10.8	1.08	4.9	90
	-20°C	6.8	8.2	0.82	2.8	90
	-25°C	3.4	5.3	0.64	1.4	90
60°C	25°C	8.4	6.0	1.40	4.3	90
	16°C	10.8	8.5	1.27	5.4	90
	7°C	14.3	10.9	1.32	7.2	90
	2°C	13.3	12.0	1.11	6.5	90
	-7°C	10.3	10.5	0.98	5.3	90
	-10°C	10.1	10.8	0.93	5.0	90
	-20°C	6.1	8.4	0.73	3.0	90
	-25°C	3.0	5.3	0.56	1.5	90

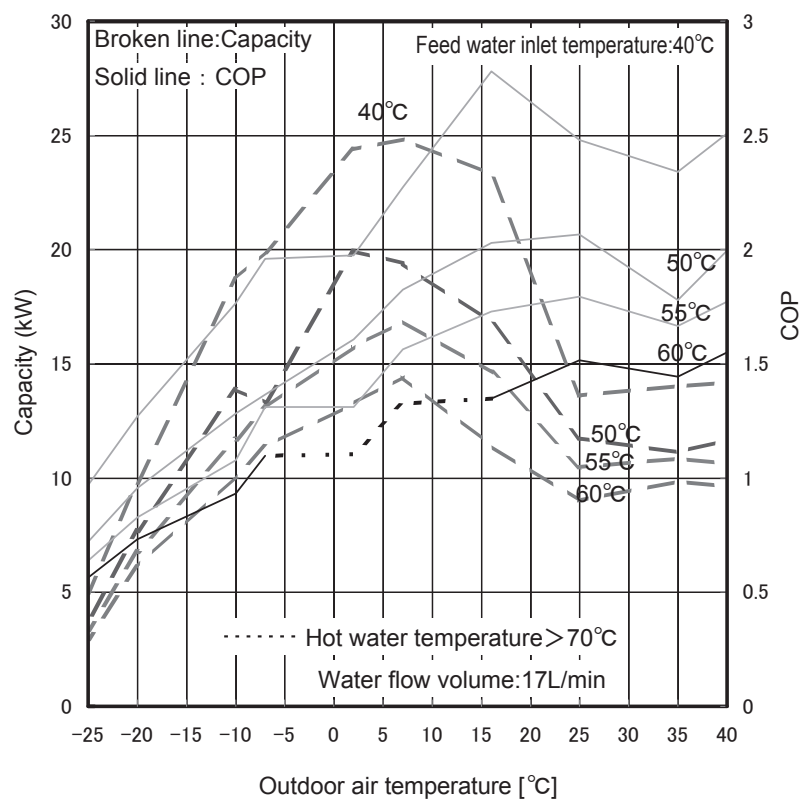
* For above conditions performance decrement for frosting is considered.

(4) Hot water performance curve for systems with recirculation loop**(a) In case of temperature set to 65°C**

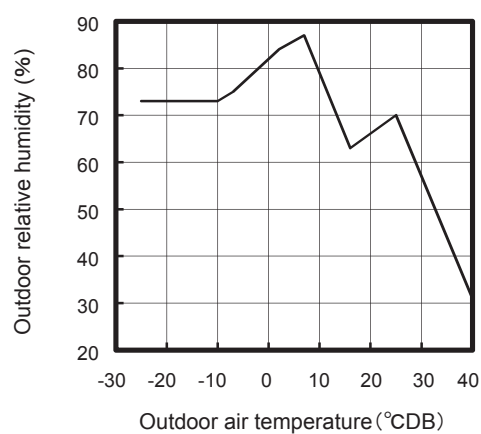
Relative humidity of performance characteristics



- Notes
- 1) Performance characteristics are based on the relative humidity mentioned above.
 - 2) System performance may vary according to climate and system conditions.

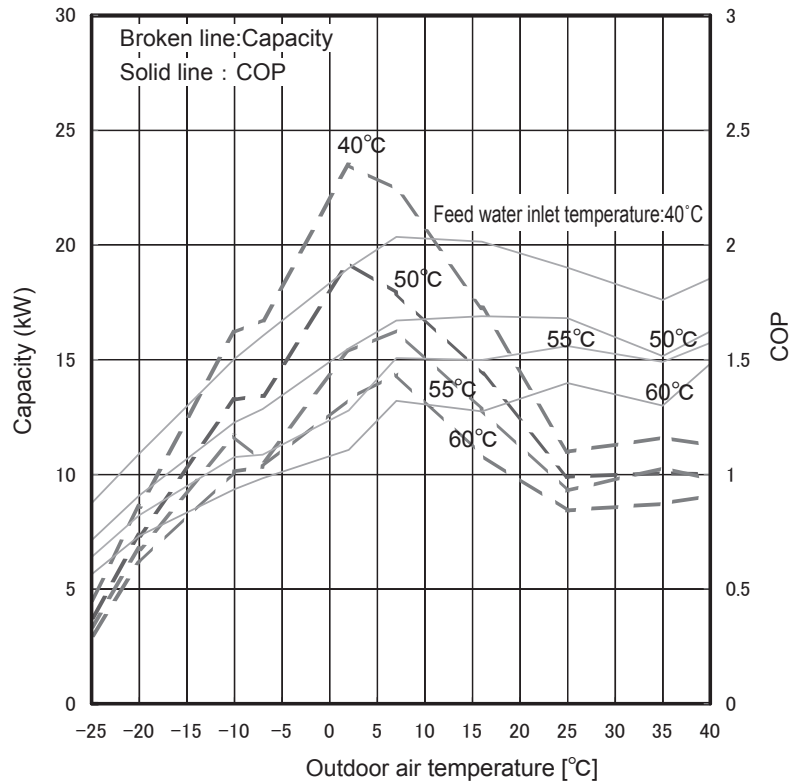
(b) In case of temperature set to 70°C

Relative humidity of performance characteristics

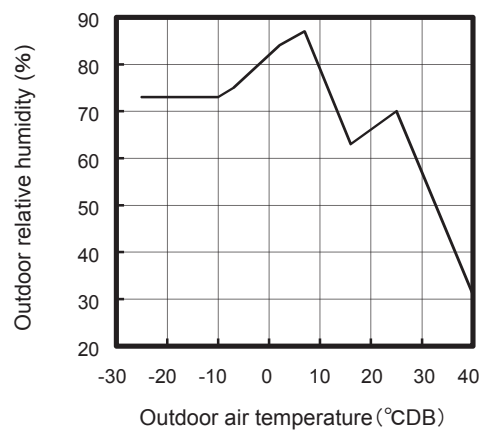


- Notes
- 1) Performance characteristics are based on the relative humidity mentioned above.
 - 2) System performance may vary according to climate and system conditions.

(c) In case of temperature set to 90°C



Relative humidity of performance characteristics



- Notes
- 1) Performance characteristics are based on the relative humidity mentioned above.
 - 2) System performance may vary according to climate and system conditions.

2.7 Performance correction method by the effects of outdoor relative humidity

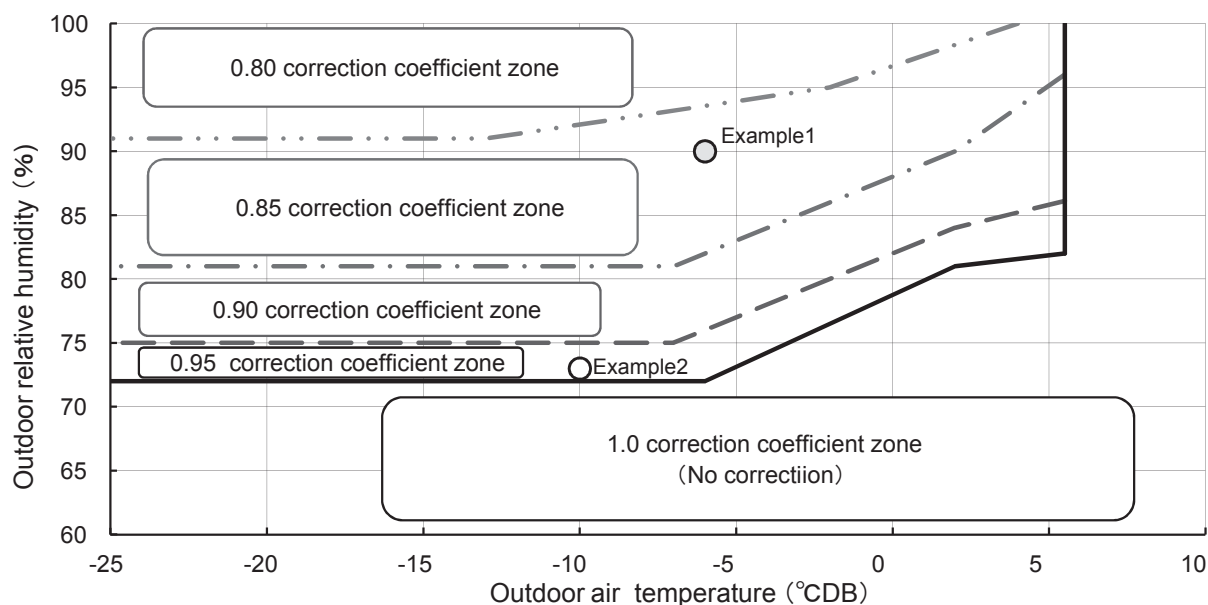


Figure. Hot water performance correction coefficient chart for the operation to top up in RH

It is necessary to get the data of the annual minimum outdoor air temperature and relative humidity of the place where CO₂ heat pump water heater will be installed.

- [Example1] In case of outdoor air temperature -6 (°CDB) and relative humidity 90%
(Hot water outlet temperature 60°C/Feed water temperature 5°C)
- Capacity is 30kW according to the performance table for operation to top up.
 - COP is 2.90 according to the performance table for operation to top up.
 - Correction coefficient is 0.85 according to performance coefficient curve for operation to top up.
 - Capacity after correction $25.5 \text{ kW} = 30\text{kW} \times 0.85$
 - COP after correction $2.465 = 2.90 \times 0.85$

- [Example2] In case of outdoor air temperature -10 (°CDB) and relative humidity 73%
(Hot water outlet temperature 60°C/Feed water temperature 5°C)
- Capacity is 28.5kW according to the performance table for operation to top up.
 - COP is 2.79 according to the performance table for operation to top up.
 - Correction coefficient is 0.95 according to performance coefficient curve for operation to top up.
 - Capacity after correction $27.1 \text{ kW} = 28.5\text{kW} \times 0.95$
 - COP after correction $2.65 = 2.79 \times 0.95$

- Notes
- 1) This chart is based on the capacity measurements with actual use conditions and capacity decrease with defrost operation is considered, but performance values vary depending on installation or weather conditions when using.
 - 2) Power consumption is read on the “Hot water performance table for operation to top up” without correction (COP is given by Performance $\div$ Power consumption, so the correction of this chart is also applied to the COP).
 - 3) This chart is applicable for all “Hot water performance table for operation to top up”, except the curves for recirculation system in which feed inlet water temperature is higher than 40°C.

2.8 Operation sound

Model: ESA30 series (50/60Hz)

Measurement condition: Hot water operation to top up in intermediate season

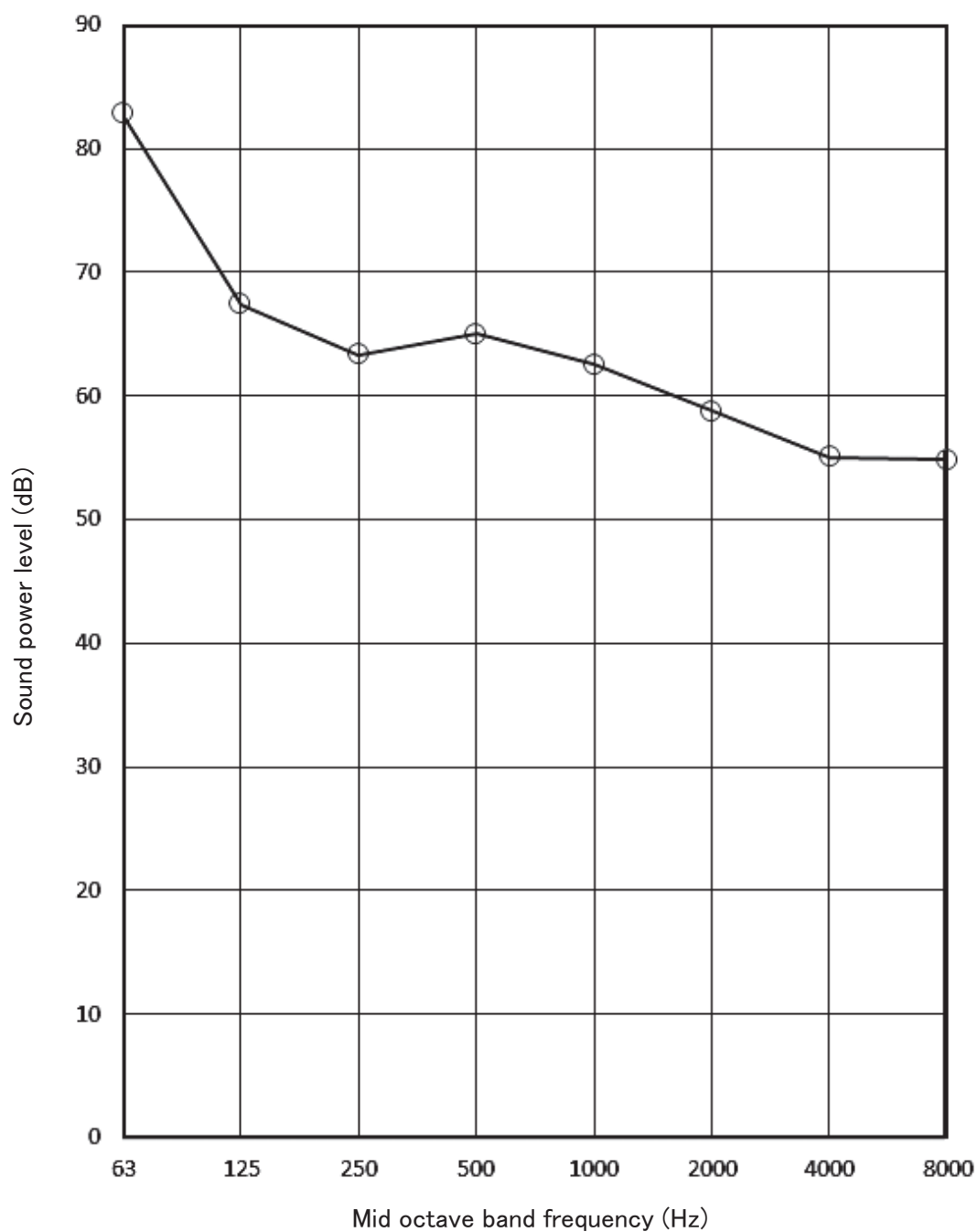
Outdoor air temperature: 16°CDB/12°CWB

Feed water inlet temperature: 17°C

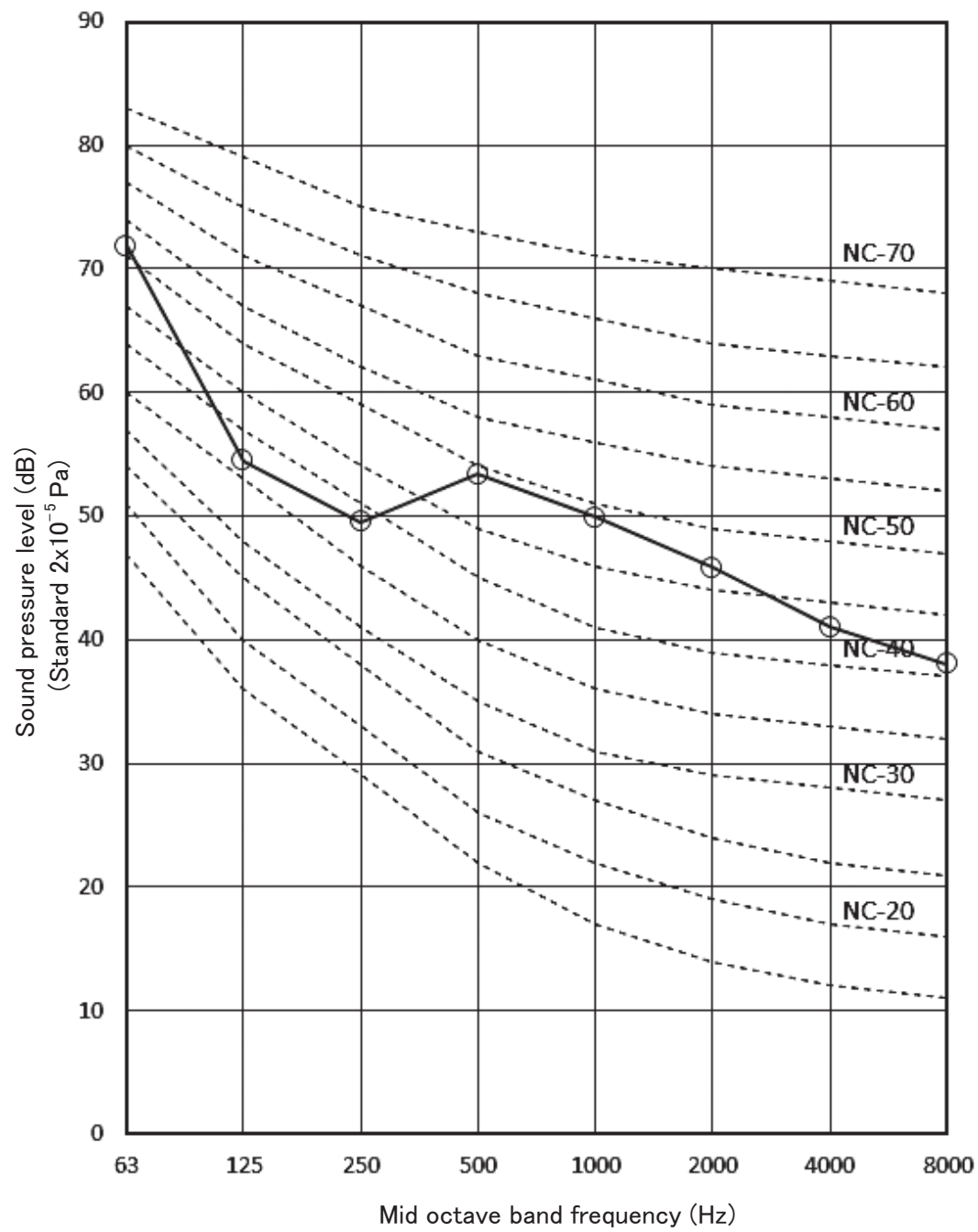
Hot water outlet temperature: 65°C (JRA 4060)

Mike position: 1m in front and 1m in height

(1) Sound power level



(2) Sound pressure level



Measurement condition: Hot water operation to top up in colder climate

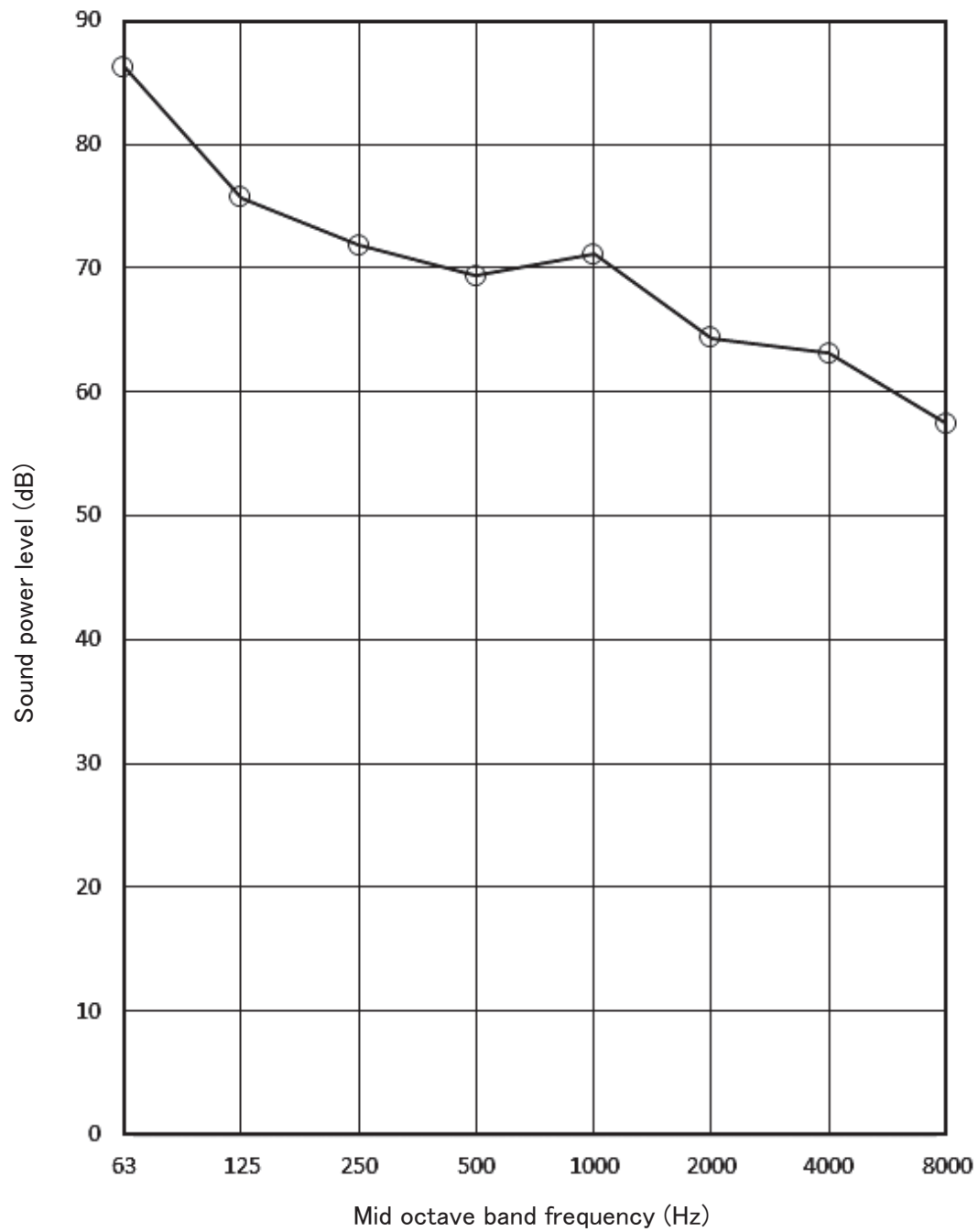
Outdoor air temperature: 2°CDB/1°CWB

Feed water inlet temperature: 5°C

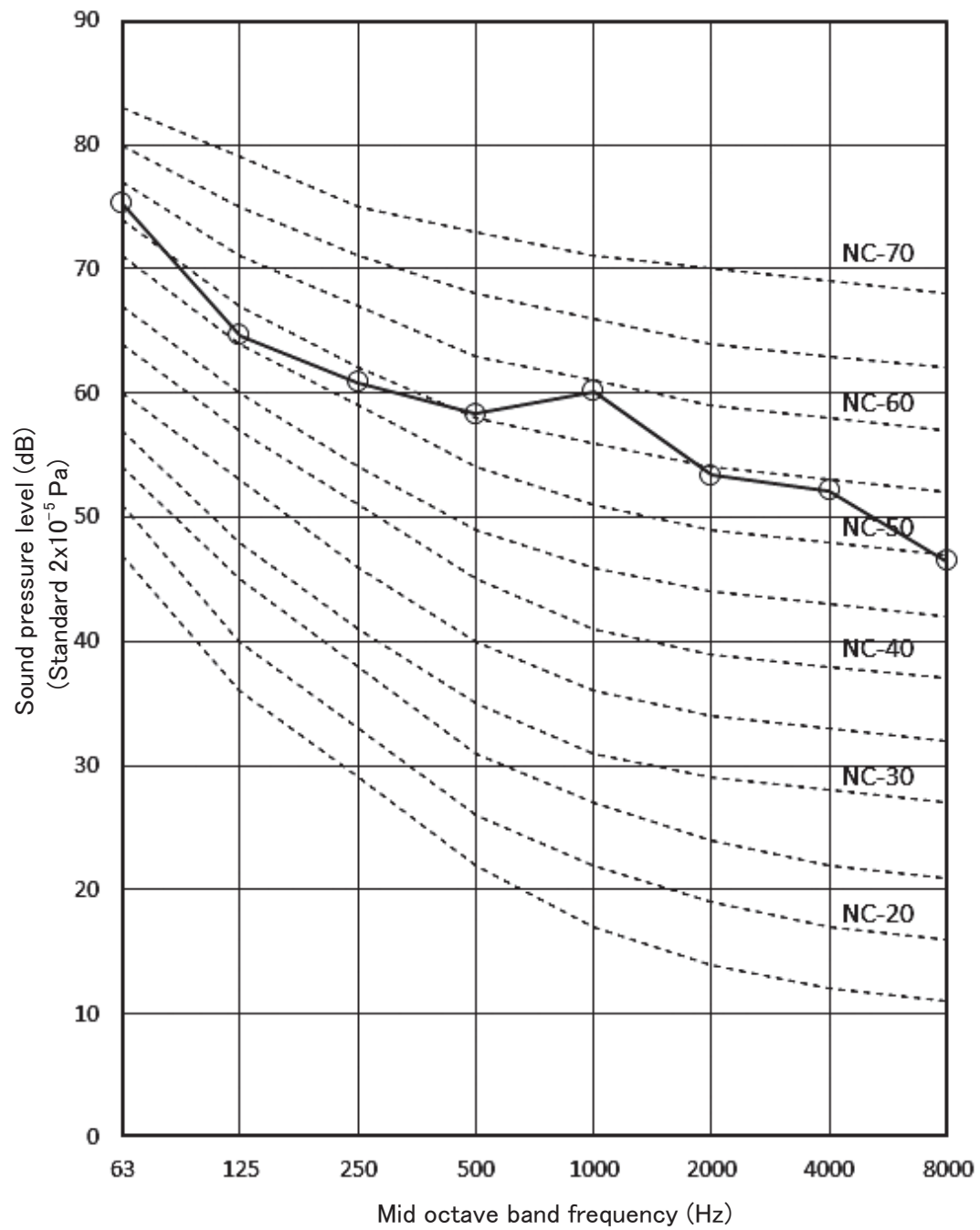
Hot water outlet temperature: 65°C (JRA 4060)

Mike position: 1m in front and 1m in height

(1) Sound power level



(2) Sound pressure level



2.9 Control

(1) Functional components for refrigerant cycle

	Symbol	Name of component	Function	Details
1	CM1	Inverter scroll compressor	The compressor speed is controlled to maintain nominal heating capacity according to the outdoor air temperature, feed water inlet temperature and hot water outlet temperature set by remote control. Control range of compressor speed: 42-104rps The target speed of compressor can be checked with Mente PC.	-
2	FMo1,2	Fan motor	Low pressure control is done by fan speed. The fan speed is controlled to maintain the low pressure 4.1±0.4MPa. Control range of fan speed: 0-1000min ⁻¹	-
			Snow protection control is done by fan rotation. If outdoor air temperature is 3°C or lower and during 10 minutes period after stopping fan motor, fan rotates at 800rpm for 30 seconds.	-
3	EEVG1	Electronic expansion valve for gas cooler	EEVG1 is used for discharge pipe temperature control. The target temperature of discharge pipe is decided by outdoor air temperature, feed water inlet temperature and hot water outlet temperature set by remote control. Control range of target discharge pipe temperature: 77-125°C The target discharge pipe temperature can be checked with Mente PC.	-
	EEVH1,2	Electronic expansion valve for air heat exchanger	EEVH1,2 are used for low pressure control and suction superheat control of compressor. Control range of suction superheat: 3-5degC	-
4	SV-INJ1	Solenoid valve for injection	Refrigerant gas from receiver is injected to the intermediate pressure port of compressor. If gas refrigerant injection is required, SV-INJ1 is opened. As for the detail of gas injection control, please refer to [Injection control].	Page57
5	SVHG1	Solenoid valve for hot gas bypass	During defrost control, SVHG1 is opened. As for the detail of defrost control, please refer to [Defrost control].	Page55
6	SV-OIL1	Solenoid valve for oil separator	SV-OIL1 is used for oil return control from oil separator. If compressor is ON and outdoor air temperature is -5°C or higher, SV-OIL1 is opened.	-
7	63H1-1	High pressure switch	63H1-1 is used for the detection of high pressure anomaly. When 63H1-1 is opened, it makes the compressor stopped. As for the contents of high pressure anomaly detection control, please refer to [High pressure protection control].	Page56
8	PSH1	High pressure sensor	PSH1 is used for high pressure protection control and the detection of high pressure anomaly. As for the contents of high pressure anomaly detection control and high pressure protection control, please refer to [High pressure protection control].	Page56
	PSL1	Low pressure sensor	PSL1 is used for fan control, suction superheat control, low pressure protection control and the detection of low pressure anomaly. As for the contents of low pressure protection control, please refer to [Low pressure protection control].	Page57
	PSM1	Intermediate pressure sensor	PSM1 is used for open/close control of injection circuit. As for the detail of injection control, please refer to [Injection control].	Page55
9	Tho-A	Outdoor air temperature sensor	Tho-A is used for compressor control, anti-freeze control of water pipe and EEV control.	-
	Tho-C1	Under-dome temperature sensor	Tho-C is used for under-dome temperature protection control.	Page60
	Tho-D1	Discharge pipe temperature sensor	Tho-D1 is used for discharge pipe temperature control, discharge pipe temperature protection control and detection of discharge pipe temperature anomaly. As for the contents of discharge pipe temperature anomaly detection control and discharge pipe temperature protection control, please refer to [Discharge pipe temperature protection control].	Page57
	Tho-G1,3	Temperature sensor at inlet and outlet port of gas cooler	Tho-G1, 3 are used for checking the operation status. Tho-G1, 3 can be checked with Mente PC.	-
	Tho-INJ1	Temperature sensor at inlet injection port	Tho-INJ1 is used for checking the operation status. Tho-INJ1 can be checked with Mente PC.	-
	Tho-M1	Temperature sensor at inlet port of intermediate pressure receiver	Tho-M1 is used for checking the operation status. Tho-M1 can be checked with Mente PC.	-
	Tho-P1	Power transistor temperature sensor	Tho-P1 is used for power transistor temperature protection control. As for the contents of power transistor temperature protection control, please refer to [Power transistor temperature protection control].	Page60
	Tho-R1,2,3,4	Temperature sensor at inlet and outlet port of air heat exchanger	Tho-R1, 2, 3, 4 are used for defrost control and oil return control.	-
	Tho-S1	Suction pipe temperature sensor	Tho-S1 is used for suction superheat control.	-
10	CH1	Crankcase heater	CH1 is used for warming up the compressor.	-
	DH	Drain pan heater	DH is used for preventing from freezing drain pan. If outdoor air temperature is 3°C or lower and outdoor unit is in operation mode during 5 minutes period after finishing defrost operation, or during snow protection control, DH is energized.	-
	H1	Anti-freezing heater	H1 is used for preventing from freezing water pipings. If outdoor air temperature is 3°C or lower and heat pump water heater is off, H1 is energized.	-

(2) Functional components for water cycle

	Symbol	Name of component	Function	Details
1	DCWP	Water pump	DCWP is controlled to adjust the hot water outlet temperature to the set temperature set through remote control. DCWP is used for anti-freeze control of the water pipe. Control range of pump rotation speed: 2000-4000min ⁻¹ As for the control details, please refer to [Water flow volume control] and [Anti-freeze control of water pipe].	Page62 Page63
2	CWFBV1	Flow regulator (Flow regulating valve)	CWFBV1 is used for controlling hot water outlet temperature. The opening of CWFBV1 is decided according to the external pump head at water pump test run. As for the control details, please refer to [Water flow volume control] and [Anti-freeze control of water pipe].	Page62 Page63
	CWFBV2	Flow regulator	CWFBV2 is used for controlling return hot water flow direction. To use this function, turn SW4-4 ON. As for the control details, please refer to [Return hot water control].	Page68
	CWFBV3	Switching valve for anti-freeze	When circulating the inlet/outlet water of the unit, CWFBV3 is switched to form C position. When feeding clean water, CWFBV3 is switched to form B position.	Page56
	CWFBV5	Hot water stop valve	If multiple heat pump water heater systems are connected in parallel, the water may flow disproportionately. In case that cold water maybe supplied to the hot water supply line, CWFBV3 is closed. As for the control details, please refer to [Preventing control from disproportionate water flow].	Page56
3	Tho-W1	Gas cooler water temperature sensor (Inlet)	Tho-W1 is used for ①Discharge pipe temperature control, ②Compressor control, ③Detection of feed water inlet temperature anomaly. Condition to detect feed water inlet temperature anomaly. Judging anomaly: 63°C or higher Release : lower than 60°C As for the control details, please refer to [Discharge pipe temperature control] and [Compressor control].	Page64
	Tho-W2	Gas cooler water temperature sensor (Outlet)	Tho-W2 is used for ①Hot water outlet temperature control, ②Detection of hot water outlet temperature anomaly. Condition to detect feed water outlet temperature anomaly Judging anomaly: 100°C or higher for 5sec Released : lower than 60°C. Or the temperature difference between the inlet and outlet water temperature of gas cooler is within As for the control details of hot water outlet temperature, please refer to [Water 10°C flow volume control].	Page62 Page63

(3) Control of refrigerant piping system

(3)-1 Defrost control

In order to recover from dropping the heating capacity for producing hot water due to the frost on the air heat exchanger of heat pump water heater, defrost operation is done periodically.

By cutting jumper wire (J15), it can switch from normal defrost control to defrost priority control*1

*1. If there is any frosting problem on the air heat exchanger in case of the operation in heavy-snow area and like that, please cut (open) J15.

In case of defrost priority control (J15 is open), defrost operation can start earlier to prevent from growing frost on the air heat exchanger, but heating capacity may decrease.

1) Starting condition

① Starting condition A

If all of following conditions are satisfied

- a) 8 minutes has elapsed after compressor started operation.
- b) 8 minutes has elapsed after outdoor fan started operation.
- c) The cumulative operation hour after starting operation is 60 minutes or more.
Or the cumulative operation hour after the end of previous defrost operation is 60 minute or more.
- d) Either one of temperature sensors on the inlet of heat exchanger (Tho-R1, -R2) detects lower temperature than the defrost starting temperature, which is decided by the outdoor air temperature, for 30 seconds continuously. (Fig 1-1)
- e) Or the suction pressure saturated temp calculated from the low pressure detected by LP sensor is lower than the defrost starting temperature, which is decided by the outdoor air temperature, for 180 seconds continuously. (Fig 1-2)

② Starting condition B

If all of following conditions are satisfied

- a) to c) Same as the starting condition A
- d) The ending condition of previous defrost operation is forced to end by the forcible end time of defrost operation.

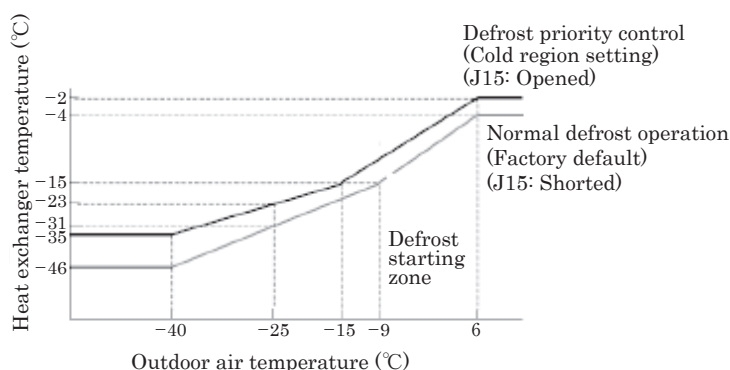


Fig 1-1 Defrost starting condition by temperature sensor Tho-R1 or -R2

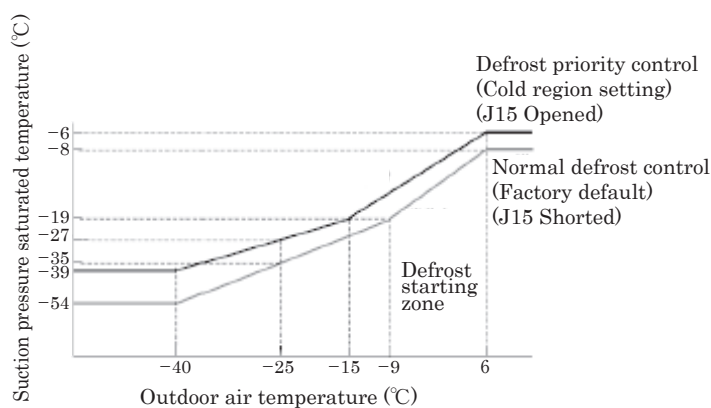


Fig 1-2 Defrost start condition by suction pressure saturated temperature

2) Ending condition

If one of following conditions is satisfied;

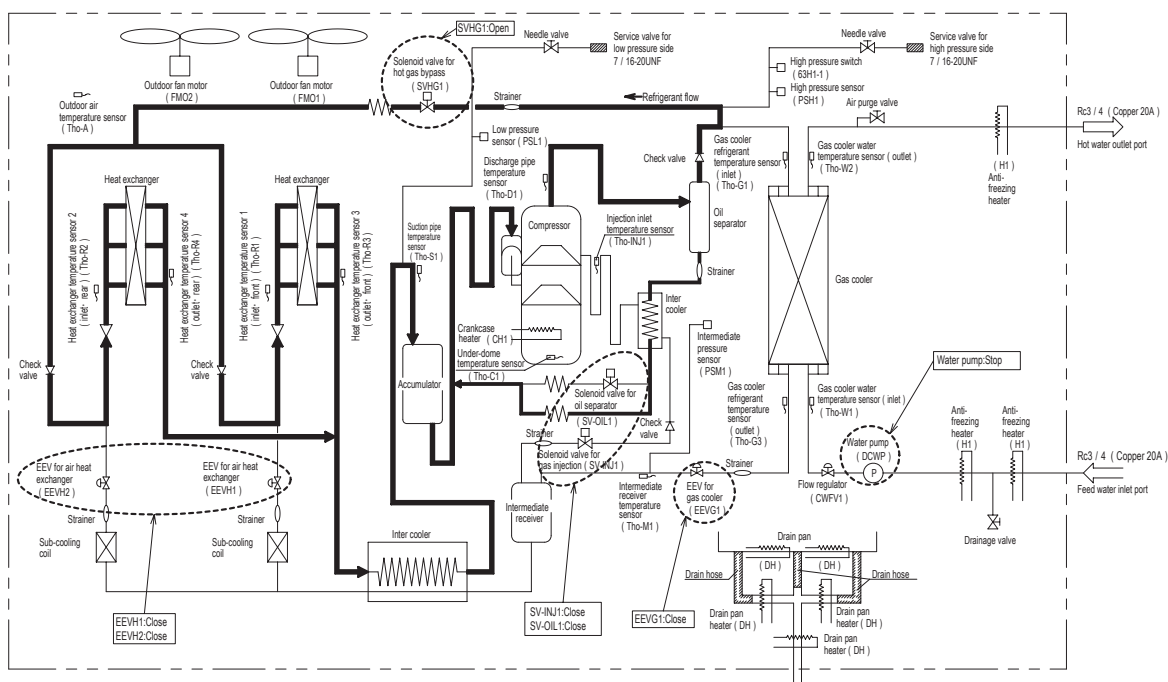
- Both of temperature sensor on the outlet of heat exchanger (Tho-R3, -R4) detects 6°C or higher temperature for 10 seconds continuously.
- Defrost operation time exceeds 20 minutes. (the forcible end time of defrost)
- The cumulative operation hour of defrost exceeds the forcible end time and compressor stops.

3) Contents of control

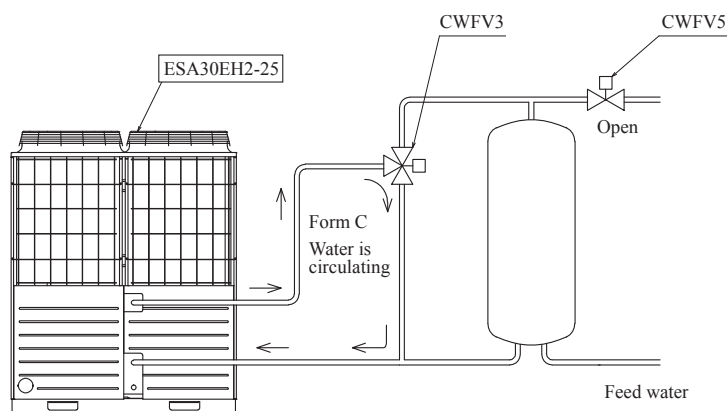
The frost on the air heat exchanger is defrosted by opening the hot gas bypass valve (SVHG1) to flow the discharge gas into the air heat exchanger.

Following diagram shows the behavior of functional parts and the flow of refrigerant and water.

[Refrigerant circuit]

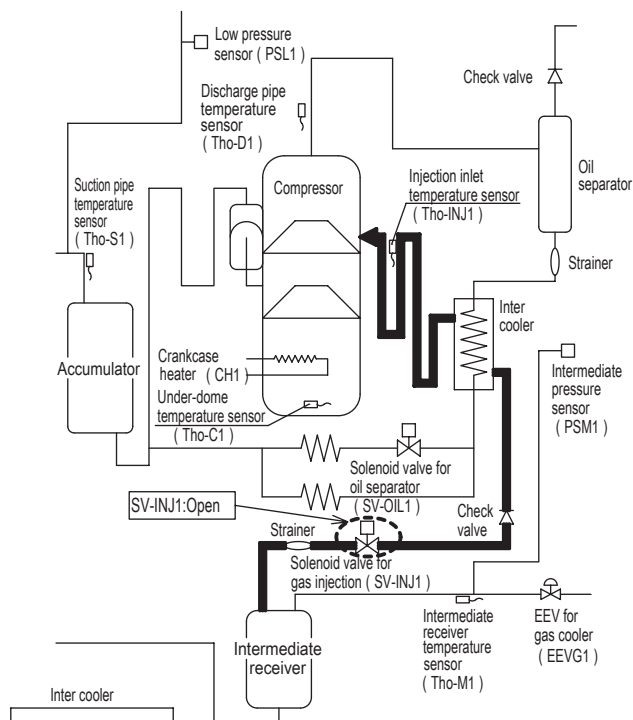


[Water circuit]



(3)-2 Gas injection control

<Gas injection circuit>



1) Starting condition

If all of following conditions are satisfied;

- Compressor is ON.
- Compressor is ON or 2 minutes has elapsed after the end of defrost operation.
- Suction super heat of compressor $< 5^{\circ}\text{C}$ is detected for 30 seconds or more continuously.
- Intermediate pressure sensor $< 7.0\text{MPa}$
- Outdoor air temperature $< 5^{\circ}\text{C}$
- Inlet water temperature $\leq 30^{\circ}\text{C}$

2) Ending condition

If one of the start conditions a) b) d) is not satisfied.

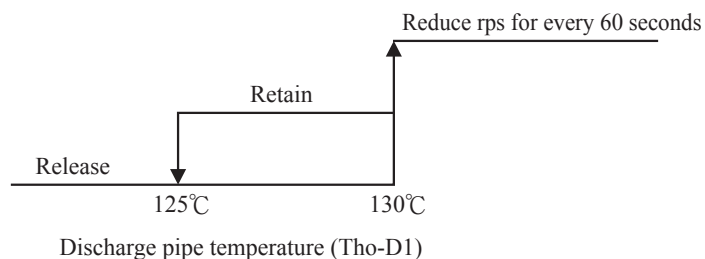
3) Contents of control

Open the solenoid valve for gas injection (SV-INJ1)

(3)-3 Discharge pipe temperature protection control

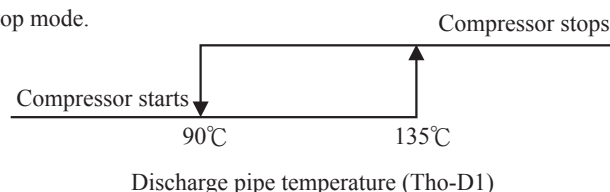
1) Protection control

If the discharge pipe temperature (detected by the sensor Tho-D1) exceeds the set value shown in the following figure, compressor speed is controlled to suppress the rise in discharge pipe temperature.



2) Anomalous stop control

- If the discharge pipe temperature exceeds the set value shown in the following figure, compressor is stopped.
- If this anomalous stop happens 3 times within 100 minutes, [E36] is displayed on the remote control and it becomes error stop mode.



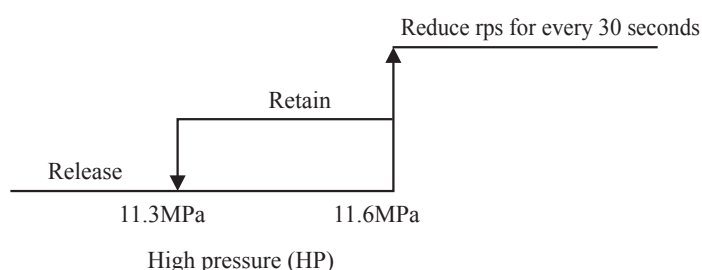
3) Release error stop mode

If the discharge pipe temperature becomes below the release value 90°C for 60 minutes continuously, restarting operation by remote control becomes available.

(3)-4 High pressure protection control

1) Protection control

If high pressure (detected by high pressure sensor PSH1) exceeds the set value shown in the following figure, compressor speed is controlled to suppress the rise in high pressure.

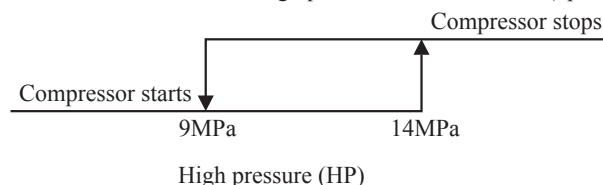


2) Anomalous stop control ①

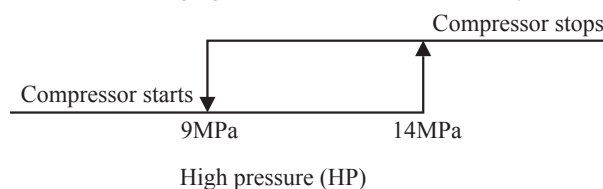
a) Starting condition

If one of the following conditions is satisfied;

- If high pressure is increased to activate high pressure switch 63H1-1. (open at 14MPa/close at 9MPa)



- If high pressure is increased and high pressure sensor PSH1 detects that the high pressure exceeds the set value shown in the following figure for 10 seconds continuously.

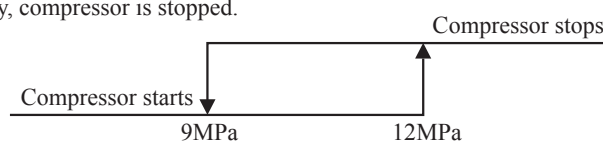


b) Contents of control

- Stop compressor
- If this anomalous stop detected by high pressure switch or sensor happens 5 times within 60 minutes, [E40] is displayed on the remote control and it becomes error stop mode.

3) Anomalous stop control ②

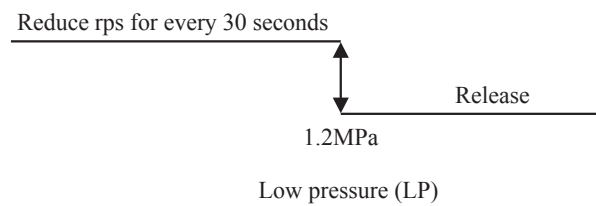
If high pressure (detected by high pressure PSH1) exceeds the set value shown in the following figure for 10 minutes continuously, compressor is stopped.



(3)-5 Low pressure protection control

1) Protection control

If low pressure (detected by low pressure sensor PSL1) becomes below the set value shown in the following figure, compressor speed is controlled to suppress the decrease of low pressure.



2) Anomalous stop control

a) Starting condition

If one of the following conditions is satisfied;

① Starting condition A

Compressor is ON, and

Low pressure $\leq 1.0\text{MPa}$ is detected for 30 seconds continuously or low pressure $\leq 0.003\text{MPa}$ is detected for 5 seconds continuously.

② Starting condition B

Compressor is OFF, and

Low pressure $\leq 1.0\text{MPa}$ is detected for 30 seconds continuously.

b) Contents of control

① Stop compressor and not permit to operate the unit.

② If this anomalous stop happens 5 times within 60 minutes, [E49] is displayed on the remote control and it becomes error stop mode.

c) Ending condition

If low pressure $\geq 1.5\text{MPa}$ is detected for 10 seconds continuously.

(3)-6 Over current protection control

1) Current safe control

If the input current (at primary side) or the output current (at secondary side) of inverter on the heat pump water heater exceeds the set value, compressor speed is controlled to protect the inverter.

1) - 1 Current safe control by inverter primary current.

a) Starting condition

If all of the following conditions are satisfied;

① Compressor is ON

② Except that the actual rps is kept on decreasing or it is within 1 second after the actual rps decreased.

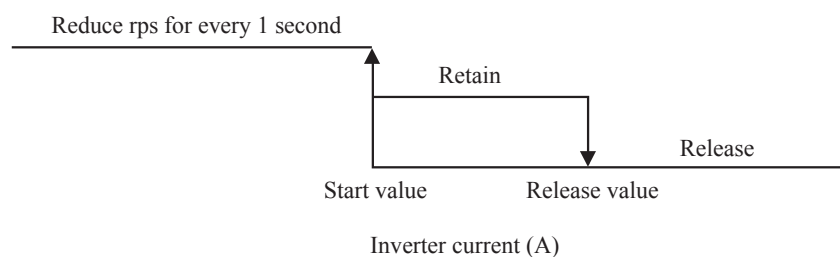
③ Inverter primary current $\geq$ current safe value (21A)

b) Ending condition

① Inverter primary current $\leq$ current safe value (20A) for 3 minutes continuously.

② Inverter primary current $<$ current safe value (21A) for 6 minutes continuously.

c) Contents of control



1) - 2 Current safe control by inverter secondary current

a) Starting condition

If all of the following conditions are satisfied;

- ① Compressor is ON
- ② Except that the actual rps is kept on decreasing or it is within 1 second after the actual rps decreased.
- ③ Inverter secondary current $\geq$ current safe value (23A)

b) Ending condition

- ③ Inverter secondary current $\leq$ current safe value (22A) for 3 minutes continuously.
- ④ Inverter secondary current $<$ current safe value (23A) for 6 minutes continuously.

c) Contents of control

Same as that for the current safe control by inverter primary current

2) Inverter anomaly (Current cut)

When the current cut signal received from inverter PCB, compressor is stopped.

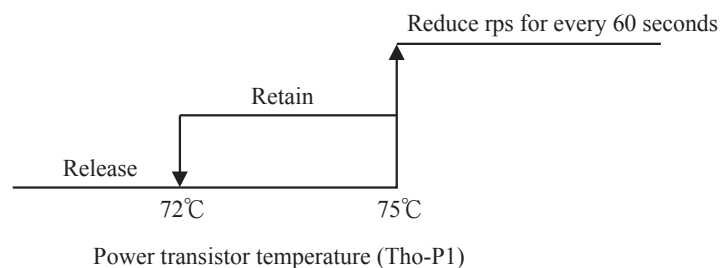
If one of following condition is satisfied, [E42] is displayed on the remote control and it becomes error stop mode.

- ① If the current cut signal is detected 4 times within 15 minutes
- ② If compressor speed $\geq$ 80rps, and the current cut stop are detected 4 times within 30 minutes.

(3)-7 Power transistor temperature protection control

1) Protection control

Power transistor temperature (detected by the sensor Tho-P1) exceeds the set value shown in the following figure, compressor speed is controlled to suppress the rise in power transistor temperature.

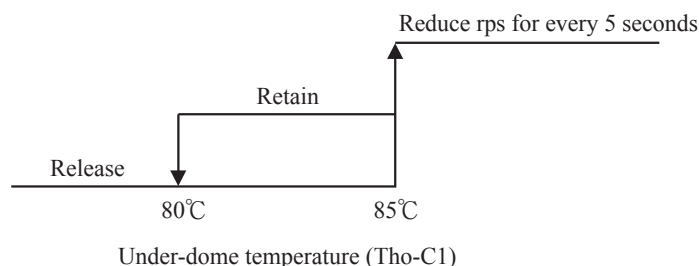


2) Anomalous stop control

- a) If the power transistor temperature increases further, the protection switch in the power transistor activates and compressor is stopped.
- b) If this anomalous stop happens 5 times within 60 minutes, [E41] is displayed on the remote control and it becomes error stop mode.
- c) If this anomaly is detected for 15 minutes continuously, [E51] is displayed on the remote control and it becomes error stop mode.

(3)-8 Under-dome temperature protection control

Under-dome temperature (detected by the sensor Tho-C1) exceeds the set value shown in the following figure, compressor speed is controlled to suppress the rise in under-dome temperature.



(3)-9 Detection of temperature or pressure sensors disconnection

1) Starting condition

If one of following conditions is satisfied;

- ① Outdoor air temperature sensor, Heat exchanger temperature sensors, Intermediate receiver inlet temperature sensor, Suction pipe temperature sensor, Gas cooler water temperature sensor
 - a) The disconnection of sensor is detected for 5 seconds continuously within 20 seconds after the power turns ON.
 - b) The disconnection of sensor is detected for 5 seconds continuously within 2 minutes to 2 minutes 20 seconds after the compressor turns ON.
- ② Low pressure sensor, High pressure sensor, Intermediate pressure sensor
 - a) The disconnection of sensor is detected for 5 seconds continuously within 2 minutes to 2 minutes 20 seconds after the compressor turns ON.
- ③ Discharge pipe temperature sensor, Under-dome temperature sensor
 - a) The disconnection of sensor is detected for 5 seconds continuously within 10 minutes to 10 minutes 20 seconds after the compressor turns ON.
- ④ Power transistor temperature sensor
 - a) The disconnection of sensor is detected for 5 seconds continuously within 10 minutes to 10 minutes 20 seconds after the compressor turns ON and it is detected at the outdoor air temperature $\geq 0^{\circ}\text{C}$.

2) Control conditions

If the judgment of either one of sensor disconnection is detected 3 times within 40 minutes, it becomes error stop mode.

(3)-10 Outdoor fan motor anomaly

If one of following conditions is satisfied, compressor is stopped.

- a) Under the outdoor fan control mode, the outdoor fan speed $\leq 100\text{min}^{-1}$ is detected for 30 seconds continuously.
- b) Under the fan control mode and the outdoor fan speed command ≤ 4 speed, if the outdoor fan anomaly signal is detected for 10 seconds continuously or if the compressor is stopped 5 times within 60 minutes by the outdoor fan motor anomaly, [E48] is displayed on the remote control and it becomes error stop mode.

(3)-11 Feed water inlet temperature anomaly

If feed water inlet temperature exceeds usage range, it makes the heat pump water heater stopped.

This control is for emergency avoidance against the transitional temperature increase.

1) Starting condition

If [a) and b)] and [c) or d)] of following conditions are satisfied.

- a) Compressor is ON
- b) Not in defrost operation
- c) Following high water inlet temperature condition is satisfied
[High water inlet temperature condition]
Feed water inlet temperature $> 63^{\circ}\text{C}$ is detected for 2 seconds or more. (Upper limit)
Or at outdoor air temperature $\geq 40^{\circ}\text{C}$, feed water inlet temperature $> 58^{\circ}\text{C}$ is detected for 2 seconds or more.
- d) Following water inlet temperature change conditions is satisfied
When 20degC or more temperature difference Δt of feed water inlet temperature (Tho-W1) is detected for 5 seconds continuously.

2) Control content

- a) Stop compressor and after 3-minute delay, restart compressor if ending condition is satisfied.
- b) During satisfying [High water inlet temperature condition], water pump is operated intermittently in case of connecting unvented cylinder.
- c) Other functional components comply with the behavior at compressor stopping.

3) Ending condition

- [High water inlet temperature condition]
Feed water inlet temperature $< 60^{\circ}\text{C}$
Or at outdoor air temperature $\geq 40^{\circ}\text{C}$, feed water inlet temperature $< 55^{\circ}\text{C}$
- [Water inlet temperature change condition 1), 2)]
When the starting condition is not satisfied

(4) Water circuit system control**(4)-1 Water circuit system control at [Operation to top up]**

1) Operation to top up

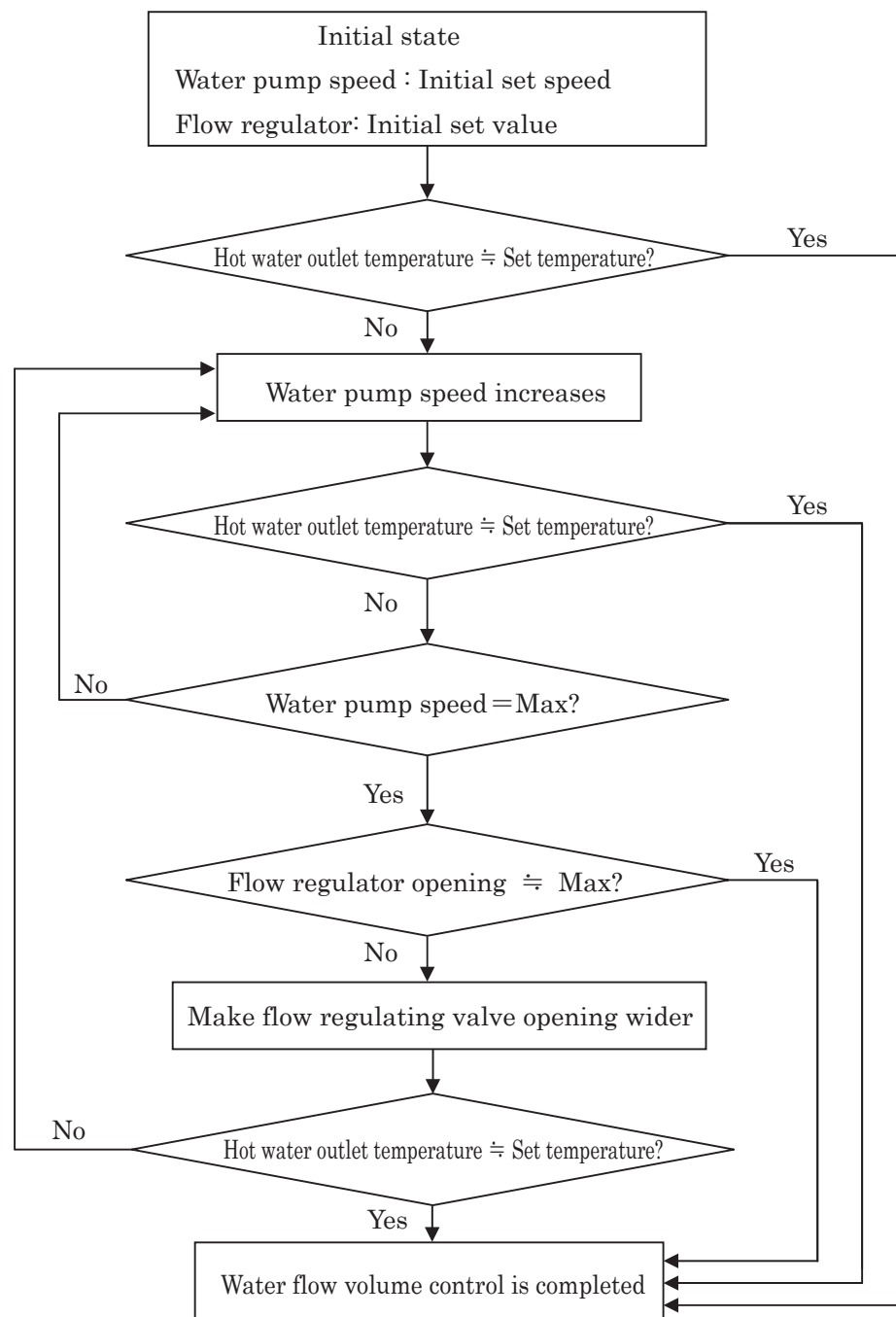
If the hot water amount detected by the cylinder temperature sensor is less than the set amount in the cylinder, the heat pump water heater starts operation to top up the hot water and storage it.

After switching the valve for anti-freezing (CWFV3) and feed water is heated up by heat pump water heater and is stored in the unvented hot water storage cylinder.

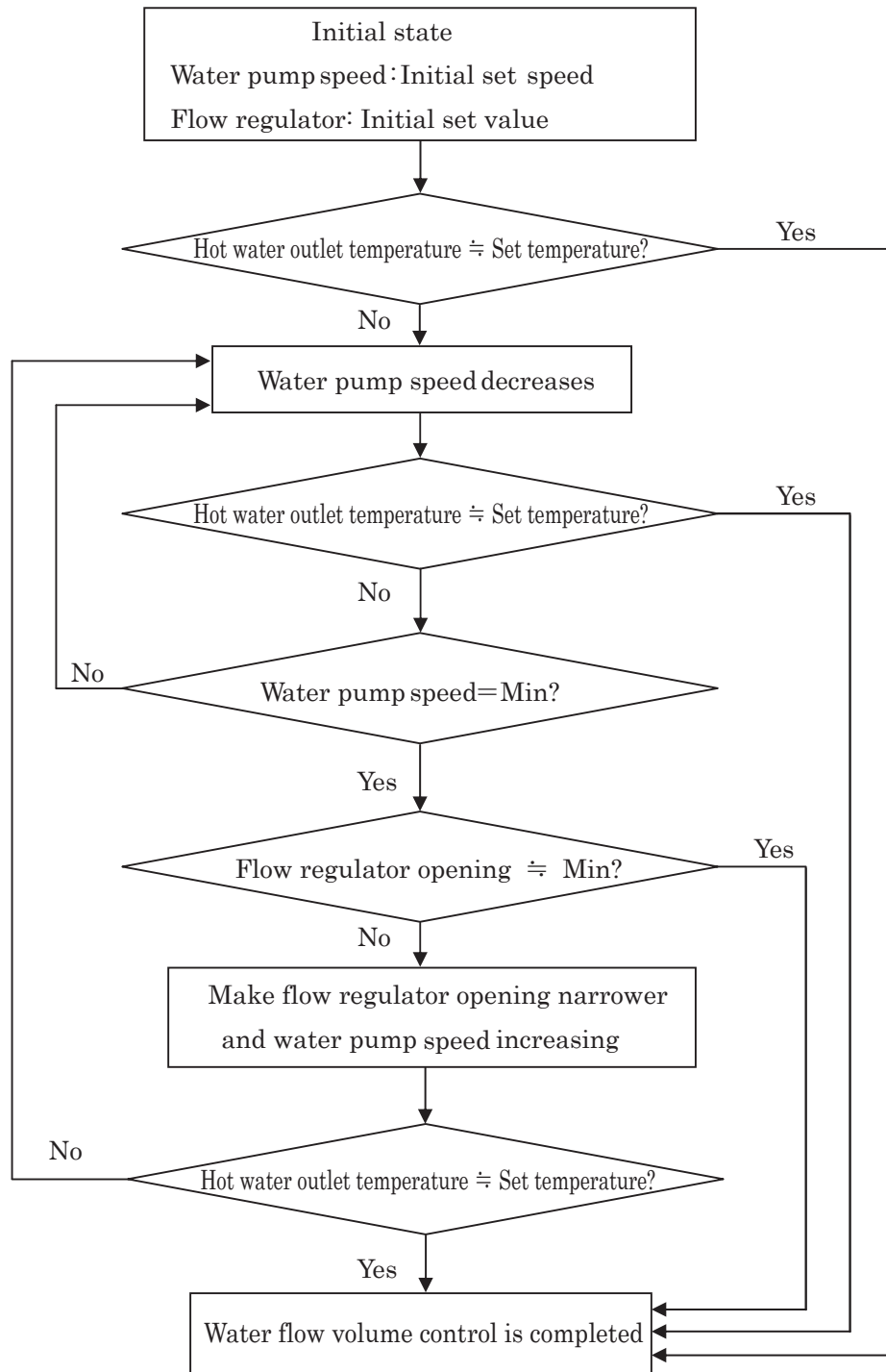
(4)-2 Water flow volume control

Water flow volume is controlled by water pump and flow regulator in order to adjust the hot water outlet temperature to be the set temperature which is set with remote control.

[Set temperature < Actual outlet temperature of hot water]



[Set temperature > Actual hot water temperature]



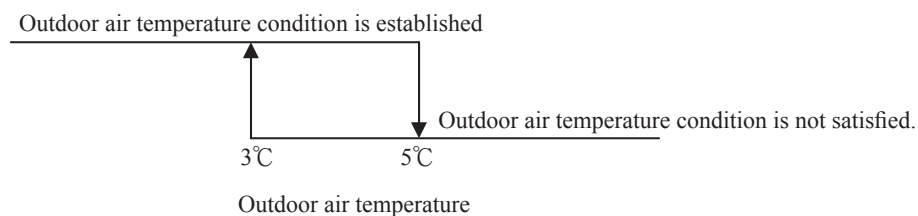
(4)-3 Water pump operation for anti-freezing

In case that the water in the pipe may be frozen due to decreasing the water temperature below 0°C in winter season during the long term stop or anomaly stop of heat pump water heater, the water pump is forcibly operated in order to prevent water in the pipe from freezing.

1) Starting condition

If all of the following conditions are satisfied;

- a) Operation mode of heat pump water heater is not [Operation to top up], [Operation to fill up] or [Defrost operation]
- b) Outdoor air temperature condition is satisfied with the following condition.



* If SW3-5 is ON, the following condition is added to the starting condition.

(Factory default: SW3-5 OFF)

- c) Inlet water temperature of the gas cooler $\leq 3^{\circ}\text{C}$

2) Ending condition**① Ending condition A**

- a) The starting condition (a) is not satisfied or the starting condition (b) is not satisfied.
- b) Inlet water temperature of the gas cooler $\geq 5^{\circ}\text{C}$ is detected for 10 minute continuously.
- c) The operation to top up for anti-freezing water is not conducted.

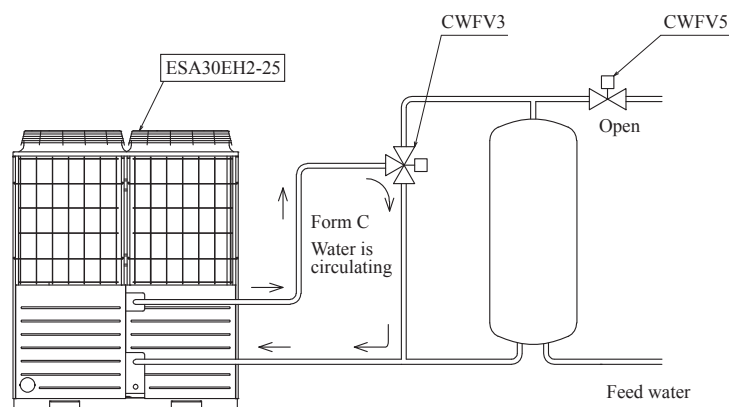
② Ending condition B

- a) Operation mode becomes [Stop] mode.

③ Contents of control

The water circuit is changed to circulate the water as shown in the following figure.

- In case of unvented cylinder

**(4)-4 Control for preventing from disproportionate water flow**

In case that multiple hot water storage systems are connected in parallel, hot water from each cylinder may flow out disproportionately.

In such case, the hot water in one system which can flow out smoothly becomes colder than those in other systems.

In order to prevent the cold water in such storage system from flowing out and flowing into the hot water supply line, the hot water supply valve CWFV5 of such storage system is closed by this control.

(4)-5 How to judge hot water amount in the cylinder

The hot water level in the cylinder is judged by the temperature sensor on the cylinder.

(5) Limited unit control

Limited unit control is enabled when the following conditions are satisfied.

- (a) When the master unit 7-segment display shows 1 for P12
- (b) When the demand control is enabled with the external input (CNS2) or the remote control
- (c) The version of main ROM is 1.812 or later.

① Demand rate from external input (CNS2) or remote control	② Demand rate from master unit			
	Master	Sub 1	Sub 2	Sub 3
100%	100%	100%	100%	100%
80%	100%	100%	100%	0%
60%	100%	100%	0%	0%
40%	100%	0%	0%	0%
0%	0%	0%	0%	0%

[Reference] Master-sub setting

SW4-7	OFF	ON	OFF	ON
SW4-8	OFF	OFF	ON	ON

Demand rates on the display at that time are as follows.

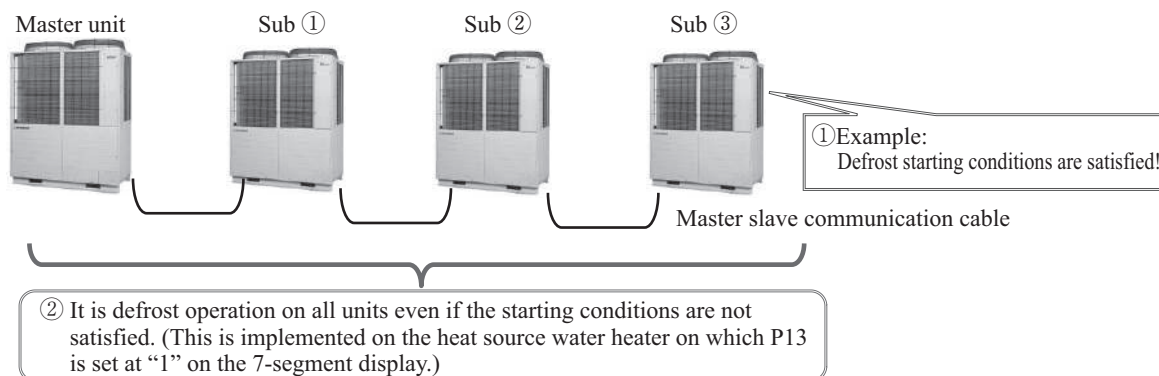
	Master	Sub
Remote control	(i)	-
7-segment	(i)	(ii)
Mente PC	(i)	(ii)

(6) All units defrost control

* This is operable with the heat source unit software version 1.802 or later.

* Simultaneous defrost function can be set using P13 on the 7-segment display.

[If the defrost starting conditions are satisfied on the master or slave unit on the master-sub system, it is defrost operation on all units in the system.]

**<Example of application>**

- When the defrost operation is extended under the influence of air blown out from other heat source unit.
- Almost closed, poorly ventilated site, etc.

<Exception> When it is not defrost operation on all units:

- Accumulated heating operation time is less than 60 minutes.
- When it is defrost operation after the end of hot water storing at night

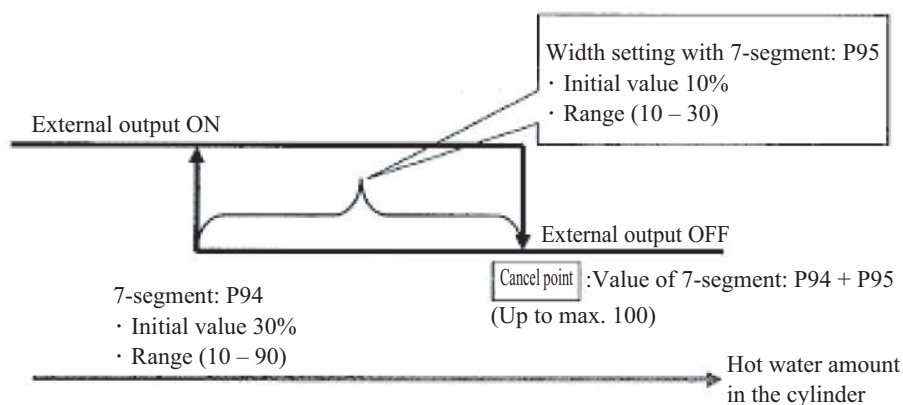
(7) External output of hot water amount

* This is operable with the heat source unit software version 1.802 or later.

* This can be set with the external output function No. "15".

In case of 15: Hot water amount output

- If it is the master unit, it controls as shown below depending on the setting values of P94 and P95 on the 7-segment display.
- If the value of P94 + P95 on the 7-segment display is larger than 100, this control is implemented taking the Cancel point at 100.
- If the hot water amount in the cylinder falls within the differential (Between P94 $\leftrightarrow$ P94 + P95) after the power ON, the external output is turned ON.



[Setting value]

- ① If P94 is set at 40 and P95 at 20 on the 7-segment display:

The output is turned ON if the hot water amount decreases to 40% while it is turned OFF if it increases to 60% (40 + 20).

* Take care of the unvented cylinder when the number of sensors is small!

- ② If P94 is set at 80 and P95 at 20 on the 7-segment display:

The output turns ON if the hot water amount decreases to 80% while it is turned OFF if it increases to 100% (80 + 20, operation to fill up).

(8) Checking of operation of water-side solenoid valves CWFV3, 5

- 1) Stop the entire system of heat source water heater.
(Reference) The entire system stops if [System off] is selected from the [Service & Maintenance] menu on the remote control or if the shorting pin for the external input CNS1 on the heat source water heater PCB is pulled out.
- 2) Stop to supply water to the system side. (Stop the water supply pressurizing pump or close the GV at the water supply side on the system.)
- 3) Turn SW5-3 on the heat source water heater PCB to ON. Confirm also that both SW5-7 and 5-8 are turned OFF.
- 4) It can be checked if the water-side solenoid valves CWFV2 – 6 are opened or closed, by changing SW6-7 on the heat source water heater to OFF ⇔ ON.
Valve opening or closing can be changed as follows.
(Point) Check the open/close of CWFV3 and 5 on the master and sub units respectively.
It is necessary to set SW5-3 and SW6-7 on the master and sub units respectively.

		CWFV3	CWFV5
SW6-7	OFF	CLOSE (anti-freezing water side)	OPEN
	ON	OPEN (supply water side)	CLOSE

- 5) For confirmation of the open or close of water-side solenoid valves CWFV 3 and 5, refer to the following.

[EA(L)100/200-1, 1.5] (Same operation also on those equipped with the terminal box)

- ① When the red mark on the valve indicator can be seen, it means that the valve is opened fully, or it is fully closed when it cannot be seen. (Fig. 1) In the event the lateral 3-way ball valve is used, the red mark can be seen at the form (B or C) where the fluid is flowing.

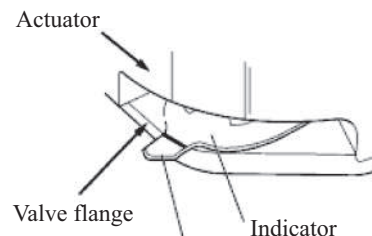


Fig. 1 Indication of open/close

- 6) After checking the open or close of water side solenoid valves CWFV3 and 5, turn SW5-3 to OFF to release the stop of entire system.
 · Press the [Run/Pause] button on the remote control, and touch [Run] on the LCD screen. (Select [Pause] to stop.)
 · When the shorting pin of external input CNS1 on the heat source water heater PCB has been pulled out, reinsert the pin.
 At that time, in order to restore the operation from the [Pause] state, press the [Run/Pause] button on the remote control and touch [Run] on the LCD screen.

(9) Return hot water control

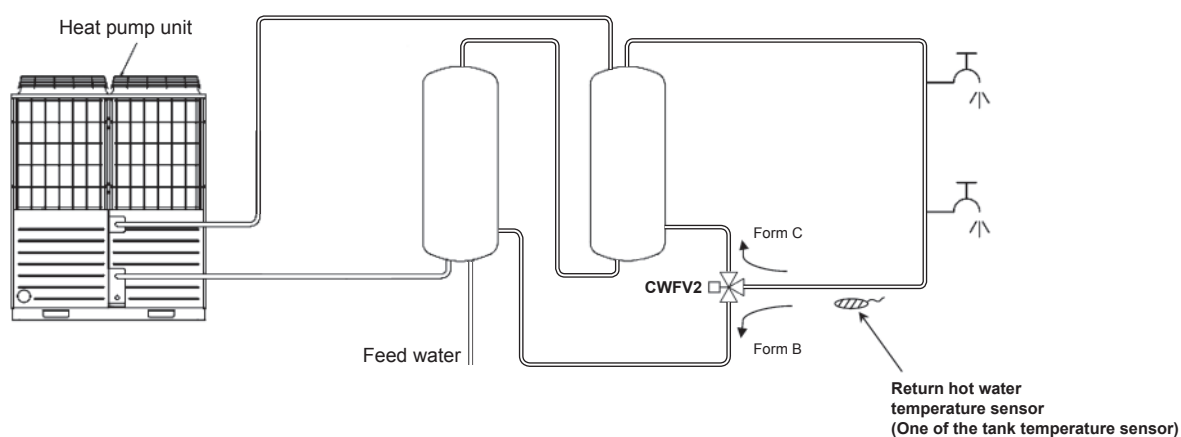
CWFFV2(3-way valve) and the temperature sensor can be used to control the position of the return hot water. By controlling the return hot water position, high-temperature water entry into the unit is prevented, abnormal stop is prevented and efficient operation is realized.

*To use this function, SW4-4 must be turned ON.

*This function uses one of the tank temperature sensors. This function is not available when 9 sensors are used.

*To use this function, use the option kit MTH-Q8E. This kit contains the 3-way valve and connection wiring.

[Water circuit]



- Normally, the position is B, but when the return hot water temperature sensor value is higher than the temperature set at 7seg: P47, the position is switched to C.
- When SW4-4 is turned ON, the tank temperature sensor functions as shown in the table below.
"※" indicates the return hot water temperature sensor position.

Sensor No.	Number of sensors to apply (7-segment:P01)					
	3	4	5	6	7	8
Th1-1	20%	25%	20%	10%	20%	10%
Th1-2	60%	50%	40%	30%	30%	20%
Th1-3	100%	75%	60%	40%	40%	30%
Th1-4	※	100%	80%	60%	50%	50%
Th1-5		※	100%	70%	65%	60%
Th1-6			※	100%	80%	70%
Th1-7				※	100%	80%
Th1-8					※	100%
Th1-9						※

2.10 Technical information of European regulations

(1) Lot1

(a) Summary

This document is intended to clarify that the water heater manufactured by us is adapted to European ErP (Ecodesign requirements for energy-related Products) directive Lot1 (space heater and combination heater) and Lot2 (water heater and water storage tanks).

These units are electric mains-operated heat pump combination heaters with a rated heating capacity of 30kW and less and are assessed on the basis of the above-mentioned directive.

(b) Applied Directives and Standard

DIRECTIVE

“DIRECTIVE 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products”

“DIRECTIVE 2010/30/EU of the European Parliament and of the Council of 19 May 2010 on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products”

REGULATION

“COMMISSION DELEGATED REGULATION (EU) No.811/2013 of 18 February 2013 ” supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to the energy labelling of space heaters, combination heaters, packages of spec heater, temperature control and solar device and packages of combination heater, temperature control and solar device

“COMMISSION DELEGATED REGULATION (EU) No. 813/2013 of 2 August 2013”

Implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for space heaters and combination heaters

(c) Target Model

Heat Pump Combination Heater	ESA30EH2-25
Hot Water Storage Tank	GX-1000-RB

(d) Specification of the apparatus

1) The name and address of the supplier

Manufacture's name and address
MITSUBISHI HEAVY INDUSTRIES THERMAL SYSTEMS, LTD. 2-3, Marunouchi 3-chome, Chiyoda-ku, Tokyo, 100-8332, Japan http://www.mhi-mth.co.jp
Branch name and address
MITSUBISHI HEAVY INDUSTRIES AIR-CONDITIONING EUROPE, LTD. 5 The Square, Stockley Park, Uxbridge, Middlesex, UB11 1ET, UK Tel : +44-333-207-4072 Fax : +44-333-207-4089 http://www.mhiaec.com MHIAE SERVICES B.V. (Wholly-owned subsidiary of MITSUBISHI HEAVY INDUSTRIES AIR-CONDITIONING EUROPE,LTD.) Herikerbergweg 238,Luna ArenA,1101 CM Amsterdam,Netherlands Tel : +31-20-406-4535 http://www.mhieservices.com/

2) Heating energy efficiency

Model name		ESA30EH2-25
Water heater load profile		XXL
Seasonal space heating energy efficiency class		A ⁺
Water heating energy efficiency class		A
Rated heat output	Average	27kW
	Warmer	30kW
	Colder	19kW
Annual energy consumption for space heating	Average	14822kWh
	Warmer	9199kWh
	Colder	15499kWh
Annual energy consumption for water heating	Average	1909kWh
	Warmer	1683kWh
	Colder	3467kWh
Seasonal space heating energy efficiency	Average	146%
	Warmer	174%
	Colder	127%
Water heating energy efficiency	Average	114%
	Warmer	130%
	Colder	63%
Off peak operation		Correspond
Sound power level		77 dB(A)

Storage tank

Lapesa Grupo Empresarial, S. L	
Model name	GXM-R-500×2 or GX-1000-RB
Energy efficiency class	C
Standing loss	100W×2 or 125 W
Storage volume	500L×2 or 1000 L

PCM011B023

(e) Technical Information

1) Function

Manufacturer's specification for intended use;

The appliance is with an outdoor unit and indoor unit. The outdoor unit is an air/water heat pumps including electrical-ly driven compressor. The indoor unit is a domestic hot water storage tank and floor heating panel.

2) Technical data of water heater

Model name	ESA30EH2-25
Rated voltage (V)	3N~, 380 / 400 / 415
Rated frequency (Hz)	50 / 60
Rated heating capacity (kW)	30
Net weight (kg)	375
Refrigerant	R744 (CO ₂)
Mass of refrigerant (kg)	8.5

Sound power level	Criteria	Judgement
77	≤78	○

※The sound power level is measured under heating conditions at outdoor air temperature 7°CDB/6°CWB, and water inlet temperature 30°C.

(2) Lot 11 (Glandless circulators)**(a) Summary**

This document is intended to clarify that the circulators integrated in our product are adapted to European ErP (Ecodesign requirements for energy-related Products) directive Lot11 (glandless standalone circulators and glandless circulators integrated in products).

(b) Applied directives and standard

2009/125/EC

- DIRECTIVE 2009/125/EC of the European parliament and of the council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products

REGULATION

- COMMISSION REGULATION (EC) No. 641/2009 of 22 July 2009 implementing Directive 2005/32/EC of the European parliament and of the council with regard to ecodesign requirements for glandless standalone circulators and glandless circulators integrated in products
- COMMISSION REGULATION (EU) No. 622/2012 of 11 July 2012 amending Regulation (EC) No 641/2009 with regard to ecodesign requirements for glandless standalone circulators and glandless circulators integrated in products

(c) Product information**1) Function**

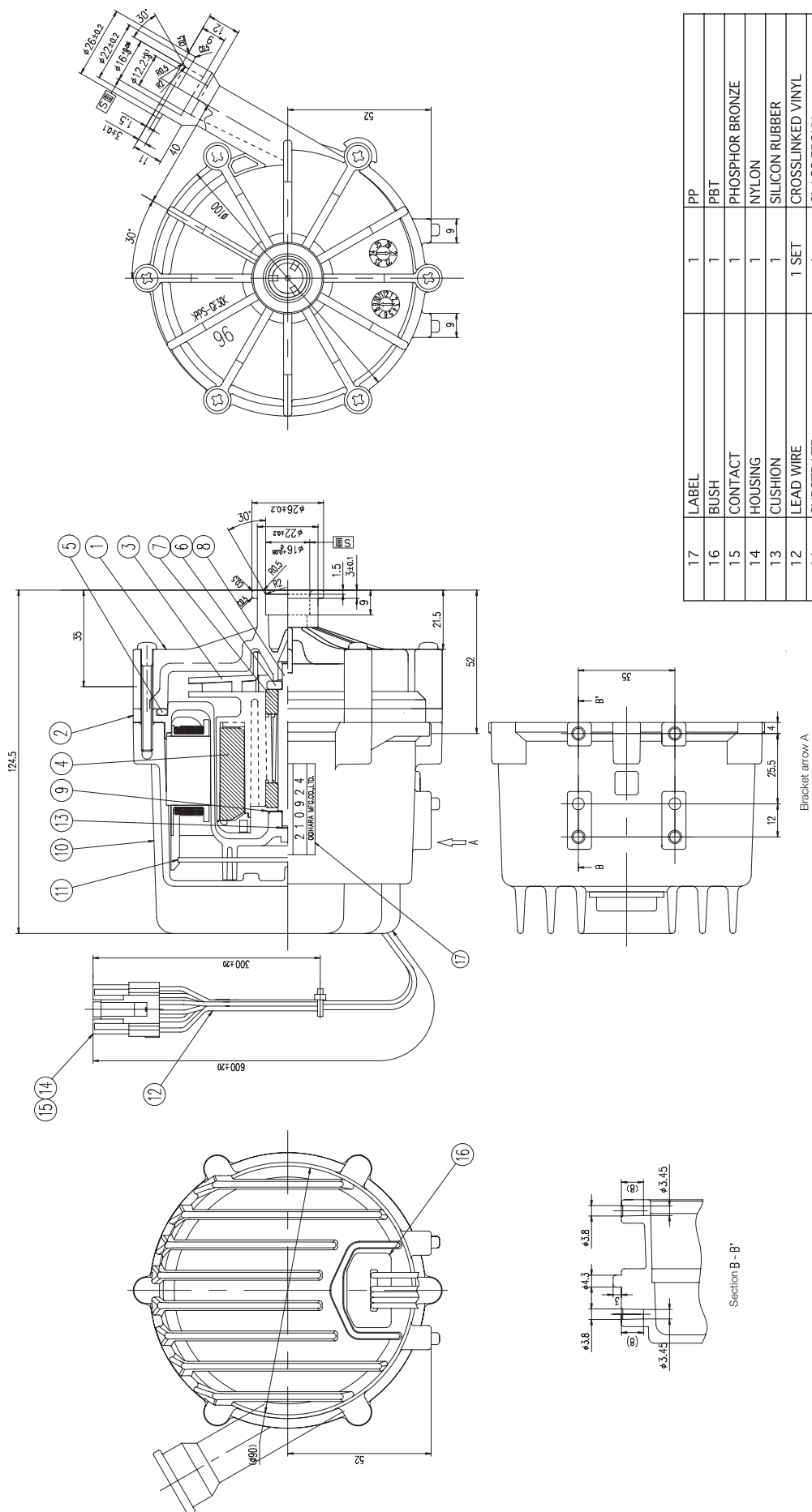
The apparatus is a DC brushless pump integrated in the heat pump water heater. The function of this apparatus is circulating water inside the water heater.

2) Specification of the water heater and the water pump

Specification of the water heater	
Model name	ESA30EH2-25
Rated voltage (V)	3 Phase, 380 / 400 / 415
Rated heating capacity (kW)	30
Refrigerant	R744 (CO ₂)
Mass of refrigerant (kg)	8.5

Specification of the water pump	
Drawing number	SSA451A014
EEI: Energy efficiency index	≤ 0.23
Rated voltage (V)	DC 339
Control power source (V)	DC 18 $\pm$ 1.6
Control Signal (V)	0-8.2 $\pm$ 1.6V
Rated power consumption (W)	95

*The benchmark for the most efficient circulators is $EEI \leq 0.20$.



17	LABEL	1	PP
16	BUSH	1	PBT
15	CONTACT	1	PHOSPHOR BRONZE
14	HOUSING	1	NYLON
13	CUSHION	1	SILICON RUBBER
12	LEAD WIRE	1 SET	CROSSLINKED VINYL
11	SUBSTRATE	1	GLASS EPOXY
10	BRACKET	1	ALUMINIUM
9	WASHER	1	STTEL
8	SHAFT	1	ALUMINA CERAMIC
7	BEARING	1	CARBON
6	THRUST WASHER	1	ALUMINA CERAMIC
5	O-RING	1	FKM
4	MAGNET	1	FERITE
3	IMPELLA	1	PPS
2	BACK CASING	1	PPS
1	PUMP CASING	1	PPS
No.	PART NAME	QUANTITY	MATERIAL

3. APPLICATION DATA

3.1 Installation work for air to water heat pump water heater

- ⊙ This instruction shows for the installation work of the heat pump unit and the total hot water supply system.
- ⊙ Please read this technical manual carefully to install the unit properly before starting the installation work.

SAFETY PRECAUTIONS

- Read these “Precautions for safety” carefully before starting installation work and do it in the proper way.
- Safety instructions listed here are grouped into **⚠ WARNING** and **⚡ CAUTION**. If a non-compliant installation as mentioned likely to result in a serious consequence such as death or major injury. The instruction is grouped into **⚠ WARNING** to emphasize its importance. However, a failure to observe a safety instruction listed under **⚡ CAUTION** can also result in a serious consequence depending on the circumstances. Please observe all these instructions, because they include important points concerning safety.
- The meaning of “Marks” used here are as shown on the right. **⊙ Never do it under any circumstances.**
Ⓜ Always do it according to the instruction.
- When you have completed installation work, perform a test run and make sure that the installation is working properly. Then, explain to the customer how to operate and how to take care of the heat pump water heater according to the user’s manual. Please ask the customer to keep installation manual together with the user’s manual.
- This unit complies with EN61000-3-11
- For heat pump unit, EN61000-3-12 are not applicable as consent by the utility company or notification to the utility company is given before usage.

Heat pump unit: ESA30E/
ESA30EH series HW
storage unit: Unvented
cylinder

* The Unvented cylinder is
procured locally. Please
procure the unvented
cylinder according to the
specifications mentioned
in this manual.

⚠ WARNING



- The appliance shall be installed in accordance with national wiring regulations.
- Installation should be performed by your dealer or the specialist.
Improper installation made by yourself may cause water leak, electric shocks, fire or injury by dropping the unit.
- Installation should be performed properly according to this installation manual.
Improper installation may cause water leak, electric shocks, fire or injury due to overturn of the unit.
- Use the genuine accessories and the specified parts for installation.
Using unspecified parts may cause falling or turnover of the unit, water leak, fire, electric shocks, refrigerant leak, insufficient capacity, improper controlling or injury.
- Consider measures not to exceed the critical concentration of refrigerant in the event of leakage especially when it is installed in a small room.
If the refrigerant leaks and exceeds the critical concentration, it may cause oxygen deficiency accident.
(The concentration of CO₂ in nature is 0.03-0.04%. If the concentration of CO₂ exceeds 0.1%, it may affect the human body.)
- Ventilate the working area well in case the refrigerant leaks during installation.
If the refrigerant leaks and exceeds the critical concentration, it may cause oxygen deficiency accident.
- Check no leakage of refrigerant after installation.
If the refrigerant leaks and exceeds the critical concentration, it may cause oxygen deficiency accident.
- When carrying the unit in, hoist the unit with slings for haulage by putting it through the holes at the anchor leg of the unit.
And in order to keep its balance, be sure to support it at 4 points securely. Do not use a fork lift to lift unit using lifting points.
If supporting the unit at 3 points or applying wrong method for carrying in, it may cause death or severe injury.
- The hoisting work shall be done by the qualified worker for slinging work.
Improper hoisting may cause an accident resulting in injury or death by dropping the unit.
- During hoisting, any person shall not enter under the unit slinging.
If the unit falls, it may cause death or severe injury. Be sure not to enter under the unit slinging.
- Do not carry the unit, whose weight exceeds 20kg, by oneself without any other supporters.
- Install the unit properly on a place to be able to withstand the heavy weight when filled with water fully.
Improper installation or insufficient strength may cause falling or turnover of the unit that leads to injury.
- Install the remote control on a place to be able to hold its weight.
Improper installation or insufficient strength may cause falling of R/C.
- Install the unit properly and fix it with anchor bolts in order to be able to withstand strong winds such as typhoon, and earthquakes.
Improper installation may cause an accident due to turnover of the unit.
- The electrical wiring work shall be done by a qualified electrical installer, and the exclusive circuit shall be used.
Insufficient capacity of power source, improper work may cause electric shocks or fire.
- Shut OFF the main power source before electrical wiring.
Without shutting OFF the power, it may cause electric shocks, breakdown or malfunction.
- Be sure to use the specified wire for electrical wiring conformed to the standard and the current capacity.
Using improper electrical wires may cause electric leak, heat generation or fire.
- Be sure to use the specified wire for electrical wiring, to fasten the wiring to the terminal securely and hold the cable securely in order not to apply unexpected stress on the terminal.
Loose connection and improper hold may cause heat generation or fire.
- Arrange the electrical wires in the control box properly to prevent them from rising the terminal cover.
Improper arrangement may cause heat generation at the terminal, fire or electric shocks.
- Do not perform brazing work in a sealed room.
It may cause oxygen deficiency accident.
- Do not put the drain pipe directly into the ditch where toxic gas such as sulfide gas is generated.
Toxic gas would flow into the unit and it may cause poisoning or deficiency of oxygen.
And it may cause corrosion of the inside unit that leads malfunction of the unit or refrigerant leak.
- Be sure to use the breaker [Earth leakage breaker, circuit breaker (breaker + B type fuse)] with proper capacity to shut off all poles.
Using improper breaker may cause malfunction or fire.
- Use the genuine optional parts. And installation should be performed by a specialist.
If you install the unit by yourself, it may cause water leak, electric shocks or fire.
- The water piping work for feed water side shall be performed by the specialist for water supply work qualified by the authority.
Improper water supply work may cause malfunction of the unit or water leak.
- Use the mixing faucet with thermostat for a shower bath.
If the event of malfunction may happen, it may cause a risk of scald.

⚠ WARNING

- The D-type grounding work shall be done properly.
Do not connect the grounding wire to gas pipe, water pipe, lightning rod, earth wire of telephone.
Improper grounding may cause malfunction, electric shocks at electrical leakage and fire.
In case of connecting to gas pipe, if gas leak occurs, there is a risk of explosion or catching fire.



- During installation work or relocation work of the unit, do not mix the air other than CO₂ into the refrigerant circuit.
If the air is mixed in, the high pressure in the circuit becomes extremely high and it may cause burst or serious injury.
- Do not connect the power with the voltage other than 380/400/415V±5% 50Hz to the unit.
If connecting the power not specified, it may cause abnormal heating of electrical components and catching fire.
- Do not connect the AC power to the remote control. The connectable voltage to the R/C is DC18V at the maximum.
If connecting AC power, it may cause breakage, catching fire or fire.
- Fit the service panel and the control lid securely.
Improper fitting may cause fire or electric shocks due to intrusion of dust or water into the control box.
- Be sure to install an earth leakage breaker and check its operating behavior.
Without installation of earth leakage breaker, it may cause fire or electric shocks.
- Be sure to use only the fuse with proper capacity.
If steel wire or copper wire is used, it may cause malfunction of the unit or fire.
- Do not install the unit near gas bombs or inflammables.
It may cause catching fire.
- Do not install the unit in high humid atmosphere.
If installing in the bath room and the high humid place, it may cause electric shocks or fire.
- Do not leave packing materials after unpacking.
If packing materials is sucked in the other machine located there, it may cause breakdown or abnormal operation.
- Dispose the packing materials properly after unpacking.
If leaving packing material without removing nails and metal pieces, it may cause injury.
If disposing plastic covers without tearing, it may cause an accident of oxygen deficiency for the child who are playing with it.
- When using this unit with combustion appliance, be sure to ventilate frequently.

⚠ CAUTION

- Do not touch the aluminum fin of the heat exchanger with bare hands.
If touching, it might cause injury.
- Dispose the packing materials properly after unpacking.
If leaving packing material without removing nails and metal pieces, it may cause injury.
If disposing plastic covers without tearing, it may cause an accident of oxygen deficiency for the child who are playing with it.
- Insulate the hot water piping securely.
Improper insulation might cause radiating heat from the surface of the piping and decreasing the hot water temperature.
- Check no refrigerant leak by performing air tightness test after the end of piping work.
If refrigerant gas leaks in a small room and exceeds the critical concentration, it might cause oxygen deficiency accident.
- For drain piping work, be sure to make descending slope of greater than 1/100, not to make traps and not to make air-purging.
Check if the drainage is correctly done during test run and ensure the space for inspection and maintenance.
- Always open the valves installed in the inlet and outlet piping of the unit during operation of the unit.
Operating the unit with the valves closed may cause failure.
- Always stop the unit using the "Pause" button the remote control during the maintenance operation of the water tank.
- Dispose cleaning solution and glycol solution properly according to the regulation.
If dispose them illegally, it might cause not only to violate the law, but also to have adverse effects on health and environment.
- Use clean water conform to the water quality criteria of drinking water.
The deterioration of water quality may cause malfunction of the unit or water leak due to corrosion.
- For the system that the fresh water is always flowing in, be careful not to flow excessive amount of water.
It might cause water leak due to corrosion depending on the water quality.
- Do not supply the power between the units. Supply the power to each unit independently.
If supplying power between the units, it might cause fire.
- Be sure to take measure for anti-freezing.
Without taking measure for anti-freezing, it might cause breakage of water pipe, components or connecting joints in the system.
- Be sure to perform waterproofing work and indirect wastewater treatment work.
Improper treatment might cause serious damage, when water leak occurs.
- Be sure to perform waterproofing work and drain work in order to prevent from the secondary damage due to the leakage from HW storage unit and water piping.
- Do not touch the high temperature section of the hot water pipe with bare hands.
If touching, it might cause scald.
Direct drain of hot water from the HW storage unit is prohibited. It might cause scald or damage of the packing on the unit side.
- Hot water temperature is 90°C at the maximum.
Be sure to mind about the specification of packing regarding the heat-resistant.
Using poor heat-resistant packings might cause water leak.
- Ensure 0.1-0.2MPa of supply hot water pressure at the lowest.
Lower pressure than above might cause insufficient amount or force of hot water supply due to the pressure loss.
- At the service and maintenance work, be sure to drain off all hot water in the HW storage unit and in the piping before starting work.
- When replacing valves such as pressure reducing valve, relief valve and other valves, shut the stop valve and drain off hot water before starting work.
If not, it might cause scald with hot water flown out or electric shocks due to splash water to the electrical parts.
Drain off the water in the piping of the unit by opening valves for drain and air purge located inside of the unit.

⚠ CAUTION



- Do not install or operate the unit at a place where corrosive gas (sulfurous acid gas, etc) or flammable gas (thinner, gasoline, etc), could be generated or accumulated, or volatile flammable materials are handled.
It might cause corrosion of the heat exchanger, breakage of the plastic parts, and fire for flammable gas.
- Secure specified spaces for installation, inspection and maintenance work.
Insufficient space might cause injury due to a fall from installation place.
- When installing the unit on a roof or a high place, for preventing from a fall, install permanent ladders and handrails at the passage, and install fences and handrails around the unit.
If not, it might cause injury due to falling from the installation place.
- Do not install and use the unit near the hospital and telecommunication facility where equipment generate electromagnetic wave and/or high frequency wave.
It might cause malfunction or failure of the unit due to the effect of inverter equipment, private power generators, high frequency medical equipment or radio communication equipment, or may cause harmful effects such as interfering with medical activity or visual and noise disturbance of video communication due to the influence from the unit to medical equipment and/or communication equipment.
- Do not install the unit in a place that may become a nesting site for insects or small animals.
If insects or small animals come into the unit and touch the internal electrical wiring of the unit, it might cause malfunction of the unit, fuming or catching fire.
Please ask the customer to keep the surroundings clean.
- Do not use the base frame for installing unit which is corroded or damaged after long-term use.
If leaving corroded or damaged, it might cause a fall of the unit or injury.
- Do not install the unit at following places.
 - Where carbon fiber, metal powder, or other powdery substance is floating
 - Where the substances which affect the unit such as sulfide gas, chloride gas, acid or alkali could be generated
 - On vehicles and ships
 - Where cosmetics or special sprays could be frequently used
 - Where oil mist or steam could be generated much (in a kitchen, machine shop and etc.)
 - Where the equipment, which generates high frequency wave, is used
 - Highly salted area such as beach
 - Heavy snow area (When installing the unit in such area, it is necessary to use the specified installation stand and snow prevention hood.)
 - Where chimney smoke comes directly
 - Altitude over 1000m
 - Where the unit could be exposed to an atmosphere of ammonia
 - Where the unit could receive heat radiation from other heat source
 - Where air circulation is not good
 - Where there is obstacles at air inlet/outlet port of the unit
 - Where short circuit of air could happen, in case of installing several units
 - Where the unit could be affected by strong winds (Where strong winds blow directly into the unit)
It might cause a decrease in performance significantly, corrosion or breakdown of parts, or fire.
 - Where the noise or the cold air from the unit could bother neighboring house
 - Where the outlet air from the unit could blow directly to plants
It might cause damage to plants.
 - Where the vibration could be amplified and transmitted due to insufficient strength
 - Where the noise and vibration generated by the unit could affect to (On a wall near bed room or such area)
 - Where there is an equipment which is affected by high frequency wave (near TV set, radio and etc.)
 - Where there is no place to drain off
It might affects the environment and might be cause of the claim.
- Do not install the remote control at a place where it is exposed to direct sunlight.
It might cause malfunction or discoloration of the R/C.
- Do not install the remote control at a place where water could be splashed to the R/C.
If water could get into the R/C, it may cause electric shocks or malfunction of internal electronic parts.
- The ambient temperature for use is -25 to +43°C and the storage temperature is -25 to +50°C.
- If use the unit at -5°C or lower of outdoor temperature, be sure to mount snow prevention hood or mat.
In heavy snow area, be sure to install the unit at a high place not to be buried under the snow.

Feature of CO₂ refrigerant

- The operation pressure of CO₂ refrigerant is generally 12- 15MPa at the maximum, which is about 4 times high pressure of R410A.
Consideration for safety to high pressure is required more than that for R410A.
Please be careful not to break the piping of refrigerant circuit of the heat pump unit during service work.
When purging CO₂ refrigerant, please purge a small amount to a place where there is no person by opening service valve slightly.
- CO₂ refrigerant is non-inflammable and non-poisonous, but under the high concentration, it may affect the human body.
At more than 3% of concentration it affects the physiological function, at 7% to more than 9% it causes disturbance of consciousness, and at 25% to more than 30% it causes death.
CO₂ refrigerant is heavier than the air and accumulates easily at lower place. Therefore, if there is a risk of refrigerant leak or when purging refrigerant, please take measure to prevent CO₂ refrigerant from accumulating by ventilating the air at the surface of floor.

First aid under high concentration of CO₂ gas

- (a) When breathing a high concentration of CO₂ gas
Move the sufferer immediately to a place where fresh air can be breathed and ensure the person can relax and kept rested.
If he is unconscious, call for an ambulance immediately, loosen his clothing, ensure the respiratory airway is clear and perform artificial respiration.
- (b) When the high concentration of CO₂ gas makes contact with the skin
If it is a mild frostbite, only rubbing that section is OK. But in case of severe frostbite, warm that section with lukewarm water and wrap lightly with gauze, and then consult a physician immediately.
- (c) When the high concentration of CO₂ gas gets into the eye
Rinse the eye with fresh water, and consult a physician immediately.

Legal formalities

- Responding to the Water Low
When connecting the HW storage unit with clean water pipe
Consult with the Waterworks Bureau under the jurisdiction of the local government.

1-3 Specifications of unvented hot water storage cylinder for connecting to ESA30EH2

Please arrange and procure a new unvented cylinder with following specifications for connecting to ESA30EH2.

*If connecting ESA30EH2 to the existing cylinder, the hot water temperature and amount in the cylinder cannot be detected correctly.

In such case, please consult with our distributor.

In some case, preliminary survey on site may be required before installation.

Specifications of unvented cylinder

- For commercial use
The cylinder is installed indoors, not outdoors.
- It should be unvented hot water storage cylinder, not open tank.
- The minimum capacity is 500liter. If increasing capacity, please use bigger size cylinder or several cylinders in series.
- The maximum capacity is 4000liter. (only as a guide)
The cylinder capacity may vary according to feed water inlet temperature, hot water outlet temperature and operation hours in the night.
 $25837 \times \text{Operation hour in the night} / (\text{Hot water outlet temperature} - \text{feed water inlet temperature}) = \text{available hot water supply volume (Liter)}$.
However, there is dead volume, where the cold water is always filled in, at the bottom of cylinder to which the feed water line is connected.
Therefore please select the cylinder volume in consideration of available hot water supply volume and dead volume.
- Design pressure
Design pressure is 0.5MPa or higher.
The design pressure of ESA30EH2 is 0.5MPa. Even if the design pressure of the cylinder is 0.5MPa or higher, the maximum water pressure applied to the cylinder actually shall be less than 0.5MPa. And please decide the usage pressure in consideration of allowance and setting value of relief valve.
Even if the actual pressure applied to the cylinder is 0.5MPa, the cylinder can be used, but the minimum pressure shall be 0.1 to 0.2MPa or higher. If the pressure becomes lower than the minimum pressure, water volume becomes decreasing.
- Pipe connection port
Cylinder has one or more pipe connection ports at the top. The size of port shall be 32A or bigger.
If it is smaller than 32A, it is difficult to detect the hot water temperature and hot water amount in the cylinder properly. And when discharging the hot water from the cylinder, the outlet flow volume may be restricted.
Cylinder has 2 or more pipe connection ports at the bottom. The size of one port shall be 32A and the other port shall be 20A.
- Specifications of inner cylinder
In order to ensure the temperature boundary layer as minimum as possible when hot water and feed water flow into the cylinder, the cylinder shall have buffer plates built-in.
- Material
SUS444 or SUS316 (with consideration for stress corrosion cracking resistance)
If using the other material than the specified one, hot water temperature and hot water amount in the cylinder may not be detected correctly.
Please consult with our distributor.
- Heat resisting temperature
90°C
The maximum hot water outlet temperature of ESA30EH2 is 90°C. If the heat resisting temperature of the cylinder is lower than 90°C. Be sure to reduce the hot water outlet setting temperature in order to meet the specifications of the cylinder.
If using the cylinder at the higher water outlet temperature than the heat resisting temperature of the cylinder, it may have break of the cylinder or leakage of hot water.
- Applying hot water temperature sensors on the cylinder
In order to judge the hot water temperature and amount in the cylinder, the temperature sensors shall be mounted or pasted on the cylinder.
If pasting the temperature sensors, they shall be pasted with aluminum adhesive tape whose heat resisting temperature is 90°C or higher.
If mounting the temperature sensors, the insertion holes with $\varnothing 7\text{mm}$ or bigger in size and 20mm or deeper in depth are required on the cylinder.
MHI's genuine temperature sensor, MHT-Q3E (option part), shall be used.
3 to 9 sets of temperature sensors shall be applied to the cylinder.
In order to detect the hot water amount by 10% intervals, 9 sets of temperature sensors shall be applied to the cylinder. If reducing the number of temperature sensor, the hot water amount cannot be detected properly.
Ex) In case of applying 3 sensors, heat pump unit can detect only 20%, 60% and 100% of HW amount. (Please refer to following table.)
Therefore, even though 80% of HW amount is set with schedule setting, the HP unit cannot stop at storing 80% of HW amount and it still keeps on operating until storing 100% of HW amount.
And if 30% of HW amount is set for the operating to top up, HP unit cannot start operation to top up until HW amount decreases to 20%.
Accordingly, we recommend to apply 9 sensors to the cylinder for precise control.
The positions to apply the temperature sensors on the cylinder are depended on the number of sensors and sensors should be applied to the designated positions on the cylinder. (See pages 90 and 91 for detail.)
According to the following table, please check the number of sensor and apply each sensor to the designated position of hot water amount% according to the sensor No.

The position to apply temperature sensor according to the hot water amount %

Number of sensors to apply							Recommendable
Sensor No.	3 pcs.	4 pcs.	5 pcs.	6 pcs.	7 pcs.	8 pcs.	9 pcs.*1
Th1-1	20%	20%	20%	10%	20%	10%	10%
Th1-2	60%	50%	40%	30%	30%	20%	20%
Th1-3	100%*2	75%	60%	40%	40%	30%	30%
Th1-4		100%*2	80%	60%	50%	50%	40%
Th1-5			100%*2	70%	65%	60%	50%
Th1-6				100%*2	80%	70%	60%
Th1-7					100%*2	80%	70%
Th1-8						100%*2	80%
Th1-9							100%*2

*1 Recommendable number of sensors is 9 pcs.

If the number of sensors is less than 9 pcs., the hot water amount cannot be detected correctly.

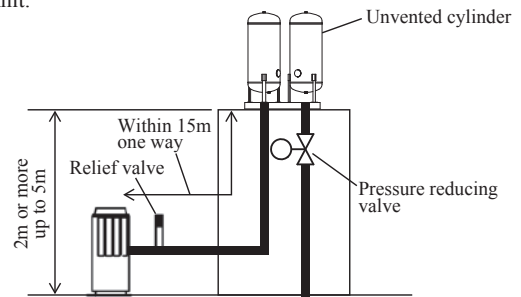
*2 The sensor which detects 100% of HW amount shall be applied to the position within the range of sensitive volume with consideration of dead volume which is 10% of total volume of cylinder.

- Insulation
Insulation must be required in order to keep hot water temperature stored in the cylinder.
- Shell
Material: Glass wool
Density: 16kg/m^3
Thickness: 50mm or more
- End plate
Material: Glass wool
Density: 24kg/m^3
Thickness: 50mm or more
- Carry in, Installation and Service & maintenance space
It depends on the installation manual of the cylinder procured.

1-4 Notabilia for designing hot water supply system

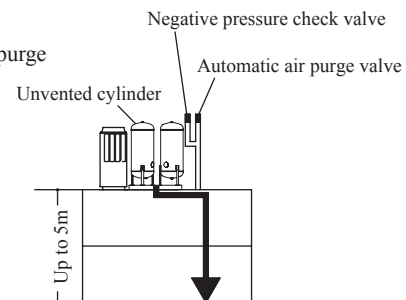
Water piping limitation between the heat pump unit and the unvented cylinder.

- The water piping limitation in length between the heat pump unit and the unvented cylinder is within 15m one way of equivalent length with pipe size 20A.
- If the equivalent piping length exceeds 15m one way, review the pipe size and select the pipe size whose pressure loss is equal. (Ex. In case of 25A, the equivalent piping length is 45m.)
However, please note, if selecting longer piping length and bigger pipe size, the heat release from piping becomes increasing and the hot water outlet temperature from the heat pump unit to the cylinder becomes decreasing.
(Ex. If pipe size 25A is used instead of 20A, the hot water temperature decreases about 1°C .)
- The wiring limitation in length between the heat pump unit and the unvented cylinder is within 20m.
- The setting pressure of the pressure reducing valve installed on the feed piping shall not exceed 400kPa at the inlet of the heat pump unit and the cylinder in consideration of the height difference (head difference) between the heat pump unit and the cylinder.
- The limitation of height difference between the heat pump unit and the unvented cylinder shall be within $\pm 5\text{m}$ basically.
Especially when the heat pump unit is installed below the unvented cylinder and the height difference exceeds 2m, be sure to install relief valve (setting pressure: 400kPa) in the vicinity of the inlet port of the heat pump unit.



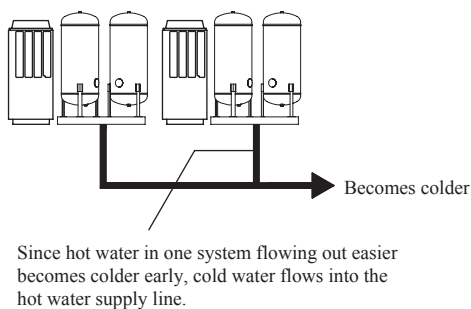
(1) Supply hot water to downstairs

Unvented cylinder can be used to supply hot water up to 5m below the cylinder.
In such case, be sure to install a negative pressure check valve, an automatic air purge valve and flow regulator.

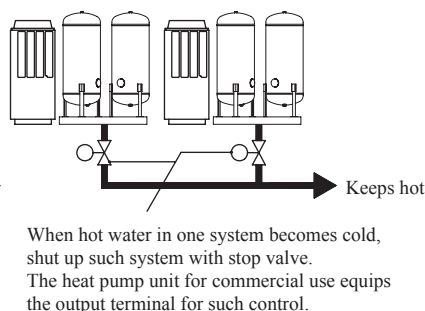


(2) Drift and parallel control

① If multiple hot water supply systems are connected in parallel, drift may happen.

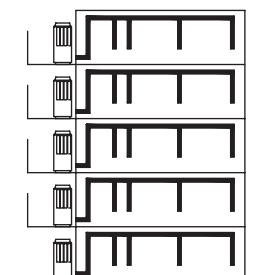


② Please install the stop valve at each outlet port. Even if drift happens, it can prevent the cold water flow into the hot water supply line.



(3) Hot water supply system

- Designing of separate system is recommendable. (Installing the hot water storage system on each floor is recommendable.)
To install hot water storage system on each floor makes water piping shorter and maintenance easier.



(2) INSTALLATION LOCATION

(Obtain approval from the customer when selecting the installation area)

2-1 Selecting the installation location

- ☐ Where air is not trapped
- ☐ Where the installation place is solid to install the unit foundation firmly.
- ☐ Where there is no obstacle to interfere air flow at inlet/outlet air ports
- ☐ Where no heat of radiation is received from other heat source
- ☐ Where strong wind does not blow against the outlet air port
- ☐ Where the electric noise is not subjected to rigid control
- ☐ Where the drain water can safely be discharged
- ☐ Where noise and hot air will not bother neighboring residents
- ☐ Where no snow will accumulate
- ☐ Where no TV set or radio receiver is placed within 5m
(If such devices still receive electrical interference, seek another place not to be interfered.)
- ☐ Do not run the signal wire between heat pump unit and HW storage unit near the devices generating electromagnetic wave and/or high frequency wave.

Please note

- a) If there is a risk of short-circuit of air flow, install a flow direction variable adapter not to short-circuit air.
- b) When installing multiple units, provide sufficient air intake space not to be short-circuited.
- c) In snowfall area, install the unit on a rack and mount a snow prevention hood on the unit in order to prevent snow from accumulating on the unit.
(Be sure not to apply collective drain discharge in a snowy area.)
- d) Do not install the unit in area where inflammable gas is generated.
- e) If installing the unit in following special area, it may cause corrosion and malfunction.
 - Where corrosive gas is generated (Hot spring area and etc.)
 - Where sea wind directly blows to the unit
 - Where oil mist is filled
 - Where there are equipments generating electromagnetic wave
- f) If ambient temperature decreases below 0°C, it is a risk to break water pipes and the unit due to freezing.
Be sure to apply anti-freezing heater to feed water piping, hot water piping and drain water piping locally installed

Caution

Please keep sufficient clearance around the unit without fail. Otherwise, a risk of compressor and/or electric component failure may occur.

[Water quality criteria]

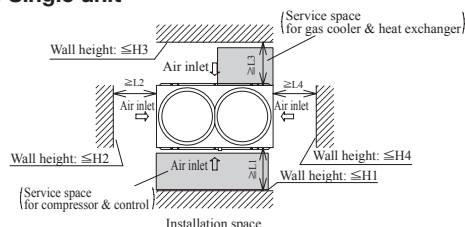
Makeup water and cyclic water shall be the water within the range of water quality criteria mentioned below.

If water quality is out of the range of criteria, it may cause a trouble such as scale adhesion and corrosion.

Item			Cyclic water (60°C < ≤90°C)	Makeup water
Standard items	pH (25°C)	—	7.0—8.0	7.0—8.0
	Electric conductivity (25°C)	mS/m	≤30	≤30
	Chloride ion	mgCl ⁻ /L	≤30	≤30
	Sulphate ion	mgSO ₄ ²⁻ /L	≤30	≤30
	Acid consumption (pH4.8)	mgCaCO ₃ /L	≤50	≤50
	Sulphide ion/Acid consumption	—	≤0.5	≤0.5
	Total hardness	mgCaCO ₃ /L	≤70	≤70
	Calcium hardness	mgCaCO ₃ /L	≤50	≤50
Reference items	Ionic silica	mgSiO ₂ /L	≤20	≤20
	Iron	mgFe/L	≤1.0	≤0.3
	Copper	mgCu/L	≤1.0	≤0.1
	Sulphide ion	mgS ²⁻ /L	Not detected	Not detected
	Ammonium ion	mgNH ₄ ⁺ /L	≤0.1	≤0.1
	Residual chlorine	mgCl/L	≤0.1	≤0.3
	Free carbon dioxide	mgCO ₂ /L	≤0.4	≤4.0
	Stability index	—	—	—

2-2 Heat pump unit installation space (Service space)

1) Single unit



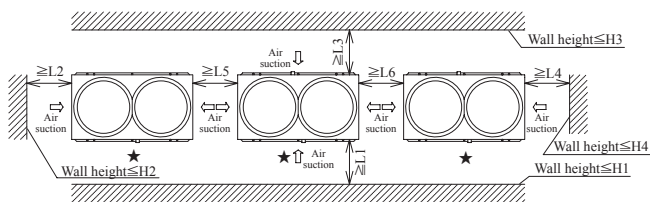
Dimension	Installation example	
	1	2
L1	800	800
L2	10	10
L3	800	500
L4	100	500
H1	1500	1500
H2	No limit	No limit
H3	1000	1000
H4	No limit	No limit

Be sure to keep space above the unit at least 2m.

2) In case that multiple heat pump units are installed

★ shows the front side of the unit

① Installation example for 3 units in a row

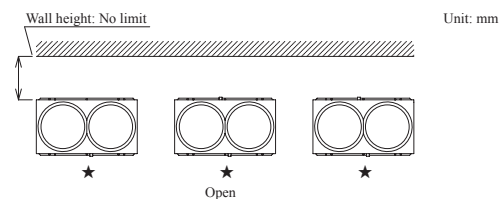


Dimension	Installation example	1	2
L1		800	800
L2		10	10
L3		800	500
L4		100	500
L5		10*	500
L6		10*	500
H1		1500	1500
H2		No limit	No limit
H3		1000	1000
H4		No limit	No limit

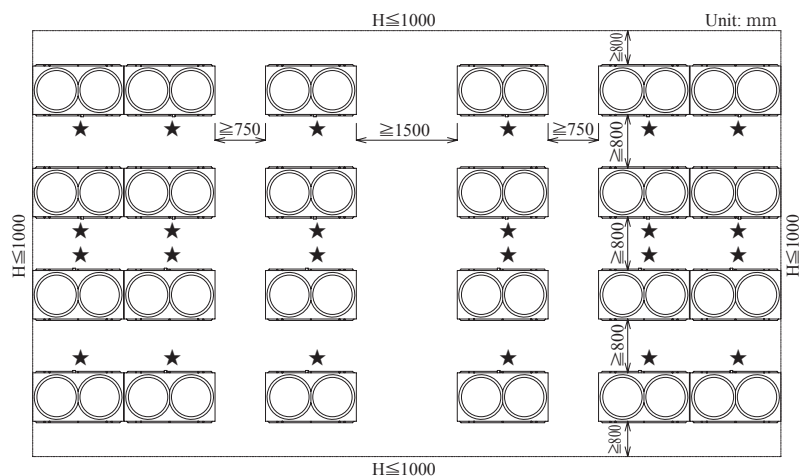
*Units can be installed continuously at intervals of 10mm.

② Installation example for 3 units in a row (In case of high wall on the back)

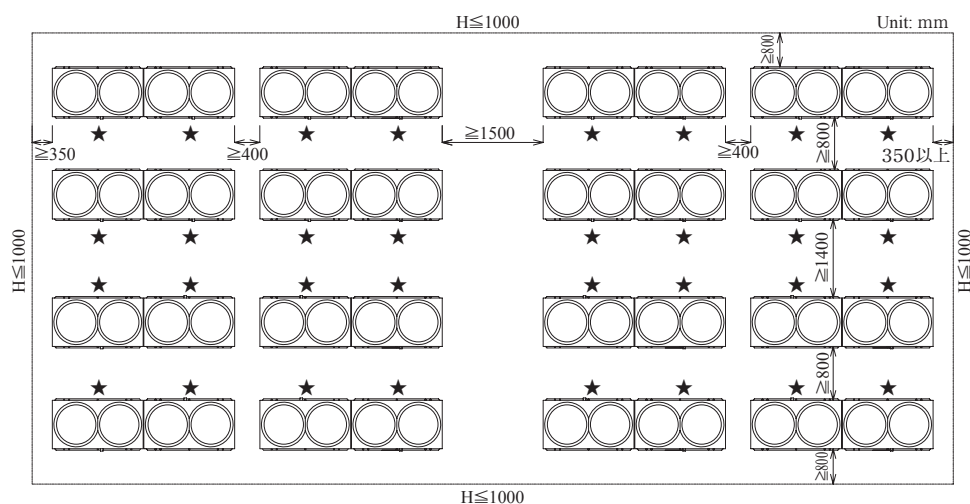
Please keep 10mm or more space between the units with consideration for the installation space.



③ Installation example for 6 units horizontally and 4 units longitudinally



④ Installation example for 8 units horizontally and 4 units longitudinally



2-3 Unvented hot water storage cylinder Installation space (Service space)

According to the installation manual attached to the cylinder procured.
Please refer to the specifications of unvented cylinder procured.

(3) Carrying in and installation of unit

⚠ CAUTION When a heat pump unit (so called "Q-ton") is hoisted with slings for haulage, please take into consideration the offset of its gravity center position.
If not properly balanced, the unit can be thrown off-balance and fall.

3-1 Carrying in

- Define a carry-in route, and carry in the entire package containing a unit to the installation point
- In slinging a heat pump unit, use two canvas belts with plates, cloth pads or other protections applied to the unit to prevent from damage

Please note

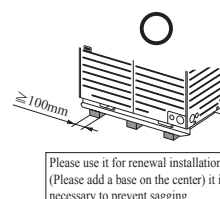
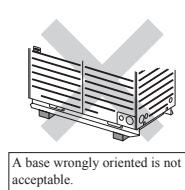
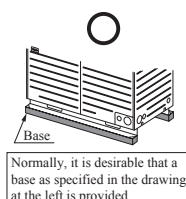
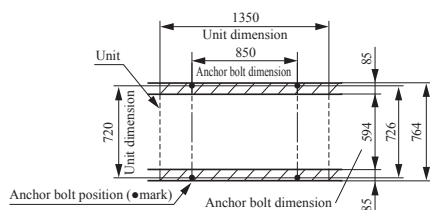
- Please do not fail to put belts through the rectangular holes of units anchor legs.
- Apply cloth pads between a canvas belt and a unit in order to prevent from damage.



3-2 Notabilia for installation of heat pump unit

(a) Anchor bolt position

- Be sure to use four anchor bolts (M10) for fixing anchoring legs of the unit.
Ideally, an anchor bolt should protrude 20mm.



(b) Base

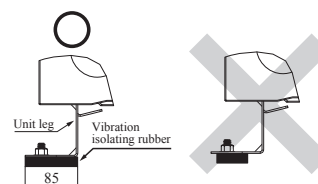
- Please install a heat pump unit after ascertaining that the bases were made to have sufficient strength and level for ensuring the unit shown in the above figure.
- Please construct a base which has larger area than the shadowed area (the entire bottom area of the heat pump unit's anchor legs) shown in the above figure.
- Please orient a base in the traversal direction (direction of W1350) of the heat pump unit as shown in the above figure.
- Please install a heat pump unit solidly not to be fallen down by earthquake or gust of wind.

(c) Vibration isolation rubber

- The vibration isolation rubber must support the heat pump unit's anchoring leg by its entire bottom area.

Please note

- Install a vibration isolating rubber **in such a manner that the entire bottom area of heat pump unit's anchoring leg can rest on it.**
- Do not install a heat pump unit in such a manner that a part of the bottom area of its anchoring leg is off a vibration isolating rubber.



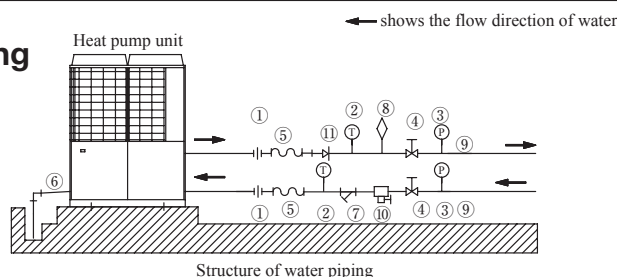
3-3 Notabilia for installation of unvented cylinder

According to the installation manual attached to the cylinder procured.

(4) Water piping work

4-1 General description

4-1.1 Outline of water piping



(i) Key consideration for water piping

Please consider following point when designing and installing. (Description of ① – ⑪ in above figure)

- | | |
|------------------------|---|
| ① Union joint | Be sure to fit it in order to enable the unit replacement easily. |
| ② Thermometer | Be sure to equip it for capacity check and operation monitoring |
| ③ Water pressure gauge | You had better equip it for checking operation status. |
| ④ Valve | Be sure to fit it for servicing such as cleaning heat exchanger and/or replacing unit and etc. |
| ⑤ Flexible joint | Be sure to fit it for preventing from transmittance of vibration |
| ⑥ Drain piping | Be sure to make its descending slop as larger as possible and make the distance of its horizontal part as shorter as possible in order to prevent the drain water from freezing.
Moreover, in cold region, be sure to take a measure for anti-freezing drain water by equipping drain heater or like that. |
| ⑦ Strainer | Be sure to fit a strainer (60 mesh or more) at the inlet port of the unit to avoid intrusion of foreign matter into the unit. |
| ⑧ Air purge valve | Be sure to equip it to the place where air may accumulate in order to purge air in the water pipe. |
| ⑨ Water piping | Water piping work shall be done by considering to purge air in the water pipe easily. Insulation work shall be done sufficiently.
Depending on the set temperature, the unit may temporarily supply hot water above 90°C. Piping should be selected by paying attention to heat resistant temperture. |
| ⑩ Drain valve | Be sure to equip it in order to drain off the water from the system at servicing. |
| ⑪ Check valve | Be sure to equip it in order to operate the multiple heat pump water heaters. |

(ii) Caution for corrosion

- ① Water quality

It is important to check in advance whether the feed water and hot water have good quality.
Be sure to use cyclic water and makeup water whose qualities are within the range of water quality criteria mentioned in page 93.
- ② Foreign matter in water

If solid matter such as sand and small stone and/or floating suspended solid such as corrosion product exist in water, the heat-transfer surface of heat exchanger is directly attacked by water flow, and corrosion may be created locally.
In order to avoid such corrosion by these foreign matters, be sure to fit a cleanable strainer (60 mesh or higher) at the water inlet port of the unit to remove foreign matters.
- ③ Contact of different metal

Depending on the type of metal, if different metals contact directly, corrosion may be generated at contact part.
Refer to followings and in case of the combination of different metals to generate corrosion, take a measure not to generate corrosion by inserting a non-conductive material (non-metallic insulation flange and etc) between the metals or by other method

The combination not to generate corrosion by contact of metals	① Stainless steel (SUS304, SUS316)
	② Bronze
	③ Copper
- ④ Others
 - 1) Water pipe shall have no water leak and no air intrusion. Especially if air intrudes at suction side of pump, pump performance becomes decreasing and it may cause generation of noise
 - 2) Be sure to take into consideration for water pipe not to freeze at stopping operation in winter

4-1.2 Piping work

(i) Piping to heat pump unit

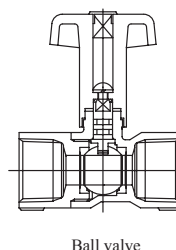
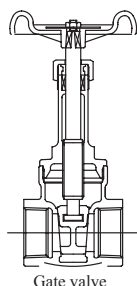
- ① Be careful not to make the water pipe connection to the inlet/outlet ports of unit being reversed by referring the exterior dimensional drawing.
- ② Be sure to install union joints and valves at water inlet/outlet ports of unit for easy maintenance.
- ③ In order to prevent from transmitting the unit vibration to the room through water piping, be sure to install flexible joint.
Since flexible joint is not strong against bending, it is necessary to install it in consideration of pipe weight and to take a measure such as supporting the pipe.
- ④ In order to clean the water side of heat exchanger with chemical cleaner, be sure to install T-joint and valve.

(ii) Piping to HW storage unit

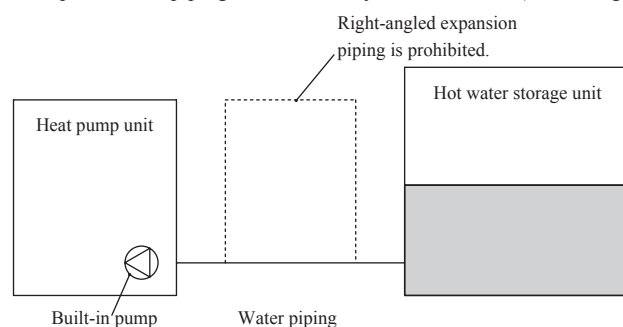
Install valves at water inlet/outlet ports of unit for easy servicing at periodical cleaning and etc.

(iii) Selection of valves and joints

- ① It is better to use a gate valve for main pipe, because the gate valve has less resistance at full opening position.
- ② For air purging or draining, ball valve shall be used. Be sure to install ball valve to be horizontal axis in order for air bubble to be able to pass freely.



- (iv) Right-angled expansion piping is prohibited. (Return piping from tank)
Be sure not to install such up and down piping that air is likely to accumulate. (such as right-angled expansion piping)



In case of the up and down feed water piping returning from hot water storage unit, the built-in water pump can not work normally, because the pump cannot suck water due to biting the air.

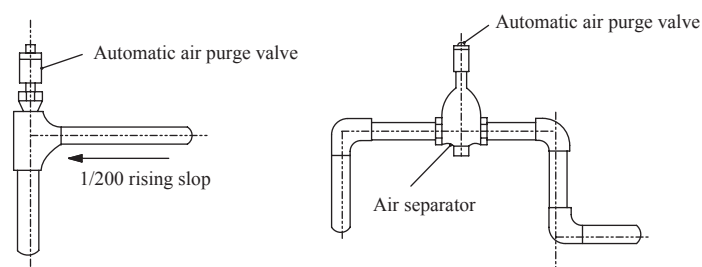
- (v) Piping slope and air purge valve (Hot water piping)

At the operation to fill up or to top up, the air dissolved in water becomes bubble which is discharged from outlet hot water pipe, because low temperature water is heated to hot water instantly.

If the air is accumulated in the pipe, the resistance of water circuit is increased and water flow volume decreases drastically.

Therefore if there is descending slope in the hot water circuit, it is necessary to install a automatic air purge valve.

In order to avoid any air entrapment in the pipe, install piping with 1/200 or more of rising slope and install automatic air purge valve at the place where the air may accumulate. The installation sample is shown in following figure.



Installation sample of air purge

- (vi) Expansion and contraction of pipe

- ① If the temperature of pipe varies, the length and diameter of pipe expand or contract. Generally, the change in pipe diameter does not matter much, but, in case of long distance straight piping, the difference of pipe length between expansion and contraction becomes large and excessive force is applied to the pipe.

Therefore, it is a risk that a serious leak may occur from the faulty joint and/or connection part of pipes.

In case of normal piping installation, there is some elasticity in the piping route that may alleviate the expansion and contraction.

However, even in case of short distance straight pipe, it is better to install piping to be able to be stretched freely in consideration of appropriate escape of piping against thermal expansion.

- ② In case of long distance straight piping, be sure to put flexible joints. (Generally, put flexible joints at every 30m intervals of straight piping.)

- ③ In order for the horizontal main piping to move freely, be sure to put roller bracket at pipe support.

Supporting interval of pipe support (m)

Nominal diameter	20A	32A, 40A	50A, 65A
Supporting interval	1.8	2.0	3.0

4-1.3 Drain piping work

- The end of drain piping should be open to the air by receiving with hopper and etc.
If not, the pressure in the cylinder increases and it may cause deformation or breakage of the cylinder.
And the drain water may flow back to the cylinder.
- At the installation place where the drain water may be frozen in winter season, take as much bigger gradient and much shorter horizontal distance as possible for drain piping.
Moreover, in cold region, be sure to use copper pipe or SUS pipe and take measure for anti-freezing drain water with enough thick insulation and anti-freezing heater.
- In cold region, if the drain water is discharged directly to the ground surface, please discharge at a place covered with mud or gravel for easy penetration.
If discharging drain water to a place covered with the concrete or asphalt, drain water may freeze and it may cause injury by falling down.
- There may be a case to discharge hot water (90°C). In consideration of heat resistance, please use copper pipe, SUS pipe or heat-resistant PVC pipe for drain piping.

4-2 Water piping work

- When doing piping work between the heat pump unit and the unvented cylinder, be sure not to interfere the service space of the heat pump unit. Regarding the service space, please refer to chapter 2.

4-2.1 Limitation of piping length between the heat pump unit and the unvented cylinder

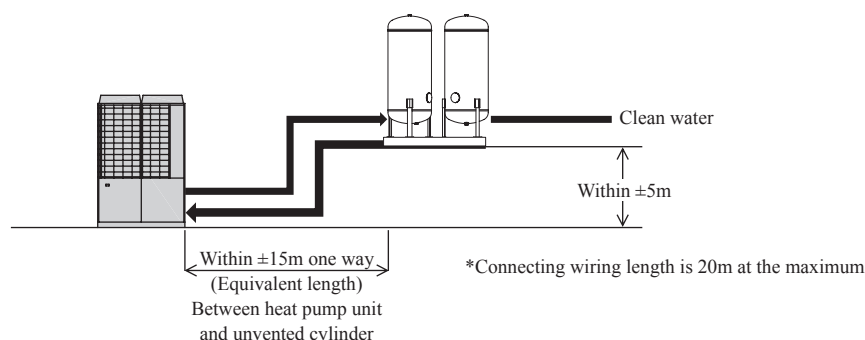
Be sure to install the heat pump unit and the unvented cylinder in the shortest piping length from the view point of saving energy. Piping length and height difference shall be within a following range.

Limitation of piping length

i) Piping length: Within 15m one way (equivalent length for pipe size 20A)

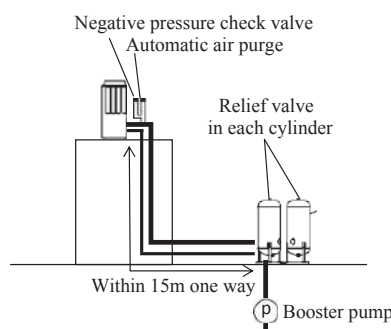
ii) Height difference: Within $\pm 5\text{m}$

- When the heat pump unit is installed below the unvented cylinder and the height difference exceeds 2m, be sure to install relief valve (setting pressure: 400kPa) in the vicinity of the inlet port of the heat pump unit.



iii) When installing the heat pump unit above 5m above unvented cylinder

- Be sure to keep pressure min 100kPa at the inlet of the heat pump water heater by using the booster pump.
- Be sure to install a negative pressure check valve and an automatic air purge valve on the hot water outlet piping (highest point vicinity) of the heat pump unit in case the clean water pressure is not supplied.



4-2.2 Pressure loss of the pipe and joint

① Pressure loss of pipe

Typical pressure loss is shown in following table. Please select the size of hot water supply pipe and return pipe by referring following table.

Nominal diameter	Flow volume (L/min)	Rough indication of pipe friction resistance per unit length
20A	20	0.1mAq (1kPa)/m
25A	40	0.1mAq (1kPa)/m
32A	80	0.1mAq (1kPa)/m
40A	120	0.15mAq (1.5kPa)/m
50A	160	0.06mAq (0.6kPa)/m
60A	160	0.02mAq (0.2kPa)/m

② Rough indication about the equivalent pipe length corresponding to the pressure loss of joints

Nominal diameter	Equivalent pipe length (m)			
	Elbow	Gate valve	Check valve (Swing type)	Y-type strainer
20A	0.75	0.15	1.6	2.18
25A	0.9	0.18	2.0	3.00
32A	1.2	0.24	2.5	4.62
40A	1.5	0.30	3.1	5.47
50A	2.1	0.39	4.0	8.00
60A	2.4	0.48	4.6	11.50

③ Pressure loss of option part.

MTH-Q4E (3-way valve) 0.9mAq (9.2kPa)@17L/min

4-3 System diagram

The system diagram for using 2, 6 and 8 sets of 500liter cylinders are shown as follows.

Please install the unvented cylinder system by referring the following notabilia for system structures.

The number of cylinder which is connectable to one heat pump unit ESA30EH2 series should be 2, 6 or 8.

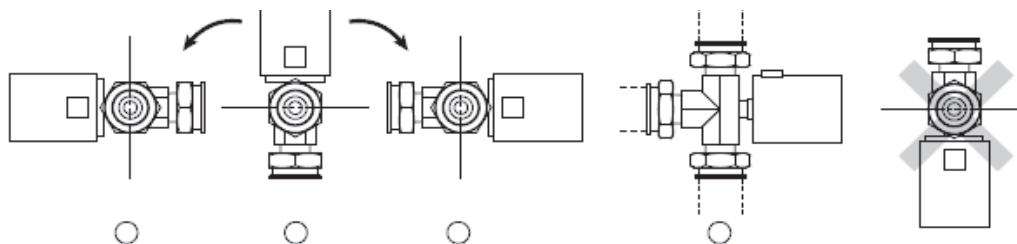
If you want to select other combination than these, please consult with our distributor.

The notabilia for system structure

* The item No. of notabilia is corresponding to the No. mentioned in the system diagram in the next page.

- ① Be sure to install an automatic air purge valve on each cylinder.
The air accumulates at the upper part of the system. So be sure to install an air purge valve at the place where the air may easily accumulate. Since the vapor with high temperature and high pressure may be blown out from the air purge valve, be sure to connect the air purge valve to the drain pipe.
Air purge valve should be installed within $\pm 5^\circ$ from upright position.
- ② Be sure to install a pressure relief valve on each system.
The pressure relief valve can prevent from increasing pressure of whole system at heating up.
Be sure to install a pressure relief valve at the place where the pressure in whole system can be released.
Since the hot water may be blown out from the pressure relief valve at heating up, be sure to connect the pressure relief valve to the drain pipe.
Pressure relief valve should be installed horizontally or downward from horizontal position of its outlet port.
- ③ The length of connecting pipe between cylinders shall be within 4m.
If the piping length is longer than this, heat release from the piping becomes more and then not only the hot water outlet temperature is decreased but also the pressure loss is increased.
- ④ When installing 3-way valve for anti-freezing, be sure to check its mounting direction before installation.
Please pay attention about the positional relation of Form B (Hot water storage side) and Form C. (Anti-freeze water circuit side)
B and C is marked on the valve body.
- ⑤ The 3-way valve for anti-freezing should not be installed at the position that its actuator is upside down.
In case installing the valve at the upside down position of its actuator, if water leak happens, water may intrude into the actuator and it may cause failure.

* Hot water stop valve is aw well.



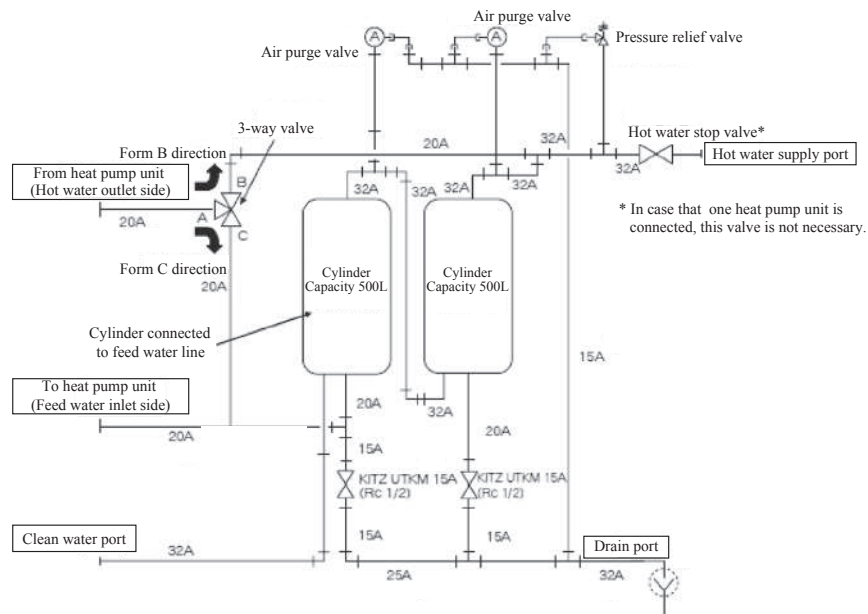
- ⑥ The drain cock for the cylinder connecting the feed water pipe shall be install at the position mentioned in the system diagram.
- ⑦ Be sure to insulate water piping and cylinders.
- ⑧ Please apply anti-freeze pipe heater to the water pipe as necessary.
- ⑨ The limitation of one way piping length between the heat pump and the cylinder is 15m. (equivalent length at pipe size 20A)
If the piping length exceeds 15m, select a bigger size pipe whose pressure loss is equal. (it can extend up to 45m at 25A)
Please refer to the installation manual attached to the cylinder procured locally for detail.
The pipe size between cylinders cannot be changed. Be sure to use 32A within 4m length.
- ⑩ The connecting wire between the heat pump unit and the cylinder cannot be extended to longer than 20m.
Be sure to check the distance between the heat pump unit and the cylinder before installation.
- ⑪ Drain port shall be open to the air by receiving drain with hopper and etc.
If not, the pressure in the cylinder may increase and it may cause deformation or damaged.
And drain water may flow backward and may intrude into the cylinder.
- ⑫ Drain piping shall be descending slope (1/100 or more) without trap and right-angle expansion.
- ⑬ In case of parallel system, the hot water stop valve is required for preventing drift.
- ⑭ Be sure to use the option parts, 3-way valve for anti-freezing (MTH-Q4E) and hot water stop valve (MTH-Q5E).
If not, it may cause malfunction.

Other points to be noted

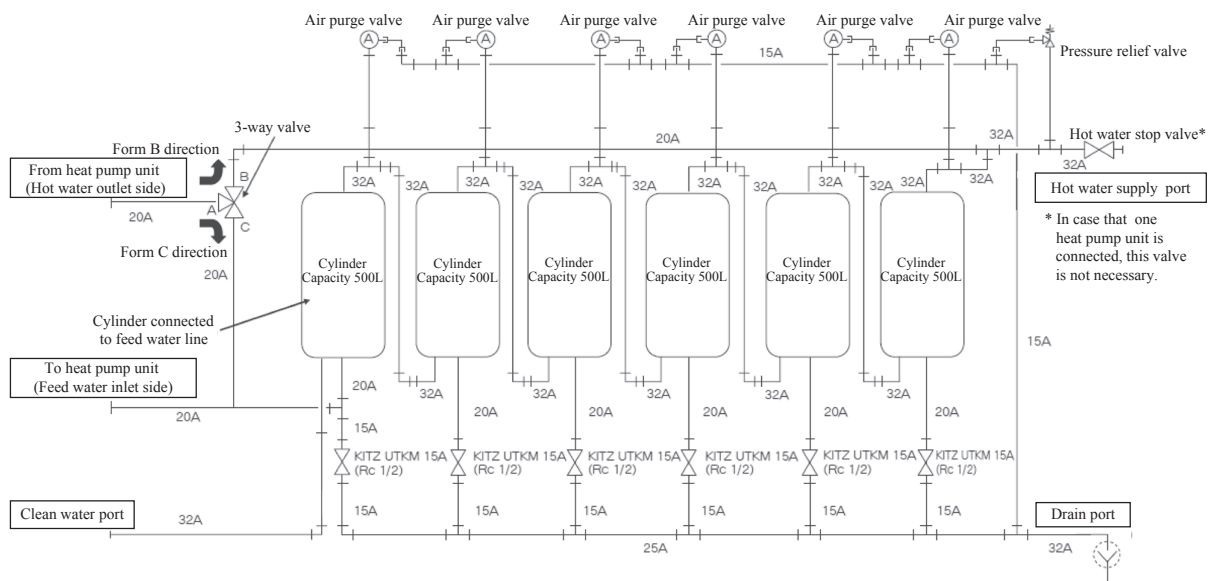
- Do not do brazing work near the cylinder.
The corrosive material included in the brazing material may give damage (Pin-hole) on the cylinder and it may cause water leak. Accordingly, regarding the piping work near the cylinder, please proceed screw connection by using union as possible as you can.
If you have to do welding or brazing work near the cylinder, be sure to cover the cylinder with some protection sheet and etc.
- After completion of the piping work, be sure to do air tightness test with N_2 gas (Pressure: about 0.2MPa) and check no leak.
If check with pressurized water and find leak, it is difficult to repair the brazed point.
Be sure to do air tightness test with N_2 gas before filling water in the system.

Installation example

(i) In case that 2 sets of cylinders are installed



(ii) In case that 6 sets of cylinders are installed



(5) Insulation work and water proofing work

5-1 Insulation work

- Temperature of cylinder and piping increase up to 90°C at the maximum. Be sure to insulate them from a view point of preventing from burns and keeping hot.

Insulation work shall be done to satisfy the following specifications.

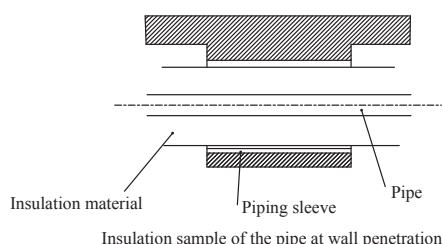
- Cylinder shell: Glass wool (Density is 16kg/m³) with 50mm or thicker
- Cylinder end plate: Glass wool (Density is 24kg/m³) with 50mm or thicker
- Water piping: Glass wool (Density is 48kg/m³) with thickness shown in following table or thicker

(Unit:mm)

Nominal diameter	Insulation thickness	
	Feed water	Hot water
20A	30	30
25A		30
32A		40
40A, 50A	40	50

Piping at wall penetration

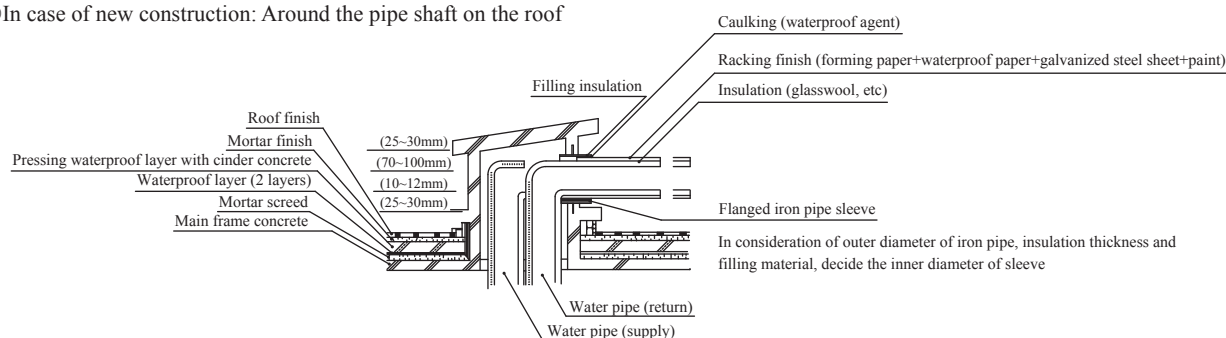
A part of wall penetration (following figure) and inlet/outlet port of water pipe at unit side shall be insulated.



5-2 Waterproofing work at the place where water pipe is passing through

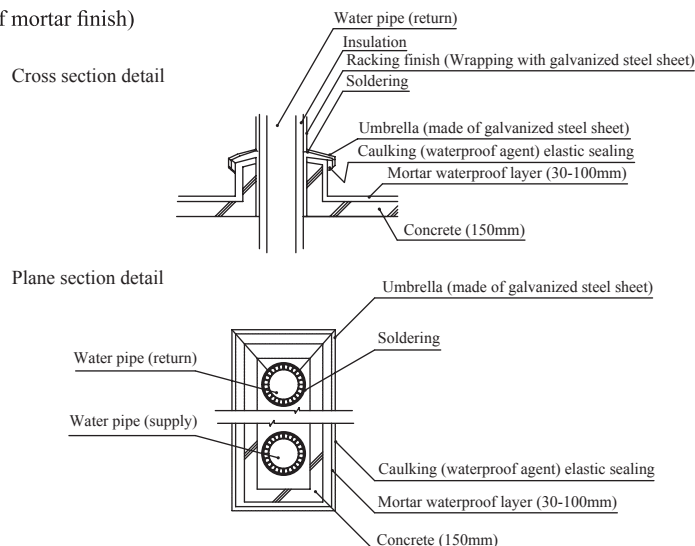
When connecting pipe to the hot water storage unit installed on the roof, if waterproof layer of the roof is cut with pipe or sleeve, It may cause rain leaking through the roof. Therefore please ask constructor to prepare the pipe penetration port mentioned below as construction work.

- In case of new construction: Around the pipe shaft on the roof



When connecting pipe to the hot water storage unit installed on the roof, if waterproof layer of the roof is cut with pipe or sleeve, It may cause rain leaking through the roof. Therefore please ask constructor to prepare the pipe penetration port like a small hut mentioned above as construction work.

- Roof penetration (in case of mortar finish)



(6) Electrical wiring work for the heat pump unit

Electrical installation work must be performed by an electrical installation service provider qualified by a power provider of the country.

Electrical installation work must be executed according to the technical standards and other regulations applicable to electrical installations in the country.

⚠ Please install an earth leakage breaker without fail. The installation of an earth leakage breaker is compulsory in order to prevent electric shocks or fire accidents.

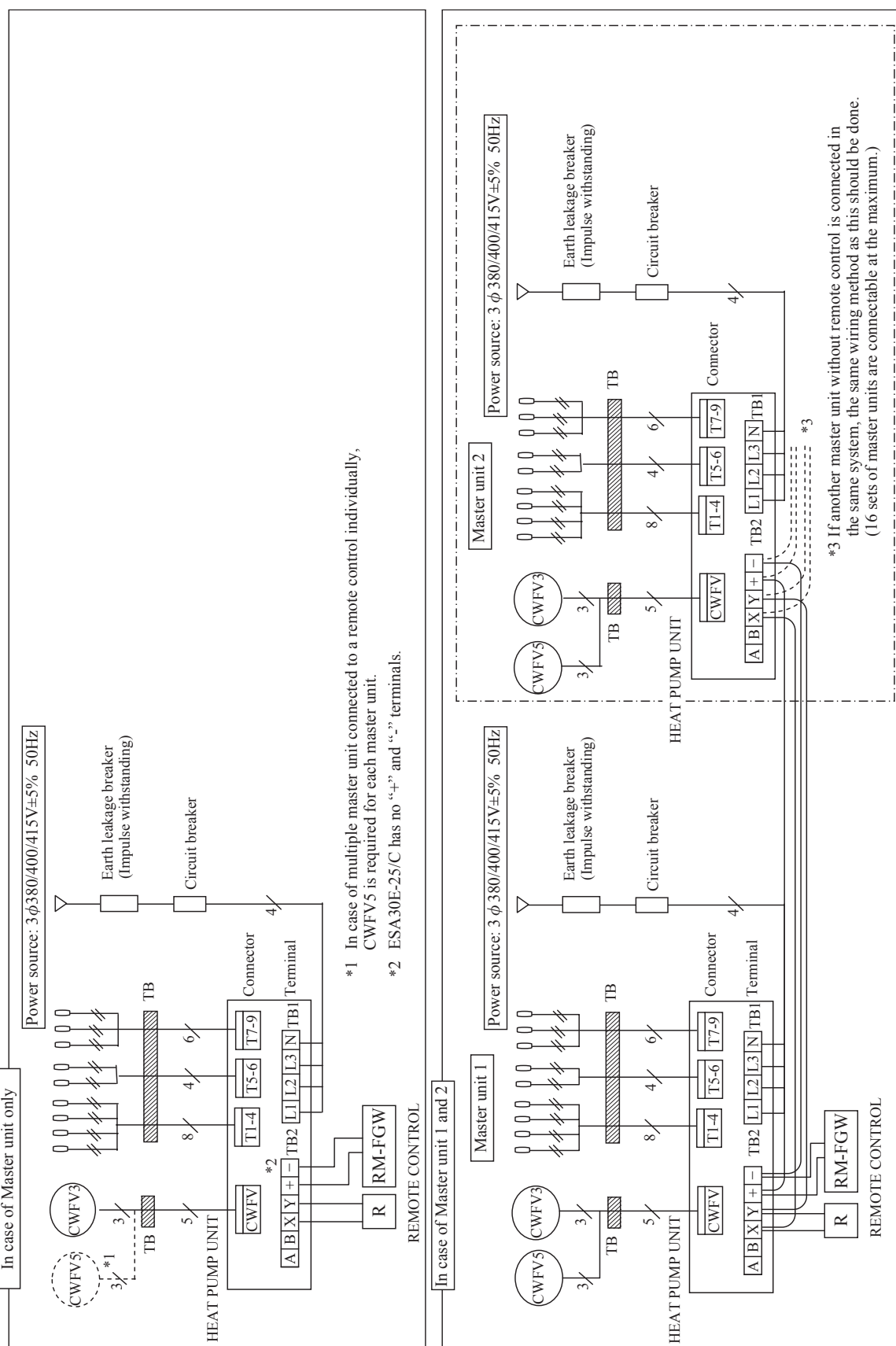
(Since this heat pump unit employs inverter control, please **use an impulse withstanding type one** to prevent the earth leakage breaker from false activation.)

Please note

- a) Use only copper wire.
 - Do not use any supply cord other than the one specified in parenthesis for each type of cord mentioned below.
 - Braided cord (Cord designation 60245 IEC 51), if allowed in the relevant part 2.
 - Ordinary tough rubber sheathed cord (Cord designation 60245 IEC 53)
 - Flat twin tinsel cord (Cord designation 60227 IEC 41)
 - Ordinary polyvinyl chloride sheathed cord (Cord designation 60227 IEC 53)

Please do not use any cord other than polychloroprene sheathed flexible cord (Cord designation 60245 IEC 57) for heat pump unit use.
- b) A grounding wire must be connected before connecting the power cable. Provide a grounding wire longer than the power cable.
- c) Ground the unit. Do not connect the ground wire to a gas pipe, lighting rod or telephone grounding wire.
 - If improperly grounded, an electric shock or malfunction may result.
 - Never connect the grounding wire to a gas pipe because if gas leaks, it could cause explosion or ignition.
- d) **The installation of an impulse withstanding type earth leakage breaker is necessary.** A failure to install an earth leakage breaker can result in an accident such as an electric shock or fire. Do not turn on the power until the electrical work is completed. Be sure to turn off the power when servicing.
- e) Please do not use a phase advance capacitor for power factor improvement under any circumstances. (It does not improve power factor, while it can cause an anomalous overheat accident.)
- f) For power source cables, use conduits.
- g) Please **do not lay electronic control wires (remote control and signal wires) and other high current cables together outside the unit.**
 - Laying them together can result in malfunction or failure of the unit due to electric noise.
- h) Power cables and signal wires must always be connected to the terminal blocks respectively and secured them with cable fastening clamps provided in the unit.
- i) Clamp cables so that they may not touch the pipe, etc.
- j) When cables are connected, please make sure to check no loose connection or disconnection at connecting coupling of all electrical components in the control box and then attach the cover to control box securely. (Improper cover attachment can result in malfunction or a failure of the unit, if water penetrates into the control box.)
- k) Make sure to use circuit breakers (earth leakage breaker and circuit breaker) of proper capacity.
 - Use of breakers of larger capacity could result in trouble on components or fire accident.
 - The circuit breaker should isolate all poles under over current.
- l) Install an isolator or a cut-off switch on the power source line in accordance with the local codes and regulations. The isolator shall be locked to keep the power source line in OFF state in conformity with EN60204-1.
- m) After maintenance service, be sure to restore all wiring, bundling wire and wiring route to their original state in order for them not to touch to the metal parts.

6-1 Wiring system diagram



CAUTION

If the earth leakage breaker is exclusively for ground fault protection, the installation of circuit breaker for cabling shall be required separately.

- a) Be sure to lead power cables, grounding wire, signal wire and remote control wire to the terminal block.
Each wiring shall be connected to the terminal block securely.
Power cable and grounding wire should be fixed with band.

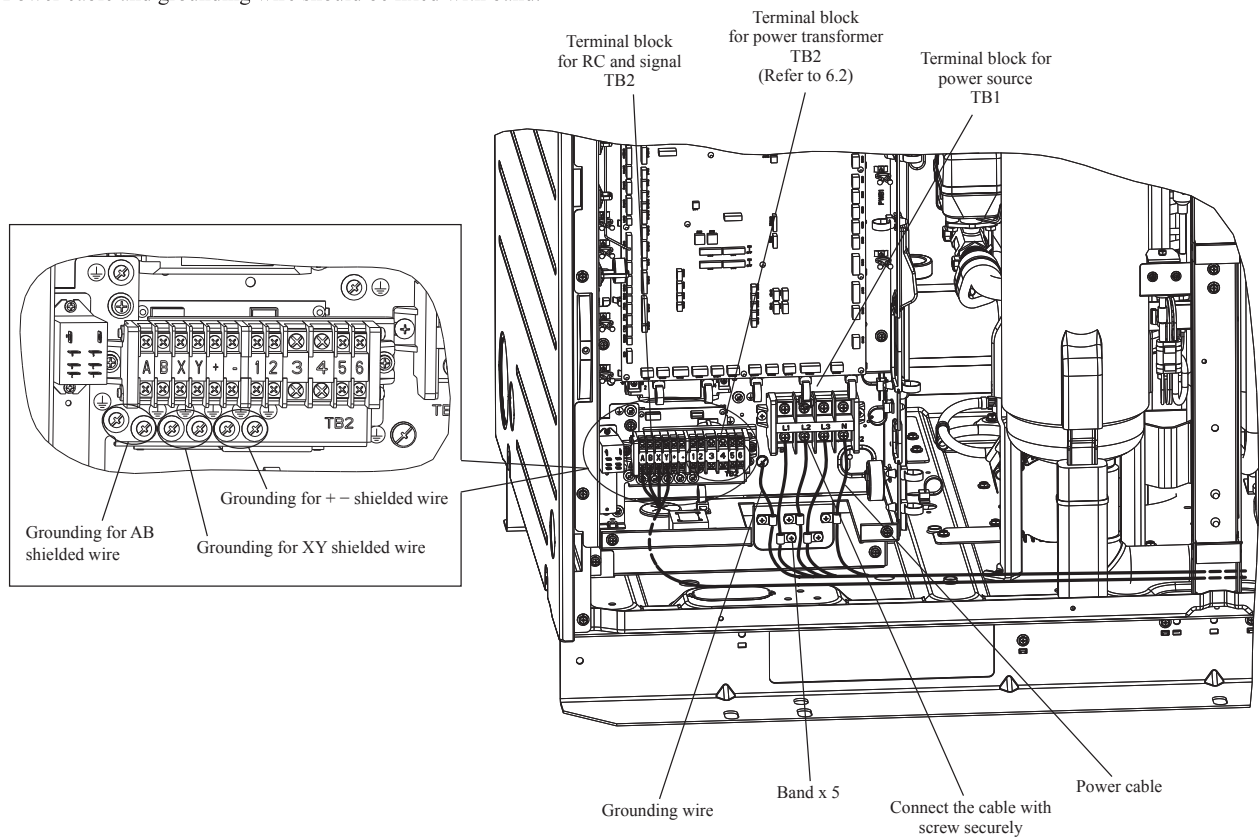


Figure-a

- b) In case to lead cables and wires to below the base plate

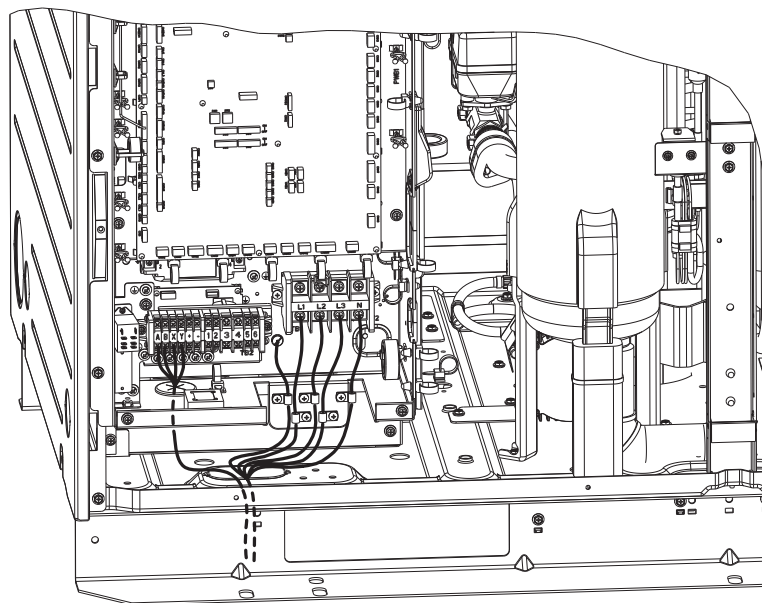


Figure-b

The figure-a shows the case to pull out cables to right front corner. In case to lead cables to below the base plate refer to figure-b.

6-2 Precautions for power wiring to creating $200V \pm 10\%$ of power voltage for control line.

This heat pump unit corresponds to 3-phase $380V \pm 5\%$ (50Hz), $400V \pm 5\%$ (50Hz) and $415V \pm 5\%$ (50Hz). of power specifications.

However for creating $200V \pm 10\%$ of power source voltage for control line, it is necessary to change connection of wire on the terminal block (TB2) in the control box according to the power source voltage to be used.

After change connection of wire according to the following flow chart, please check whether $200V \pm 10\%$ of power source voltage can be detected by measuring with a multi tester.

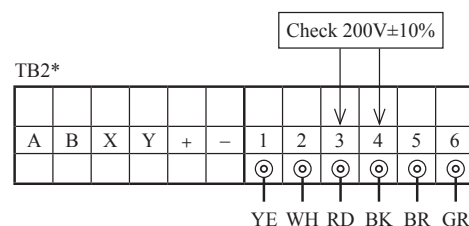
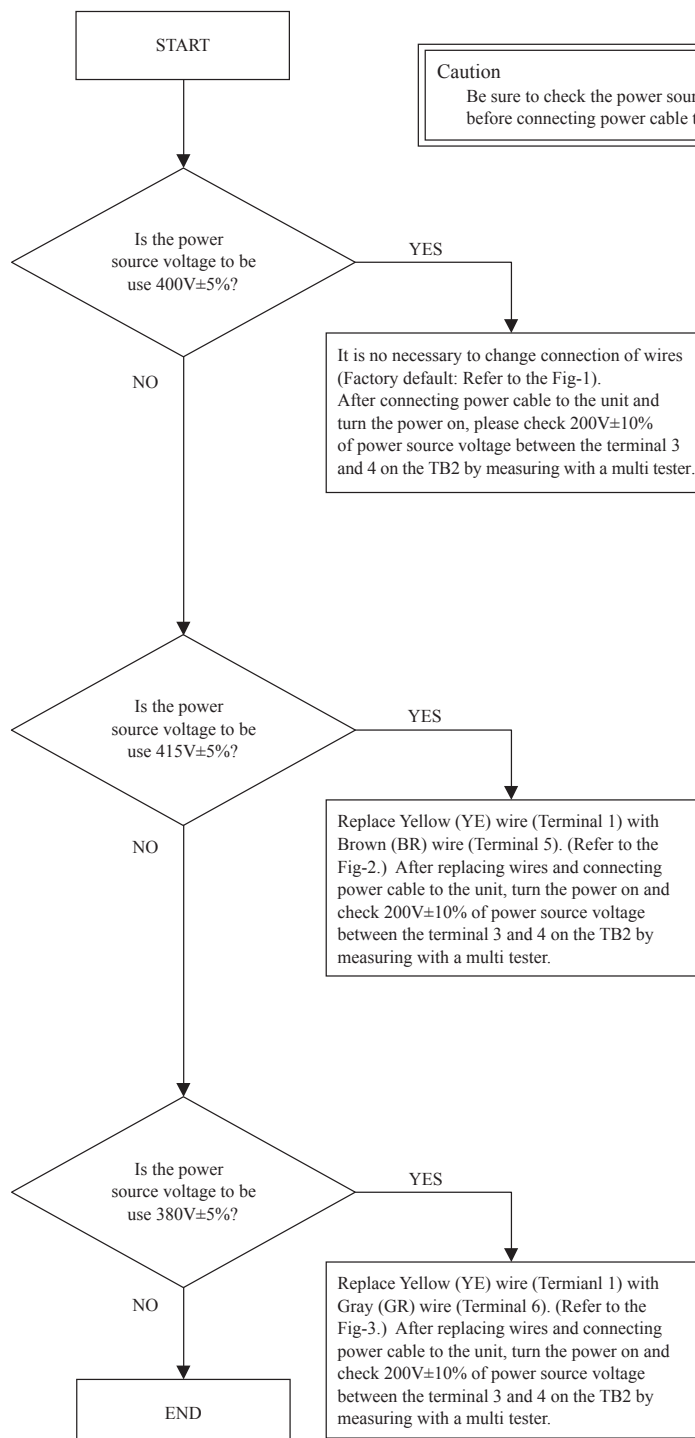


Fig-1 Wiring method for $400V \pm 5\%$
(Factory default)

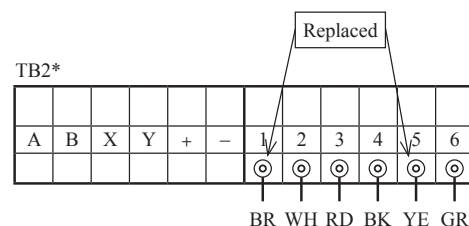


Fig-2 Replaced wires for $415V \pm 5\%$
from factory default

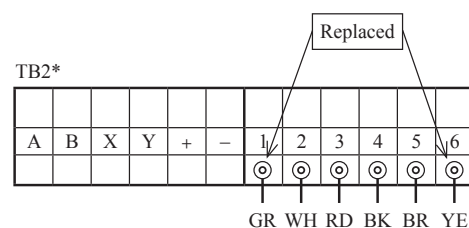


Fig-3 Replaced wires for $380V \pm 5\%$
from factory default

*ESA30EH2-25/C has no “+” and “-” terminals.

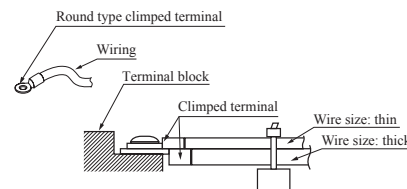
6-3 Connecting method of power cable

(a) Method for leading out cables

- Cables can be led out through the front, right, left panel and bottom plate.
- In wiring on installation site, cut off a half-blank ($\phi 50$ or elongate hole 40×80) cover for penetration of cables with nipper.
- In case of a collective drain piping, please use the hole to lead out cables or pipe other than the hole on bottom plate.
If the hole on bottom plate is used, be careful to apply adequate seal in order not to leak drain.

(b) Notabilia in connecting power cables

- Connect the grounding wire before connecting power cable. When connecting a grounding wire to a terminal block, use a grounding wire whose length is longer than the power cable so that it may not be subject to tension.
- Do not turn on power until installation work is completed. Turn off power to the unit before servicing the unit.
- Ensure that the unit is properly grounded.
- Power cables must always be connected to the power cable terminal block and clamped them outside the control box.
- In connecting to the power cable terminal block, use a round -type crimped terminal.
- If 2 cables connect to one terminal block, be sure to put the crimped terminals to back connection.
And in such case please place a thin cable on the thick cable as shown in the right figure
- Use specified wires in wiring, and fasten them securely in such a manner that the terminal blocks are not subject to external force.
- In tightening a screw of terminal block, be sure to use a correct-size screw driver.
Tightening a screw of terminal block with excessive torque force may break the screw.
For the tightening torque of terminals, refer to the table shown at right.
- When electrical installation work is completed, make sure that all electrical components in the control box have no loose connector coupling or no loose terminal connection.



Tightening torque (N·m)		
M4	Signal line terminal block	0.68-0.82
M6	Grounding wire	2.50-3.00
	Power cable terminal block	

(c) Heat pump unit power source specifications: 3-phase 380V/400V/415V $\pm$ 5% 50Hz

Cable size for power source (mm ²)	Wire length (m)	Earth leakage breaker (Grounding fault, overload, short-circuit protection)	Earth wire	
			Size (mm ²)	Screw type
14	40	30A, 30mA, 0.1sec or shorter	14	M6

Please note

- ① Wiring procedure is determined by JEAC8001. (Please adapt it to the regulations in effect in each country.)
- ② The wire length and cable size in above table show that within 2% of voltage drop. If the wire length exceeds the value shown in the above table, review the cable size according to the regulations of the country.
- ③ If the earth leakage breaker is exclusive for ground fault protection, the circuit breaker is required additionally.
For selecting the circuit breaker, please refer to the technical manual or ask our distributor.

6-4 Connecting method of signal wire

- The signal line is DC5V so that please do not connect single phase 220V/230V/240V of power cable to the signal line.
In case to connect power cable, the fuse on the control PCB is blown.

- ① Please check that power cable is not connected to the signal line.
- ② Before turning on power source, be sure to check resistance on the terminal block of signal line.

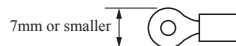
If the measured resistance is 100 Ω or lower, power line may touch to signal line.

- Standard signal wire size is 0.75mm² x 2 cores shielding wire. (MVVS)
- The both end of shielding wire shall be grounded.

• Remote control wiring

- Standard remote control wire size is 0.3mm² x 2 cores shielding wire. (MVVS)
- The both end of shielding wire shall be grounded.
- If using 100m or longer wire, please use the wire size shown in below table.

Length (m)	Wire size
100 $\leq$ < 200	0.5mm ² x 2 cores shielding wire (MVVS)
200 $\leq$ < 300	0.75mm ² x 2 cores shielding wire (MVVS)
300 $\leq$ < 400	1.25mm ² x 2 cores shielding wire (MVVS)
400 $\leq$ < 600	2.0mm ² x 2 cores shielding wire (MVVS)



(7) Electrical wiring work for the unvented cylinder

- In the area where the outdoor air temperature becomes below 0°C, it is necessary to apply the anti-freeze pipe heater on the water pipe in which water may freeze.

Please prepare the exclusive power source for the anti-freeze pipe heater.

* As a guide, the Anti-freeze pipe heater output is 10W per 1m of piping length. (In case of enough insulation thickness)

After checking the specifications of heater, please select the breaker size and wire size.

- Electrical instruction work must be performed by an electrical service provider qualified by a power provider of the country.
- Electrical installation work must be executed according to the technical standard and other regulations applicable to electrical installation in the countries.

⚠ Please install an earth leakage breaker without fail. The installation of an earth leakage breaker is compulsory in order to prevent electric shocks or fire accidents.

(Please use **an impulse withstanding type one** to prevent an earth leakage breaker's false activation.)

Please note

- Use only copper wires.
Do not use any supply cord other than the one specified in parenthesis for each type of cord mentioned below.
 - Braided cord (Cord designation 60245 IEC 51), if allowed in the relevant part 2.
 - Ordinary tough rubber sheathed cord (Cord designation 60245 IEC 53)
 - Flat twin tinsel cord (Cord designation 60227 IEC 41)
 - Ordinary polyvinyl chloride sheathed cord (Cord designation 60227 IEC 53)
 Please do not use any cord other than polychloroprene sheathed flexible cord (Cord designation 60245 IEC 57) for heat pump unit use.
- A grounding wire must be connected before connecting the power cable. Provide a grounding wire longer than the power cable.
- Be sure to do grounding work. Do not connect the grounding wire to a gas pipe, water pipe, lightning rod or telephone grounding wire. Improper grounding may cause electric shocks or malfunction.
Never connect the grounding wire to a gas pipe, because, if gas leaks, it could cause explosion or ignition.
- The installation of an impulse withstanding type earth leakage breaker is necessary.** A fail to install an earth leakage breaker may cause electric shocks or fire accident.
Do not turn on the power until the electrical work is completed. Be sure to turn off the power when servicing.
- Please do not use a phase advance capacitor for power factor improvement under any circumstances. (It does not improve power factor, while it can cause an anomalous overheat accident.)
- For power source cables, be sure to use conduits
- Please **do not lay electronic control wires (signal wire) and other high current cables together.**
Laying them together may cause malfunction or failure due to affection of electric noise.
- Power cables and signal wires must always be connected to the terminal blocks respectively and secured them with cable fastening clamps provided in the unit.
- Clamp cables so that they may not touch the pipe, etc.
- When cables are connected, please make sure to check no loose connection or disconnection at connecting coupling of all electrical components in the control box and then attach the cover to control box securely. (Improper cover attachment can result in malfunction or a failure of the unit, if water penetrates into the control box.)
- Make sure to use circuit breakers (earth leakage breaker and circuit breaker) of proper capacity.
Use of breakers with larger capacity could result in trouble on components or fire accident.
The circuit breaker should isolate all poles under over current.
- Install an isolator or a cut-off switch on the power source line in accordance with the local codes and regulations. The isolator shall be locked to keep the power source line in OFF state in conformity with EN60204-1.
- After maintenance service, be sure to restore all wiring, bundling wire and wiring route to their original state in order for them not to touch to the metal parts.

7-1 Applying method of hot water temperature sensors on the cylinder

Please apply temperature sensors at the positions mentioned in following figure according to the following table.

Temperature sensor should be applied from the nearest position of hot water inlet port on the cylinder in the order of Tht-1, Tht-2,....

Please use aluminum adhesive tapes with 90°C or higher of heat resistance for applying the temperature sensor.

* If the sensors are applied to wrong positions or applied insufficiently, the heat pump unit may not be operated properly due to wrong detection of hot water temperature.

The position to apply temp sensor according to the hot water amount %

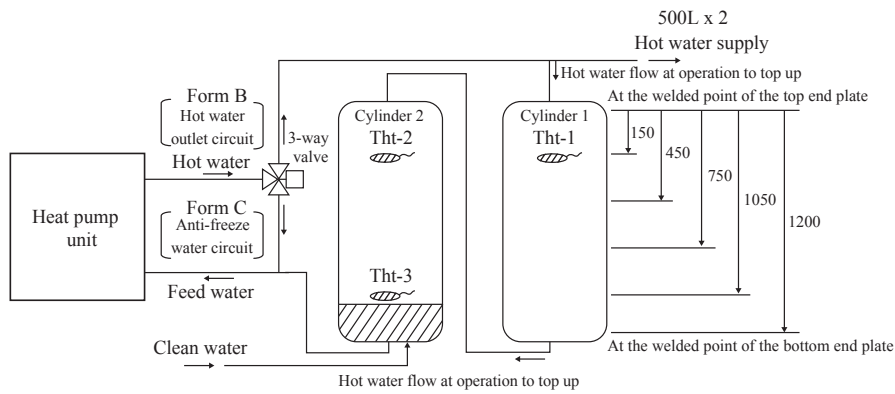
Number of sensors to apply							
Sensor No.	3 pcs.	4 pcs.	5 pcs.	6 pcs.	7 pcs.	8 pcs.	9 pcs.*1
Tht-1	20%	20%	20%	10%	20%	10%	10%
Tht-2	60%	50%	40%	30%	30%	20%	20%
Tht-3	100%*2	75%	60%	40%	40%	30%	30%
Tht-4		100%*2	80%	60%	50%	50%	40%
Tht-5			100%*2	70%	65%	60%	50%
Tht-6				100%*2	80%	70%	60%
Tht-7					100%*2	80%	70%
Tht-8						100%*2	80%
Tht-9							100%*2

*1 Recommendable number of sensors is 9 pcs.

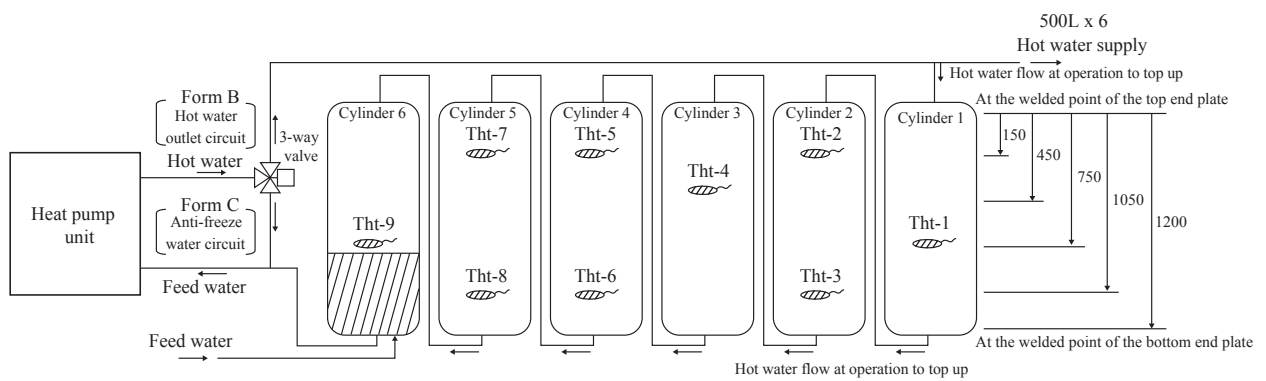
If the number of sensors is less than 9 pcs., the hot water amount cannot be detected correctly.

*2 The sensor which detects 100% of HW amount shall be applied to the position within the range of sensitive volume with consideration of dead volume which is 10% of total volume of cylinder.

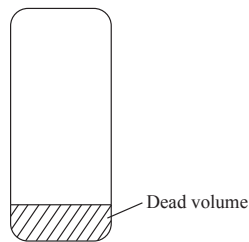
(i) In case that 2 sets of cylinders are installed



(ii) In case that 6 sets of cylinders are installed



Note: If the height of the cylinder is different from above, please apply temperature sensors at the position as same vertical proportion as above.



7-2 Wire connecting method

Please note

- ⊙ Do not turn on the power until the electrical work is completed. Be sure to turn off the power when servicing.
- ⊙ Use the specified wires, connect them securely and clamp them in order for any external force not to be applied to the terminal. (locally procured)
- ⊙ For tightening screws on the terminal, please use a proper screwdriver.
If tightening screws too much, a screw may be damaged.
Please refer to the tightening torque shown in the right table.
- ⊙ Please connect wires to the terminals or connectors correctly by checking the terminal No. and the marker of the lead wire.
If connecting incorrectly, the heat pump unit may not be able to be operated.
- ⊙ After completion of wiring work, be sure to check a loose connection of connector or disconnection of wire on each electric components in the control box.

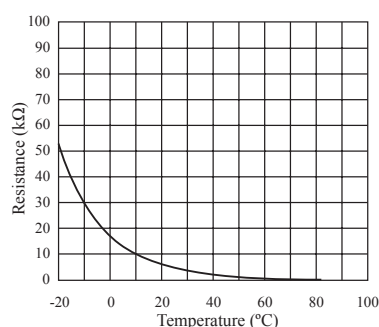
Tightening torque		
M3.5	Terminal block for power and signal wires	0.68-0.82

(i) Connecting method of temperature sensor

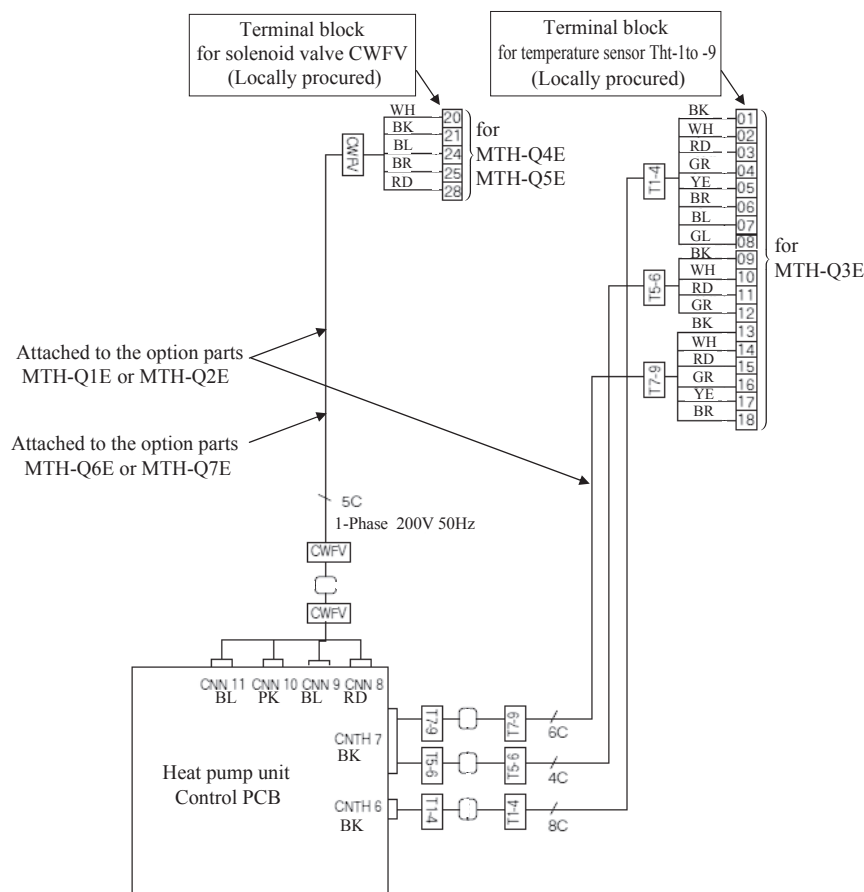
- Connect the lead wires of temperature sensors applied on the cylinder to the specified position on the terminal block. (for M3.5, with 18 terminals for 6 and 8 cylinders/4 terminals for 2 cylinders) (Refer to the figure on next page.)
Connect the lead wires to the terminal block by using round type crimped terminals.
Put the terminal block into a pull box and etc. in order to protect from water or dust.
- When connecting the lead wires of temperature sensors (Tht-1 to Tht-9), be sure to check the terminal No. mentioned in the figure on next page and connect them properly.
Wrong connection may cause malfunction of the heat pump unit.
- The lead wire length of the temperature sensor is 1.2m. If extension of wire is required for connecting to the terminal block, please use 0.3mm² or bigger size of wire with 2 cores.
* The wire length to be able to extend is 4m at the maximum.
Be sure that the connecting wire between the terminal block of the cylinder and the heat pump unit cannot be extended.
- After connecting the temperature sensors to the terminal block, please check the resistance of the sensors and whether there is no anomaly or disconnection of sensor wire.

Electric characteristics of temperature sensor

Hot water temperature sensor for unvented cylinder (Tht-1 to -9)



- By using temperature sensors of the wiring kit MTH-Q3E, connect the heat pump unit and terminal block.
There are totally 3 sets of temperature sensors with 8, 4 or 6 cores. Check the No. [1] - [18] on the markers of the lead wires and connect them to the terminal block with round type crimped terminals.
- In case of 2 sets of the cylinders, please connect only the wires with No. [1] - [4] on these markers.
Regarding wires with the No. [5] - [8] on these markers, please apply insulating treatment to the end of these lead wires.
The wires with the No. [9] - [18] on these markers do not be used.
- Lead the connector side of the lead wires of temperature sensors to the control box of the heat pump unit and connect them to the specified connectors.
Check the markers [T1-4], [T5-6] and [T7-9] of the lead wire and connect them as follows.
In case of 2 sets of the cylinders, please connect only the wires with [T1-4] on these markers.

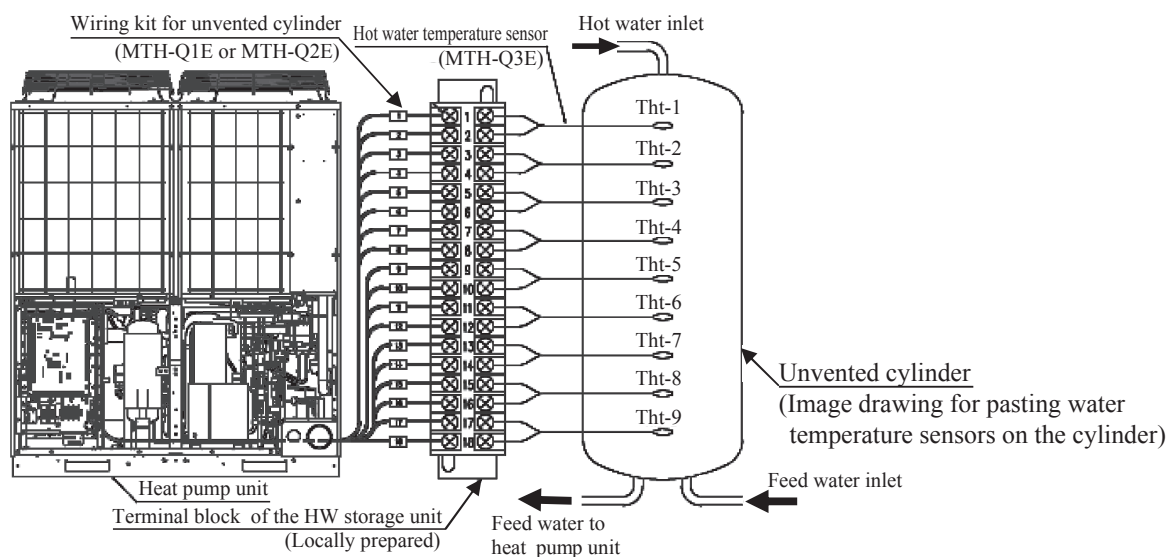


7-3 Connection of signal wire

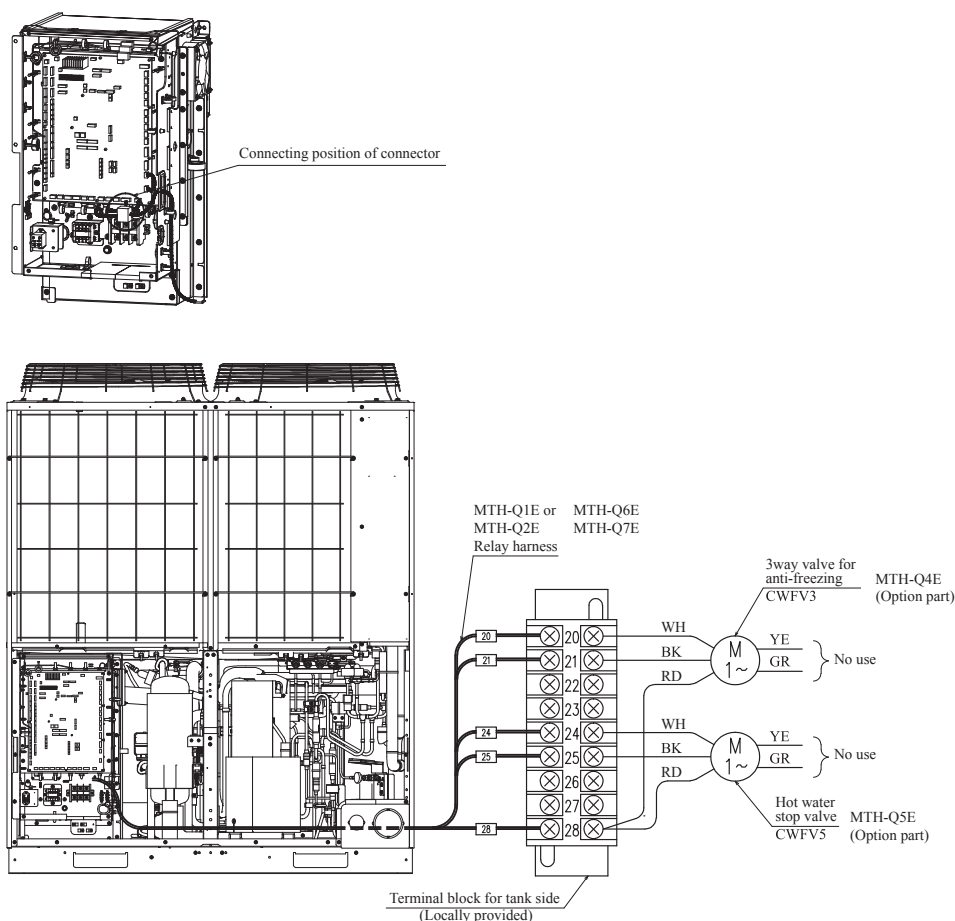
- 1) The temperature sensor wiring connectors (They are connected to the CNTH6 and CNTH7 on the control PCB in the control box of the heat pump unit at the factory) and the temperature sensor terminal block in the control box of the HW storage unit are interconnected with sensor wires. Please connect the sensor wires crimped round-type terminals to the temperature sensor terminal block with screws according to the predetermined No.

If the sensor wire is disconnected, heat pump unit cannot be operated.

Therefore please check the continuity with tester after wiring connection.



- 2) Wiring connectors of the motor-operated valve (They are connected to the CNN8 to CNN11 on the control PCB in the control box of heat pump unit at the factory) and the terminal block of motor-operated valve are interconnected with connection wires locally. Please connect the connection wires crimped round-type terminals to the terminal block in the control box of HW storage unit with screws according to the predetermined No.



7-4 Control setting when unvented cylinder is connected.

Please implement the control setting according to the instruction mentioned in “8. Control setting”.

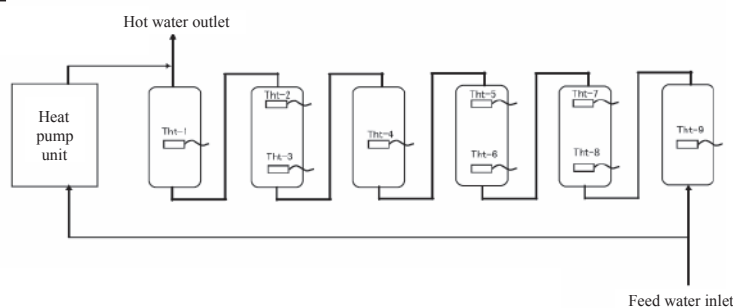
- DIP switch setting
Be sure to set SW3-3 OFF

- 7-segment LED setting
"P01"= 9 (sets of cylinder sensors) [Factory default]

The followings are examples to paste 9 sensors on the unvented cylinder.

Example

For 3000Liter (6 x 500Liter) cylinder



7-5 Anti-freezing water circuit for unvented cylinder

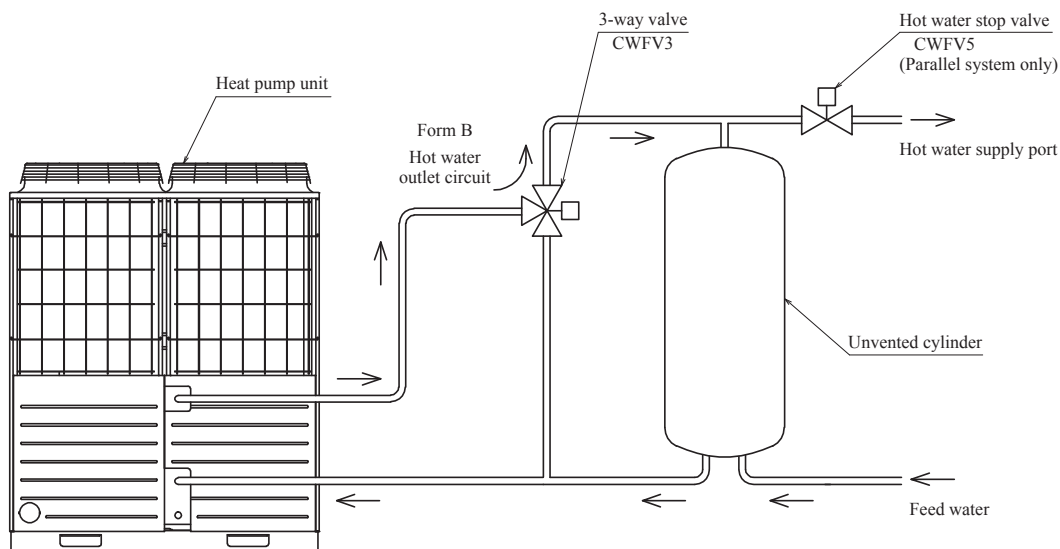
In case that the water in the pipe may be frozen due to decreasing the water temp below 0°C in winter season during the long term stop or anomaly stop of heat pump unit, the water pump is forcibly operated in order to prevent water in the pipe from freezing. The water flow is changed to ② anti-freezing water operation mentioned below.

[Water circuit]

① Normal operation (Just reference)

Compressor: ON

Gas cooler inlet water temperature > 3°C



3-way valve operation position

② Anti-freezing water operation

[Starting condition]

- Compressor: OFF
- Following condition is satisfied

SW3-5	Unvented cylinder
OFF	Outdoor air temperature $\leq 3^{\circ}\text{C}$
ON	Outdoor air temperature $\leq 3^{\circ}\text{C}$ and Gas cooler inlet water temperature $\leq 3^{\circ}\text{C}$

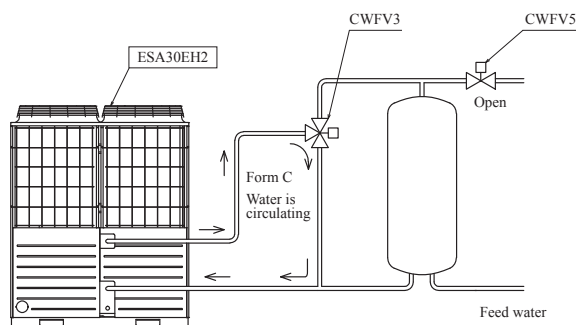
[Ending condition]

- Compressor start condition is satisfied.
- Following condition is satisfied

SW3-5	Unvented cylinder
OFF	Outdoor air temperature $\geq 5^{\circ}\text{C}$
ON	Outdoor air temperature $\geq 5^{\circ}\text{C}$ or Gas cooler inlet water temperature $\geq 5^{\circ}\text{C}$

[Control conditions]

- Operate water pump at 3 to 5 liter/min.
 - CWFV3 is OFF
 - Circulate water as mentioned below.



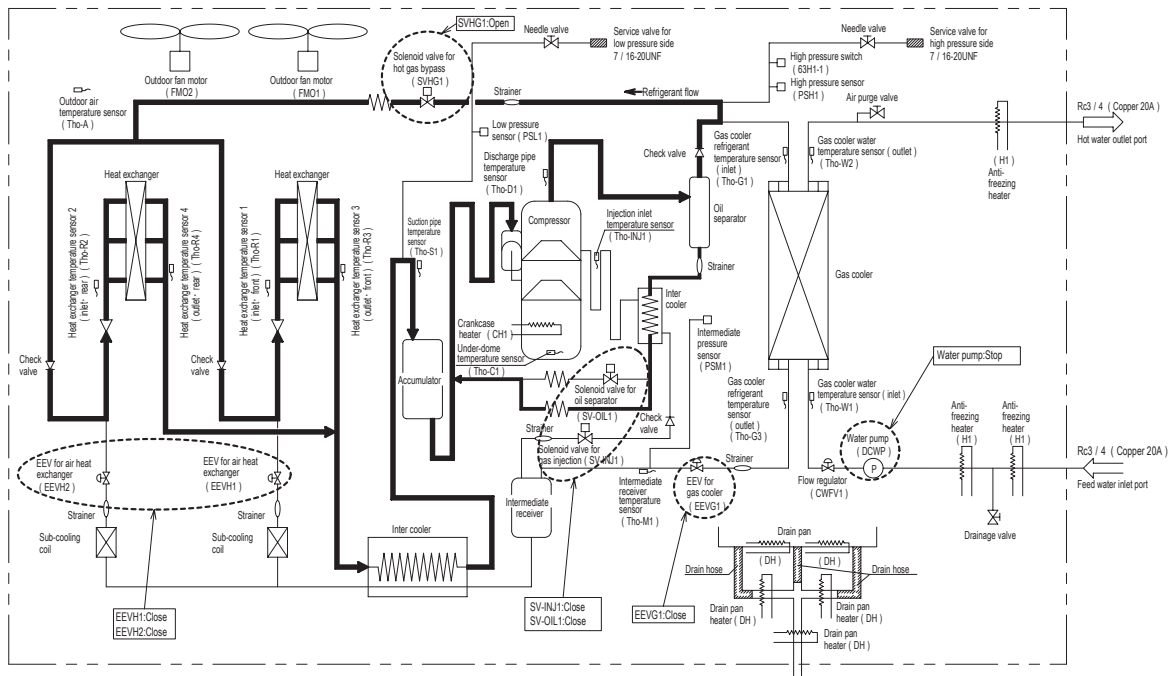
7-6 Defrost operation for unvented cylinder

In order to recover from dropping the heating capacity for producing hot water due to the frost on the heat exchanger of heat pump unit, defrost operation is done periodically.

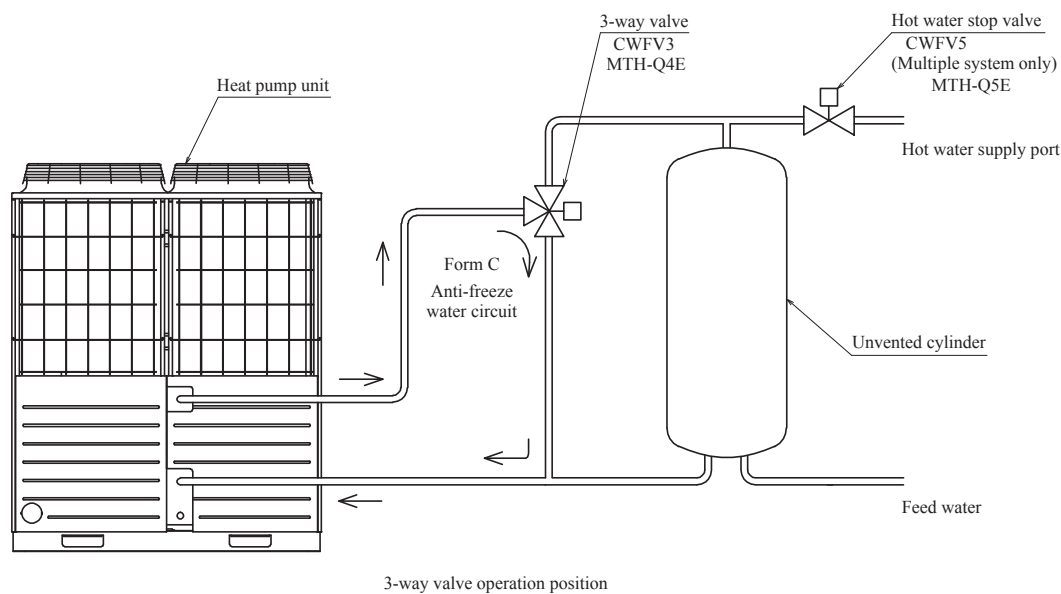
When the defrost starting condition is satisfied, defrost operation is started and the frost on the heat exchanger is defrosted by opening the hot gas bypass valve (SVHG1) to flow the discharge gas into the air heat exchanger.

Following diagram shows the behavior of functional parts and the flow of refrigerant and water.

[Refrigerant circuit]



[Water circuit at defrost operation]



(8) Control setting

8.1 Unit address setting

This control system controls the communication among the controls consisted of multiple heat pump units and remote controls by the micro-computer built in the each control.

After setting address and the communication among the multiple heat pump units is established, check the communication method by 7-segement display of the heat pump unit.

- In case no setting of master and slave units (In case of connecting remote controls to all heat pump units individually)

• Address No. setting

Set the DIP switches SW1 and SW2 on the control PCB according to the list of [Address setting method]

Control PCB	SW1, SW2	For setting address No. of a heat pump unit (Ones digit and tens digit)
-------------	----------	---

• Address No. setting method

	Address setting of heat pump unit
	Heat pump unit No. (SW1 and SW2)
Manual address setting	00–31

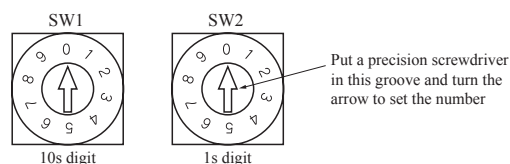
Do not set other than the number listed on this table.
It may cause error.

How to set address

Before the power ON, please set address as follows.
Address is registered by turning the power ON.

Set the address No. of heat pump units within the range of 00 to 31 with SW1 and SW2.

However the Max. connectable number of heat pump units is 16 units. Be sure not to set any duplicated address No. on the units in the same system. With that, the address setting is done.



*Be sure to check SW4-7 and SW4-8 are OFF

8.2 Switching control

Control contents of heat pump unit can be changed by DIP switches on the control PCB and the software switches displayed at 7-segment LED as shown in following tables.

Select PXX at 7-segment LED first and set the number of ones digit with SW8 and 10s digit with SW9, and then hold down SW7 (for data erase and data write-in) for 3 seconds.

Please refer the software switch setting in item (4) on next page for details.

Switching control method		Switching control content
Setting switch on the control PCB	CXX, PXX setting on 7-segement display	
SW5-1 ON	—	Primary setting of operation
SW5-2 ON	—	Water pump test run
SW5-3 ON	—	Valve (Supply hot water stop valve and emergency feed water valve) open/close test
SW4-5; OFF, SW4-6: OFF (*1) 80% (Factory default)	Set the external input function allotment to "1" (*1)	If the signal is input to the external input terminal, it will be demand mode. (J13 Short: Level input, J13 Open: Pulse input)
SW4-5; ON, SW4-6: OFF (*1) 60%		
SW4-5; OFF, SW4-6: ON (*1) 40%		
SW4-5; ON, SW4-6: ON (*1) 0%		
SW6-6 ON	—	Operation to fill up
J13: Short (Factory default), J13: Open	—	Switching external input signal (CNS1 and CNS2 only) Short: Level input, Open: Pulse input
J15: Short (Factory default), J15: Open	—	Defrost control Short: Normal (Factory default), Open: For cold region

8.3 Check DIP switch setting

Check the settings of following DIP switches on the control PCB.

Especially for SW3-3, be sure to set after checking the type of HW storage unit (Unvented or Open)

*1 In EU counties, please kept SW3-3 "OFF", because only the unvented cylinder is supplied in the market.

DIP switch	Input item (OFF/ON, Open/Short) "★" shows factory default	Check item	DIP switch	Input item (OFF/ON, Open/Short) "★" shows factory default	Check item
SW3-1	Inspection LED reset Normal ★/Reset		SW6-1		Check switch kept "OFF"
SW3-2		Check switch kept "OFF"	SW6-2		Check switch kept "OFF"
SW3-3*1	Type of tank Unvented ★/Open	Check switch kept "OFF"	SW6-3	Defrost starting temperature Normal ★/Cold region	
SW3-4		Check switch kept "OFF"	SW6-4	The periodic check 1,2 displayed Enable ★/Disable	
SW3-5		Check switch kept "OFF"	SW6-5		Check switch kept "OFF"
SW3-6		Check switch kept "OFF"	SW6-6	Operation to fill up OFF ★/ON	
SW3-7	Reset cumulative operation hours after the previous checking Normal ★/Reset		SW6-7	CWFV open/close OFF ★/ON	
SW3-8	Test mode Normal ★/Test mode		SW6-8		Check switch kept "OFF"
SW4-4	Return hot water control Invalid ★/Valid		J10		Check J10 kept "Short"
SW5-1	Primary setting of operation Normal ★/Start test run		J11		Check J11 kept "Short"
SW5-2	Water pump test run Normal ★/Start test run		J12		Check J12 kept "Short"
SW5-3	CWFV open/close test Normal ★/Forced operation		J13	External input signal type Pulse/Level ★	
SW5-4	Setting change Setting change/Normal ★		J14		Check J14 kept "Short"
SW5-5		Check switch kept "OFF"	J15	Defrost starting temperature Cold region/Normal ★	
SW5-6	Switching to 24hour operation Normal ★/24hour operation		J16		Check J16 kept "Short"
SW5-7	For air tightness test & etc. EEVH&EEVG normal ★/fully open				
SW5-8	For air tightness test & etc. EEVH&EEVG normal ★/EEVH fully open & EEVG close				

8.4 Software switch setting

Each control and setting can be set by the software switch.
Please set the setting according to the following procedure mentioned in item (b) by 7-segment display.

If No. of water temperature sensors for unvented cylinder are less than 8 pieces, this setting is required. Refer to item (b).

Code No.	Data display		Minimum unit
	Content	Display range	
P01	No. of tank water temperature sensor	9: (Factory default) 0 - 9	1 piece

(a) Unvented cylinder

Input the No. of sensors according to the capacity of the cylinder connected.

[Example] "P01" = 9 (Factory default)

(b) Setting procedure of 7-segment display

① Each item can be displayed at the 7-segment LED (3-digit x 2) on the control PCB of heat pump unit.

② Display operation is done by the DIP switches SW7-SW9

SW9:: Setting switch for 10s digit of code display

SW8:: Setting switch for 1s digit of code display

SW7:: Setting switch for data erase/data writing-in

③ Code No. of each item is selected by pressing SW9 for 10s digit and SW8 for 1s digit.

The identification alphabets of code display are following 2.

"C" : [C00] - [C99]

"P" : [P00] - [P99]

④ By pressing SW9 (for 10s digit), it makes the code display jumping to the leading code of each 10s digit.

It jumps "C00" - "C90" and displays "P00".

⑤ By pressing SW8 (for 1s digit), it displays in the order of 0⇒2⇒...⇒9⇒0.

It displays in the order of "P00"⇒"P01"⇒"P02"⇒...⇒"P09"⇒"P00"

⑥ Select the code No. to be changed and hold down SW7 (for data erase/data write-in) for 3 seconds.

⑦ The data at data display LED blinks for every 0.5 second

(Under this status, if there is no SW input for 10 seconds, data write-in mode will be ended.)

⑧ Press SW9 (for 10s digit) and SW8 (for 1s digit) and change data.

⑨ Under the status of data blinking, if holding down SW7 for over 3 seconds, the data display changes to lighting up.

By this operation, the data of each item is memorized in EEPROM. Since then, the unit is controlled to operate according to this control contents.

⑩ Even if resetting the power, the unit is controlled to operate according to this control contents which is changed and memorized.

Ex.
"P01" In case of change the No. of cylinder water temperature sensor. (from 9 to 2 pieces)

- Display "P01" at 7-segment LED by SW8 and SW9. Display [P][0][1]
- When holding down SW7 for 3 seconds, 9 of [P][0][1] blinks.
- Press SW8 (for 1s digit) to change from 9 to 2 of [P][0][2] blinks.

* In case of change setting of 10s digit, use SW9.

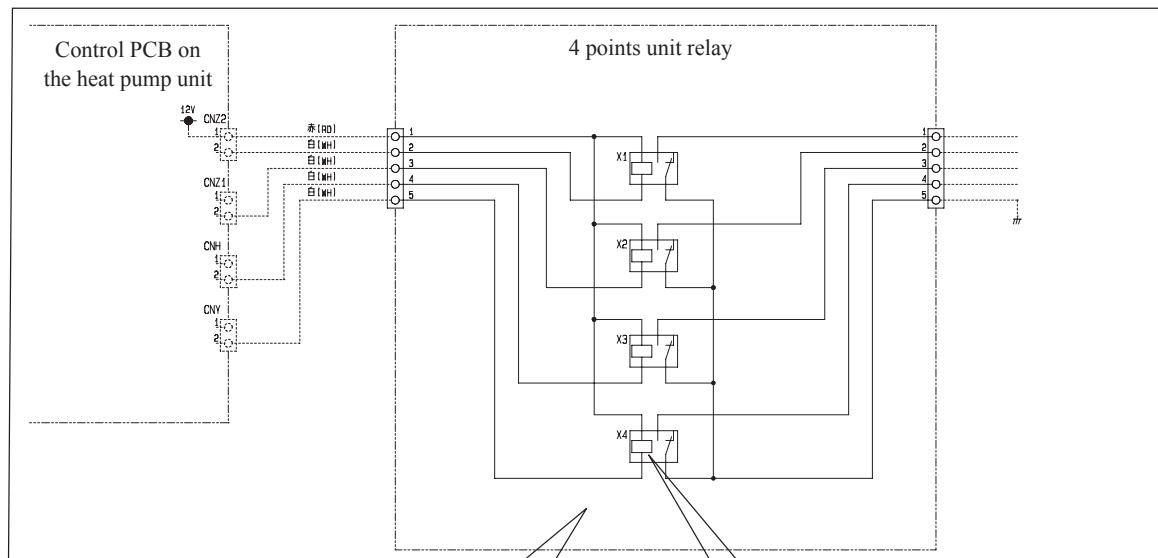
- When holding down SW7 for 3 seconds, 2 lights up 2 of [P][0][2] lights up.

With that, the setting is completed.

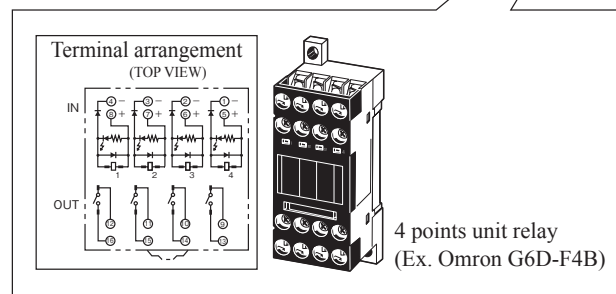
8.5 Specifications of external input terminal

Name	Usage (★ Factory default)	Specifications	Remark
External input	CNS1 All system stop input (★ Short)	No voltage contact (DC12V)	When CNS1 is opened, it makes all system stopped. Anti-freezing water operation is also canceled.
	CNS2 Demand input (★ Short)		When CNS2 is opened, demand input is available. Set the demand % with SW4-5 and SW4-6.
	CNS3 Snow prevention fan control input (★ Open)		Set it to master and slave units individually.
	CNG1 Start operation input (★ Open)		When CNG1 is shorted, the unit starts operation. After operation, when CNG2 is shorted, the unit is paused. (In this case, even if CNG1 is opened again, the unit does not become paused.) In reverse, after CNG2 is shorted, even if CNG2 is opened again, the unit does not start operation.
	CNG2 Pause operation input (★ Open)		
External output	CNH Operation output	DC12V output (10mA)	Operation signal is also output during anti-freezing operation.
	CNY Error output		—
	CNZ1 Set with 7-segment control (*1)		★0: Operation output
	CNZ2		★1: Error output

(*1) 0: Operation output, 1: Error output, 2: Compressor On output, 3: Fan On output, 4: Dry-up water output, 5: Water pump (DCWP) operation command output, 6: Anti-freezing water circuit output, 7: Defrost operation output, 8: Output of operation to top up, (9: Output of operation to keep warm) 10: Anti-freezing operation output, 11: Anti-freezing heater output, (12: Overflow output), 13: Auto-backup operation output, 14: Remote control On output, 15: Hot water amount output 16: Heating operation output
() for open tank only



Example of use



Coil resistance
720Ω or more

Note:
If external input/output is used, please use relay board to break off from the original circuit.
If not, it may not work properly due to the occurrence of sneak current.

(9) Commissioning and handover

9.1 Before test run

- (a) Be sure to check whether **1MΩ or bigger of insulation resistance can be detected by measuring with 500V meggar tester** between **power terminal** and grounding.
- (b) Before turning the power on, if the resistance between A and B of signal wiring terminal is **100Ω or lower**, the power cables may be connected to the signal wiring terminal. Be sure to check resistance of signal wiring terminal.
- (c) Be sure to **turn the power on 6hours before starting operation in order to power source to the crankcase heater.**
- (d) Be sure to check **the bottom of the compressor becomes warm.** (Outdoor air temperature + 5°C or higher)

9.2 Test run

(a) Test run procedure

In case of the operation for the first time, [Water pump test run], [Primary setting of operation] and [Valve open/close check operation] are required.

Please proceed test operation according to following procedure.

- 1) After completion of installation work, be sure to check water is fed to the hot water supply system and then turn the power on.
- 2) Start water pump test run and purge air from the hot water supply system.
Water pump test run can be done from the menu of remote control.
Menu→Installation setting→Service password (9999)→Test run→Water pump test run
* Water pump will start several 10 seconds later.
Be sure to check well drainage by opening the drain valve.
- 3) After completion of water pump test run, please proceed primary setting operation of heat pump unit.
Primary setting operation can be done from the menu of remote control.
Menu→Installation setting→Service password (9999)→Test run→Primary setting of operation
* Primary setting operation will start several minutes later. During primary setting operation, the message of "In Primary operation" is displayed on the TOP screen of remote control.
- 4) After completion of primary setting operation, please proceed to start test run by pushing **[Run/Pause]** switch.
When starting operation, the message of "It is in operation to top up" is displayed on the TOP screen of remote control.
Please check operation status of heat pump unit by Mente PC and check whether the each function is actuated normally.
- 5) After completion of test run, be sure to clean up the strainer.
After cleaning the strainer, check no leak from hot water supply system and then purge air again.

[Complement]

Water pump test run and primary setting operation can be done by switching ON the DIP switch (SW5-2) on the control PCB of heat pump unit.

[Caution]

Before completion of water pump test run, anti-freezing operation does not start in spite of pausing. Therefore if there is a risk to freeze water in the piping or if keeping the system without operating for long term, be sure to drain off the water from the hot water supply system.

(b) Contents of primary setting operation

In order to decide the opening of flow regulator appropriate to the external pump head, the following operations are done.

- 1) In order to decide the initial opening of flow regulator (CWFV1), it is operated by changing the hot water outlet temperature automatically.
In this case, it may be operated with different temperature from the hot water temperature set by remote control.
- 2) Primary setting operation will end within 60 minutes ordinarily.
If this operation does not end after 120minutes elapsed, it is stopped forcibly.
- 3) After end of primary setting operation, the heat pump unit will pause.
* Please start operation by pushing **[Run/Pause]** switch.

(10) Inspection report

10.1 Project information

Project name		Checker			Date	
Unit No.	Heat pump unit		Hot water storage tank		Remark	
	Model name	Serial No.	Model name	Serial No.		
①						
②						
③						

10.2 Check list for installation

○: OK △: shall be revised — : No item

	Check item	Standard	Checked result			Remark
			①	②	③	
Installation work	Are the heat pump unit and the HW storage unit installed on the level?	Check with level gauge				
	Are the heat pump unit and the HW storage unit fixed with anchor bolt?	Check technical manual (Anchor bolt)				
	Are the foundations enough tough to endure the weight of the heat pump unit and the HW storage unit?	Check strength and level (Foundation)				
	Is the drainage from the heat pump unit and the HW storage unit OK?	Check technical manual (Drain)				
	Are enough service spaces for the heat pump unit and the HW storage unit secured?	Check technical manual (Installation space)				
	Are there any possibility to generate combustible gas and flammable substance near the units?	No possibility				
	Aren't the heat pump unit and the HW storage unit installed in circumstance surrounded by oil and special gases (sulphidizing gas and etc.)?	No possibility				
	Are there any water leak from the cylinder, water piping and valves?	No water leak				
	Is the limitation for installation and piping preserved?	Check technical manual (Limitation)				
	Is the drain valve closed? Is the feed water valve open?	Check open or close				
Water piping work	Are the connecting pipes satisfied with the quality for corrosion resistance and thermal resistance?	Check technical manual (Quality of material)				
	Are there any problem on connection, length and route of the piping?	Check technical manual (Water piping)				
	Is the insulation work done properly?	Check technical manual (Insulation)				
	Is the cleanable strainer attached to the inlet port of feed water?	60 mesh or more				
	Are there any water leaks from water piping?	No leak				
	Can water be drained or stopped normally by operating drain valve and relief valve?	Enable to drain and stop water normally				
	Can air purge be done?	Check operability of air purge valve				
	Can water be drained from drain piping well?	Able to drain				
	Can water be drained from drain ditch well?	Drainage performance of drain ditch				
	Are any measures done for cold region like snow hood, mounting for unit and anti-freezing for water pipe?	Check measures				
Electric work	Do breaker capacity, selection of earth leakage breaker and wire thickness conform with the standard?	Check technical manual (Eclectic work)				
	Are wires connected properly without any looseness?	Check tightening				
	Is grounding work done surely?	Check technical manual (Grounding work)				
	Are the wires clamped properly? Are there any defects on the wire like scratch, crack and etc?	Check clamp and outlook of wire				
	Is the insulation resistance enough? Is the imbalance between phases within the standard?	Imbalance between phases : within $\pm 3\%$				
	Are power cable (220V or higher) and low voltage wire run adjacently?	Do not run parallelly				
Others	Are there any deformation, scratch and/or dent on the unit surface?	Check no anomaly on the unit surface				
	Are the functional parts of heat pump unit, remote control, water pump and etc operable?	Check operation				
	Is the hot water supply volume OK?	Check hot water supply				

10.3 Check list for commissioning

○: OK △: shall be revised — : No item

	Check item	Standard	Checked result			Remark
			①	②	③	
Before start commissioning (Before power source)	Is SW3-3 on the control PCB of heat pump unit set OFF?	Setting of SW3-3 OFF: Unvented cylinder (Factory default) (ON: Open tank)				See 8-(3) for details
	Are the addresses of heat pump units set correctly ? (In case of multiple heat pump units are connected)	Address setting range: 00–31 (Without any duplication)				See 8-(1) for details
	Are wires for remote control connected to X and Y terminals on TB2?	X and Y terminals (No polarity)				See 6-1 for details
	Is the power source voltage within the range of the specifications?	380V±5% or 400V±5% or 415V±5%				See 6-2 for details
	Are the power cables for the transformer connected to 1-6 terminals on TB2 properly in accordance with the power source voltage to be use? (After checking the connection, whether the 200V±10% of voltage can be measured between terminal ③ and ④ on the TB2 with a multi tester?)	380V: ①GR, ⑥YE 400V: Factory default (①YE②WH③RD④BK⑤BR⑥GR) 415V: ①BR, ⑤YE				
Heat pump unit	Does the hot water supply temperature conform with the set temperature by remote control?	Same as set temperature				
	Are high pressure, intermediate pressure and low pressure within the normal range?	HP: 7–12MPa IP: 2–6MPa LP: 1.5–5MPa				
	Is discharge temperature within the normal range?	70–120℃				
	Is suction superheat within the normal range?	3–30℃				
	Is under-dome temperature within the normal range?	25–60℃				
	Are there any anomalous drop of operation range by protection control?	Check the actuation of protection control				
	Are there any error stop?	Check the history of error stop				
	Does the fan rotate normally?	Check stable rotation				
	Are there any anomalous sound and/or vibration?	Aural and visual check				
	Does anti-freezing heater actuate normally?	When outdoor air temperature is 3℃ or lower.				
	Are operation and display of remote control normal?	Check operation				
Water circuit and hot water storage tank	Did you check and explain the setting contents of remote control to the customer?	Explain the setting contents				
	Is the cylinder filled with hot water?	Check water level sensor				
	Are the sensed values of water temperature and etc normal?	Check each sensed value				
	Does the control of anti-freezing circuit actuate normally?	When outdoor air temperature is 3℃ or lower.				
	Are there any leaks from the cylinder? (After pressurizing by filling water)	No leak				
	Is sufficient water pressure secured?	100–500kPa				
	Did you clean the strainer after commissioning?	Remove metal chips and foreign matter				

Operation data of the heat pump unit (Should attach Mente PC data) [Date of data acquisition :]

Measured item			Measured result		
	Item	Unit	①	②	③
Water circuit	Feed water inlet temperature	℃			
	Hot water outlet temperature	℃			
	Hot water temperature set with remote control	℃			
Refrigerant circuit	High pressure	MPa			
	Intermediate pressure	MPa			
	Low pressure	MPa			
	Compressor speed	rps			
	Operating current	A			
	Discharge pipe temperature	℃			
	Suction pipe temperature	℃			
	Under-dome temperature	℃			
	Suction superheat	℃			
Outdoor fan	Outdoor air temperature	℃			
	Outdoor fan speed	min ⁻¹			

(11) Notabilia for servicing (for CO₂ heat pump unit)

- 1) In order to avoid mixing different oils, please use specific tools such as gauge manifold and etc. for each unit with different kind of oil.
- 2) In order to avoid absorbing moisture, please make the period to open the refrigerant circuit to the air as shorter as possible. (within 10 minutes is recommendable)
- 3) Regarding other items such as piping work, air tightness test, evacuation and charging refrigerant, please refer to technical manual.
- 4) Troubleshooting
Regarding the contents of the trouble shooting, please refer to the wiring drawing pasted on the cover of control box on the unit and technical manual.
- 5) 7-segment display
Data can be displayed on the LED display of 7-segment by changing the setting with the switch.
Regarding the contents of display, please refer to the wiring drawing pasted on the cover of control box on the unit.

External input harness installation manual

This harness is used to control the operation of the CO₂ water heater from an external control panel.

(A separate field supply contact relay is required on site.)

Warning

- Installation should be performed by a professional contractor.
- The electrical wiring work shall be done by a qualified electrical installer, and the exclusive circuit shall be used.
- Shut off the main power source of the CO₂ water heater and external control panel before installing.
- Observe all warnings and cautions, stated or implied, in the CO₂ water heater installation manual.

External input harness (located on the side of the control box.) : Quantity = 3

BROWN:Snow prevention fan control input (CNS3)



BLUE:Start operation input (CNG1)



WHITE:Pause input (CNG2)



Installation procedure

1. Cut the cable, and connect to the relay.

※The external input is a no voltage contact input. If the control panel can provide a no voltage contact output, it is not necessary to install a relay.

2. Connect the connector to the PCB of the CO₂ water heater.

Specifications of external input

External input functions of factory default are showed in the table on the right.

The external input is a no voltage contact input.

External input functions can be changed by the following procedure in setting of 7-segment.

Set value of 7-segment and functions are showed in the table on the right.

【 Procedure for changing the external input function 】

1. Code No. of changing output is selected on 7-segment display by pressing SW9 and SW8.
2. Hold down SW7(for data erase/data input) for 3 seconds and change to the setting value of the function by pressing SW9 and SW8.
3. The data display changes to lighting up by holding down SW7 for over 3 seconds. The procedure has been completed.

*1 Demand input : Set by the combination of SW4-5, SW4-6 in the table on the right

*2 Setup of 2 phased demand input: 0%, 40%, 60%, 80% P22:OFF→000→040→060→080

*3 Error code (E63) is displayed at the time of Error input. The unit stops.

External input	function (factory default)	Code No./set value
CNS1	0 : All system stop input	P25 / 0—20
CNS2	1 : Demand input	P26 / 0—20
CNS3	2 : Snow prevention fan control input	P27 / 0—20
CNG1	3 : Start operation input	P28 / 0—20
CNG2	4 : Pause input	P29 / 0—20

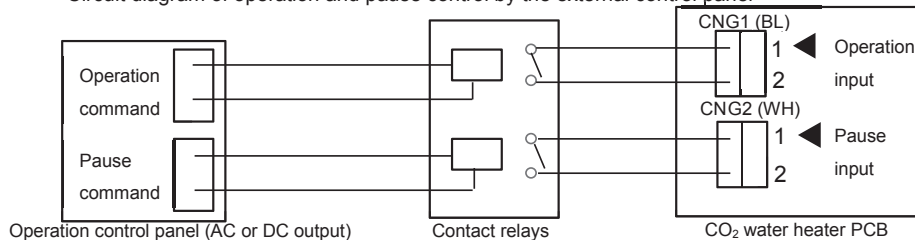
Set value	Function	Open	Short
0	All system stop input (master)	Stop	Normal
1	Demand input (master)*1	Enable	Disable
2	Snow prevention fan control input (master/slave)	Disable	Enable
3	Start operation input (master)	Normal	Operation
4	Pause operation input (master)	Normal	Pause
5	2 phased demand input (master)*2	Enable	Disable
6	Spare	Disable	Enable
7	Emergency stop (E63 is displayed) (master/slave)*3	Disable	Enable
8	Operation ⇄ Pause input (master)	Pause	Operation
9	Anti-legionella control	Disable	Enable
10	Flow volume anomaly in heating operation	Disable	Enable
11—20	Spare	Disable	Enable

Demand rate	SW4-5	SW4-6
80%(factory default)	OFF	OFF
60%	ON	OFF
40%	OFF	ON
0%	ON	ON

【 In case that operation control by external control panel 】

- Simultaneous input of start operation and pause operation is forbidden. In the case of simultaneous input, pause is enabled.
- Please do the following setting when not connecting hot water temp sensors on the cylinder with the CO₂ water heater.
 1. Switch to 24-hour control : Turn on the SW5-6
 2. Set "0" to the code No.P01 of 7-segment. The oPE-32 is displayed on the LED display at all time. It is not a malfunction.
 3. Set the remote control. : ①Disable the power failure security in order to comply with the operation of the external control panel. ②Do not use the holiday setting of schedule function. ③Set only hot water temperature on the remote control.

Circuit diagram of operation and pause control by the external control panel



External output harness installation manual

This harness is used for carrying out the removal of the operation and abnormal signal from the CO₂ heat pump water heater.

(A separate field supply 4 points unit relay is required on site.)

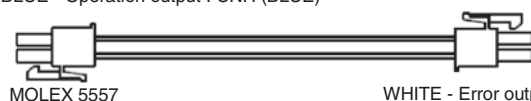
⚠ WARNING

- Installation should be performed by a professional contractor.
- The electrical wiring work shall be done by a qualified electrical installer, and the exclusive circuit shall be used.
- Shut off the main power source before installation work.
- Do not connect the connectors to the control board without connecting to the unit relays.
- Observe all warnings and cautions, stated or implied, in the CO₂ water heater installation manual.

External output harness (located on the side of the control box.) : Quantity = 2

BLUE - Operation output : CNH (BLUE)

RED - 7-segment setting output: CNZ1 (RED)



WHITE - Error output : CNY (WHITE)

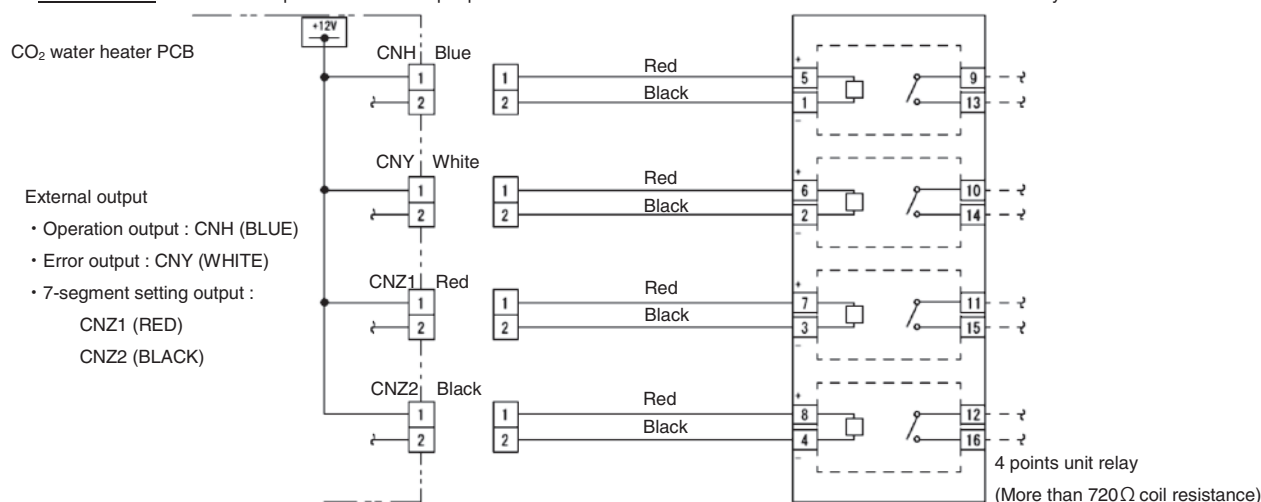
BLACK - 7-segment setting output: CNZ2 (BLACK)

Harness has connectors on both ends to prevent a short circuit by the wrong connection.

Installation procedure

1. Cut the cables in the middle of the harness to divide into two connectors.
2. Connect them to the unit relays.
3. Connect the connectors to the CO₂ water heater PCB.

Schematic ※External output is " DC12V Output plus common " . Please make more than 720Ω coil resistance of the relay contacts.



<Setting method of CNZ1 and CNZ2>

Address of 7-segment LED

CNZ1 P23 (Factory default "0": Operation output), CNZ2 P24 (Factory default "1": Error output)

Set value of P23, P24

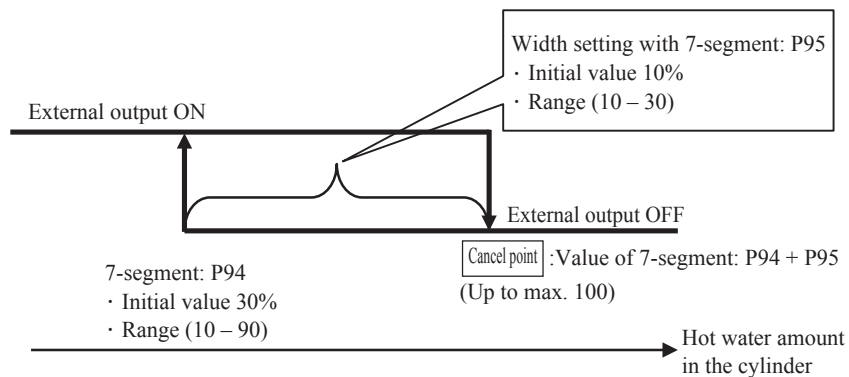
Set value	Function	Set value	Function	Set value	Function
0	Operation output	6	Anti-freezing water circuit output	12	Overflow output
1	Error output	7	Defrost operation output	13	Auto-backup output
2	Compressor ON putput	8	Output of operation top up	14	Remote control ON output
3	Fan ON output	9	Output of operation to keep warm	15	Hot water amount output
4	Dry-up water output	10	Anti-freezing operation output	16	Heating operation output
5	Water pump (DCWP) operation and command output	11	Anti-freezing heater output		

Note
Operation signal is also output during anti-freezing operation.

* This can be set with the external output function No. "15".

In case of 15: Hot water amount output

- If it is the master unit, it controls as shown below depending on the setting values of P94 and P95 on the 7-segment display.
- If the value of P94 + P95 on the 7-segment display is larger than 100, this control is implemented taking the Cancel point at 100.
- If the hot water amount in the cylinder falls within the differential (Between P94 $\leftrightarrow$ P94 + P95) after the power ON, the external output is turned ON.



[Setting value]

- ① If P94 is set at 40 and P95 at 20 on the 7-segment display:

The output is turned ON if the hot water amount decreases to 40% while it is turned OFF if it increases to 60% (40 + 20).

* Take care of the unvented cylinder when the number of sensors is small!

- ② If P94 is set at 80 and P95 at 20 on the 7-segment display:

The output turns ON if the hot water amount decreases to 80% while it is turned OFF if it increases to 100% (80 + 20, operation to fill up).

Commissioning

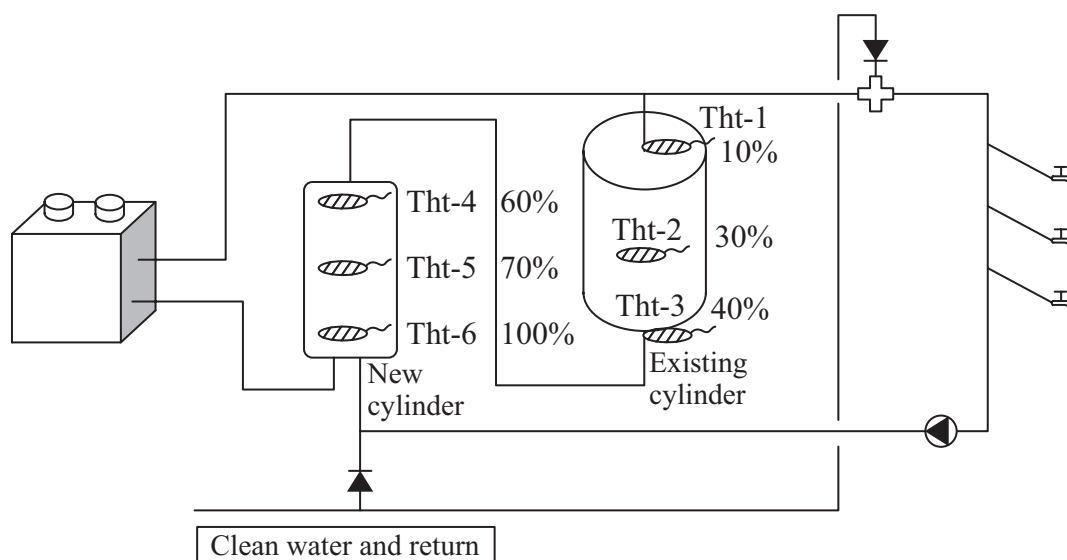
Check the normal operation by conducting a test run after installation of the external output harness.

(12) Connection to existing cylinder

When using a cylinder that cannot produce the thermal boundary layer, hot water temperatures in the cylinder are likely to become lower than the setting temperature owing to influences of the clean water or recirculation return so that it may not be able to follow the hot water supply load.

Since a cylinder that cannot maintain the thermal boundary layer may not be able to follow the hot water supply load, it is recommended to add a cylinder that can produce the thermal boundary layer.

The additional cylinder will allow adapting to the hot water supply load when temperatures in the existing cylinder drop. Regarding the position of sensors, other than 100%, which are installed on the additional cylinder, please consult us.



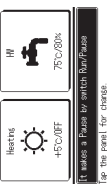
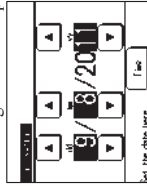
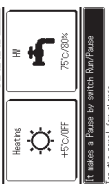
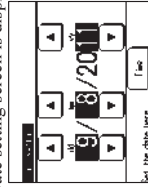
When using an additional 500liter cylinder as shown above, please set target volume 100% (RC-Q1EH2) and 7-segment P78 as "90"(ESA30EH2-25) ,then the heat pump water heater starts operation after hot water volume becomes 0%.It enables continuous operation for more than 30min to prevent frequent ON/OFF operation.

(For 10% ⇔ 100% operation, set target volume 100% and 7-segment P78 as "70")

(13) The behavior after power recovery

* The behavior after power reset (earth leakage breaker turns ON) is same as the behavior after power recovery.

* The behavior after CPU reset, and initializing is described as well.

* The behavior after CPU reset, and initializing is described as well.													
Behavior	Case	Power failure backup function (*1)	Period of power failure	Remote control display (after the end of control after power recovery)	Behavior	Date and time (*2)	HW temperature setting	Target HW amount setting	Setting of off day	Peak-cut time setting	Run/Pause(*5)		
After power recovery (After power ON)	A	Valid (Factory default)	< 80Hr	Remote control display (after the end of control after power recovery) 	The unit is recovered as same status as before power failure. ① If the it is in operation before power failure It is in [Run] mode after power recovery and if the current HW amount is less than the set amount, the heat pump water heater starts operation to top up. * If the day of power recovery is off day, it is recovered in [Pause] mode and when it becomes working day, it starts operation. ② If it is in [Pause] before power failure It is in [Pause] mode after power recovery and the heat pump water heater does not start operation. If you want to start operation, please push [Run/Pause] switch.	○	○	○	○	○	○		
	B		≥ 80Hr	Date setting screen is displayed 	After setting date and time, TOP screen is displayed. The unit is recovered as same status as before power failure, but until date and time setting is done, the heat pump water heater does not start operation to top up. * The behavior after power recovery is same as case A. * Since the set date and time is lost, it is necessary to set date and time again.	×	○	○	○	○	×	It becomes in [Pause]. If you want to operate, push [Run/Pause] switch.	
	C	Invalid	< 80Hr	TOP screen is displayed 	Since the power failure backup function is invalid, the unit is recovered in [Pause] mode, despite of the operation status before power failure. The unit does not start operation due to [Pause] mode. If you want to start operation, please push [Run/Pause] switch.	○	○	○	○	○	○	×	It becomes in [Pause]. If you want to operate, push [Run/Pause] switch.
	D		≥ 80Hr	Date setting screen is displayed 	After setting date and time, TOP screen is displayed. Since the power failure backup function is invalid, the unit is recovered in [Pause] mode, despite of the operation status before power failure. The unit does not start operation due to [Pause] mode. If you want to start operation, please push [Run/Pause] switch. * Since the set date and time is lost, it is necessary to set date and time again.	×	○	○	○	○	○	×	It becomes in [Pause]. If you want to operate, push [Run/Pause] switch.
CPU reset (*3)	E	Valid	-	Same as case A	Unit is recovered as same status as before * The behavior after power recovery is same as case A	○	○	○	○	○	○		
	F	Invalid	-	Same as case C	Since the power failure backup function is invalid, the unit is recovered in [Pause] mode, despite of the operation status before CPU reset. The unit does not start operation due to [Pause] mode. If you want to start operation, please push [Run/Pause] switch.	○	○	○	○	○	×	It becomes in [Pause]. If you want to operate, push [Run/Pause] switch.	
Initializing (*4)	G	Despite of Valid/Invalid	-	Main/Sub setting screen is displayed 	Despite of the operation status before Initializing, R/C and all heat pump water heaters connected becomes factory default. Since the date and time setting is retained, the unit is recovered in [Pause] mode, after Main/Sub setting of R/C. The unit does not start operation due to [Pause] mode. If you want to start operation, please push [Run/Pause] switch.	○	×	×	×	×	×	×	It becomes in [Pause]. If you want to operate, push [Run/Pause] switch.

[Remarks]

*1 Power failure backup function

*2 Time setting

*3 CPU reset

*4 Initializing

*5 Pause

It is the function to make the unit recovered to the operation status before power failure automatically, after power recovery, by memorizing the operation status before power failure. For example, in case of [Run] before power failure, the unit starts operation automatically after power recovery.

The set time is memorized in the memory of R/C with built-in battery. With battery it is memorized for 80 hours after power failure.

If the battery is exhausted and memory of set time is lost, set the [date and time] again.

R/C and all heat pump water heaters can be restarted.

[Pause] is the status that the operation to top up is stopped. The operation to top up is stopped, but the unit may start operation for anti-freeze of water.

(14) Recirculation hot water supply system

14.1 Features

The CO₂ heat pump water heater allows converting a set of one way system composed of heat pump water heater and hot water cylinders, without change and immediately, to a recirculation system by adding up a mixing valve and a recirculation pump at site. Its 4,000 L cylinder volume composed of eight 500 L cylinders of which 2 to 5 cylinders (depending on the hot water temperature setting and the recirculation circuit specification) are used as the recirculation load. Since the gross volume of these cylinders is 4,000 L, remaining 3 to 6 cylinders can be used as the hot water supply load. This system, in this way, is used where recirculation load and hot water supply load are present in mixture *1. With this system, risk of the short-supply of hot water is small even if the hot water temperature is not increased remarkably so far as the recirculation load in use and the hot water supply load are balanced well. When the water supply side of mixing valve is interrupted accidentally, hot water retained in the cylinder flows directly into the recirculation circuit. From the viewpoint of safety as well, it is recommended to use the system by lowering the hot water temperature *2.

*1: It is possible to compensate the recirculation load with all cylinders, but it could decrease the COP remarkably.

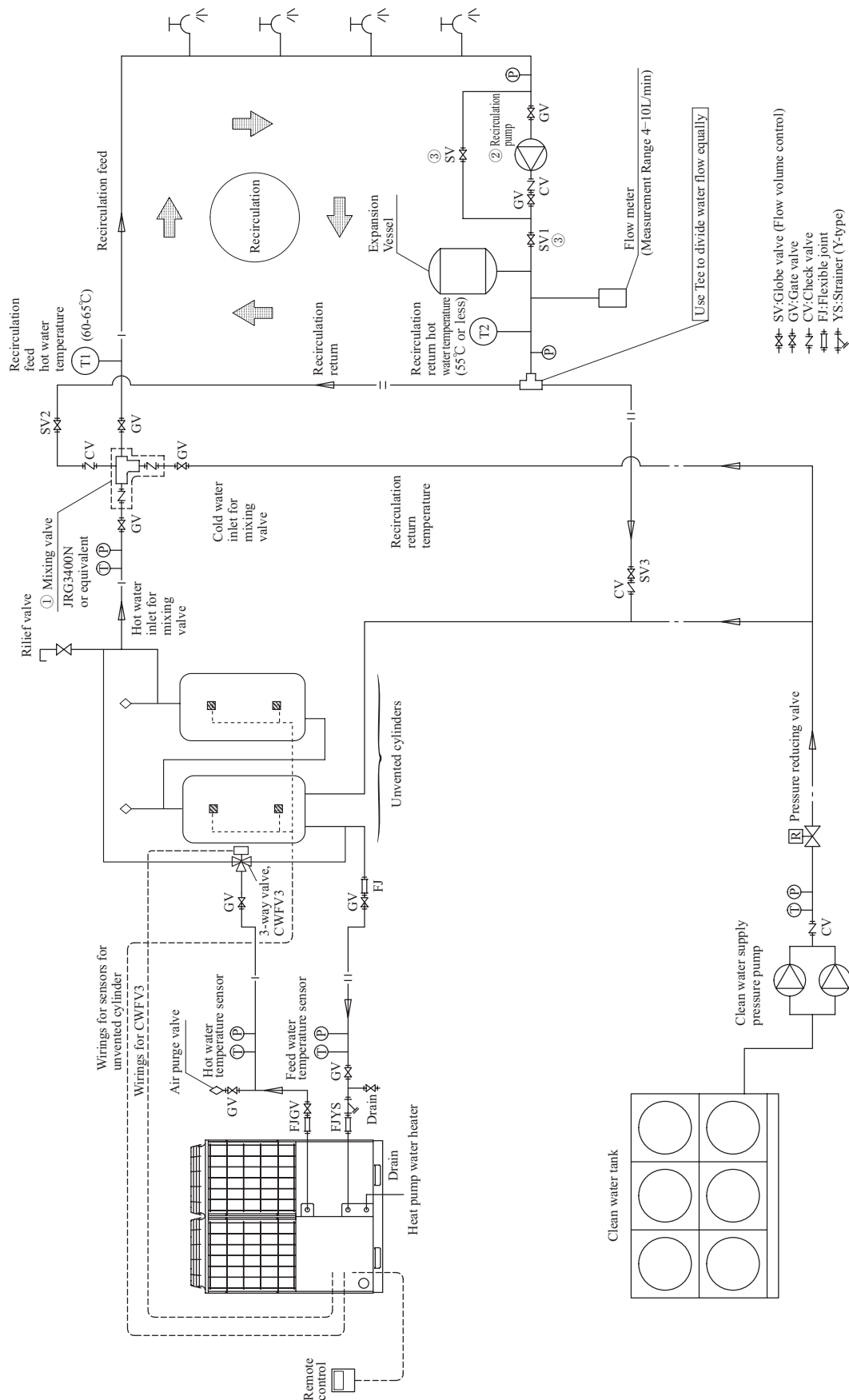
*2: Take note that if anticipated balance is lost between the recirculation load and the hot water supply load, the supply of hot water becomes likely to exhaust.

$$\text{Total heatload} = \text{Hot water supply load} + \text{Hot water recirculation load}$$

*3: Regarding as recirculation system diagram, refer to next page.

14.2 Recirculation hot water supply system diagram and component list

1) System diagram



2) Component list

Part name		Model	General description
①	Mixing valve (Locally procured)	—	Recommended: JRG3400N-946N (32A, temperature range 45–65°C, MAX temperature 90°C) * Check valves is needed at the inlet of the cold water, hot water and recirculation return of the valve. If you use JRG3400N, check valves are attached at the cold water inlet and hot water inlet.
②	Recirculation pump (Locally procured)	Please select products for hot water recirculation Use inlet water pressur is more than 0.4MPa, drip-proof protection, temperature range of use 5–90°C. Please select pump's capacity so as to 4–10L/min is attained when in use.	* Select pressure more than setting pressure of the secondary pressure of the pressure reducing valve.
③	Globe valve for water flow regulation (SV) (Locally procured)	For hot water	I is needed to regulate the flow volume or return temperature of the hot water recirculation circuit. * Gate valve (GV) is not used for the water flow regulation.

Others: please prepare parts shown in the installation manual.

14.3 Example of calculation for recirculation load

- Guidelines of the heat loss from piping and the recirculation hot water flow volume on recirculation system
Calculate the heat loss from piping and the recirculation flow volume as follows.

Heat loss from piping (W)

= Heat loss per unit length of recirculation feed pipe diameter (see table below) $\times$ recirculation feed pipe length $\times$ (Recirculation feed hot water temperature $-$ Temperature around pipe) + Heat loss per unit length of recirculation return pipe diameter (see table below) $\times$ recirculation feed pipe length $\times$ (recirculation return hot water temperature $-$ Temperature around piping)

Recirculation water flow volume (L/min) = Heat loss from pipe (W)/(4.18 $\times$ (Temperature difference between feed hot water and return hot water on recirculation circuit) $\times$ 1,000) $\times$ 60

Table of heat loss from hot water supply piping [W/(m $\cdot$ °C)]

Note) Heat transfer coefficient for external surface is 11.63 W/(m $\cdot$ °C), heat transfer coefficient for internal surface is 7,000 W (m $\cdot$ °C), coefficient of thermal conductivity for copper pipe is 388 W (m $\cdot$ °C), coefficient of thermal conductivity for stainless steel pipe is 16 W (m $\cdot$ °C), coefficient of thermal conductivity for insulation material (rock wool) is 0.045 W (m $\cdot$ °C) and pipe heat insulator thickness (15 A $-$ 50 A) is 20 mm.

Pipe diameter	Heat loss from hot water pipe [W/(m $\cdot$ °C)]							
	Nominal diameter	15	20	25	30	32	40	50
	Inch	1/2	3/4	1	1 1/8	1 1/4	1 1/2	2
Heat insulated steel pipe		0.2	0.24	0.29	—	0.33	0.37	0.44
Heat insulated copper pipe		0.2	0.24	0.29	0.30	—	0.37	0.41

[Example 1]

Recirculation feed pipe 32 A $\times$ 50 m, recirculation return pipe 20 A $\times$ 50 m

Feed hot water temperature 60°C, return hot water temperature 55°C, ambient temperature 10°C

Heat loss amount = 0.33 $\times$ 50 $\times$ (60 $-$ 10) + 0.24 $\times$ 50 $\times$ (55 $-$ 10)
= 1,365 (W)

Recirculation hot water flow volume = 1,365/(4.18 $\times$ (60 $-$ 55) $\times$ 1,000) $\times$ 60
= 3.9 (L/min)

This recirculation hot water flow volume is the needed flow volume by the recirculation pump.

* Set the recirculation hot water flow volume within 20% of simultaneous usage flow volume of hot water.

Heat required for recirculation when the recirculation pump is operated for 24 hours continuously is:

Heat required for recirculation = 1,365 W $\times$ 24 H $\times$ 3,600
= 1.18 $\times$ 10⁸ J

When the hot water temperature is set at 80°C and the return hot water temperature is made at 55°C, hot water flow volume required for recirculation is:

Hot water volume for recirculation = 1.18 $\times$ 10⁸/(4.18 $\times$ (80 $-$ 55) $\times$ 1,000)
= 1,128 kg $\approx$ 1,128 L

This is nearly equal to 1,000 L. Therefore, two 500 L cylinders are required for the recirculation load.

As it is learned from the formula, the recirculation load varies largely depending on the setting of hot water temperature and the operation time of recirculation pump.

From the viewpoint of energy saving, it is recommended to use lower hot water temperatures and to stop the recirculation pump in time zones or seasons that do not require recirculation, by a timer, or the like.

[Example 2]

If the hot water outlet temperature is changed, the number of cylinders as the recirculation load also changes.

For the calculation at 60°C of hot water outlet temperature, refer to [Example 1].

Hot water outlet temperature	°C	90	85	80	75	70	65
Recirculation temperature setting	°C	60	60	60	60	60	60
Recirculation return temperature	°C	55	55	55	55	55	55
Feed pipe length	m	50	50	50	50	50	50
Return pipe length	m	50	50	50	50	50	50
Ambient temperature	°C	10	10	10	10	10	10
Heat loss from recirculation circuit	W	1365	1365	1365	1365	1365	1365
Recirculation hot water flow volume	L/min	3.9	3.9	3.9	3.9	3.9	3.9
Operation time	H	24	24	24	24	24	24
Heat required for recirculation	kJ	1.18E + 08	1.18E + 08	1.18E + 08	1.18E + 08	1.18E + 08	1.18E + 08
Hot water volume required for recirculation	kg ÷ L	806.1	940.5	1128.6	1410.7	1881.0	2821.4
Number of 500 liter cylinders for recirculation load	Qty	1.6	1.9	2.3	2.8	3.8	5.6
Number of 500 liter cylinders for hot water supply load	Qty	6.4	6.1	5.7	5.2	4.2	2.4

[Example 3]

If the operation time of recirculation pump is halved (24H→12H) with the same conditions as the [Example 2], the radiation loss and the recirculation load decrease.

Hot water outlet temperature	°C	90	85	80	75	70	65
Recirculation temperature setting	°C	60	60	60	60	60	60
Recirculation return temperature	°C	55	55	55	55	55	55
Feed pipe length	m	50	50	50	50	50	50
Return pipe length	m	50	50	50	50	50	50
Ambient temperature	°C	10	10	10	10	10	10
Heat loss from recirculation circuit	W	1365	1365	1365	1365	1365	1365
Recirculation hot water flow volume	L/min	3.9	3.9	3.9	3.9	3.9	3.9
Operation time	H	12	12	12	12	12	12
Heat required for recirculation	kJ	5.90E + 07	5.90E + 07	5.90E + 07	5.90E + 07	5.90E + 07	5.90E + 07
Hot water volume required for recirculation	kg ÷ L	403.1	470.2	564.3	705.4	940.5	1410.7
Number of 500 liter cylinders for recirculation load	Qty	0.8	0.9	1.1	1.4	1.9	2.8
Number of 500 liter cylinders for hot water supply load	Qty	7.2	7.1	6.9	6.6	6.1	5.2

[Example 4]

Check of seasonal effect and setting of seasonal recirculation return hot water outlet temperature

An Effect expected when it is designed based on the heat loss amount 1350 under the conditions of [Example 1] and it is used, unchanged, in summer (ambient temperature at 30°C):

$$\begin{aligned}\text{Heat loss amount} &= 0.33 \times 50 \times (60 - 30) + 0.24 \times 50 \times (55 - 30) \\ &= 795 \text{ (W)}\end{aligned}$$

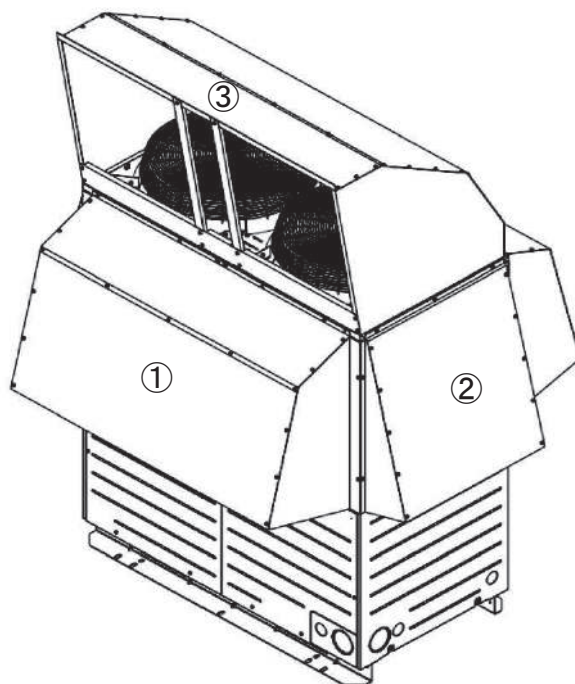
Since the flow volume of recirculation water quantity was fixed at 3.9 (L/min) utilizing the difference of 5 deg (= 60 – 55), it becomes 5 deg/1350 × 795 = 3 deg so that temperature difference in summer and winter becomes 2 deg. Therefore, provided the recirculation return hot water temperature is 53°C in winter while it is 55°C in summer, it can be used regardless of seasons. Since the calculation of heat loss amount is a guide, there will be no problem even if it is calculated with the recirculation temperature at 60°C and the recirculation return hot water temperature at 55°C, as they are. Determine the recirculation return hot water temperature by calculating the temperature difference in summer and winter as above and taking the season for test run into account.

(15) Snow prevention hood

Snow hood

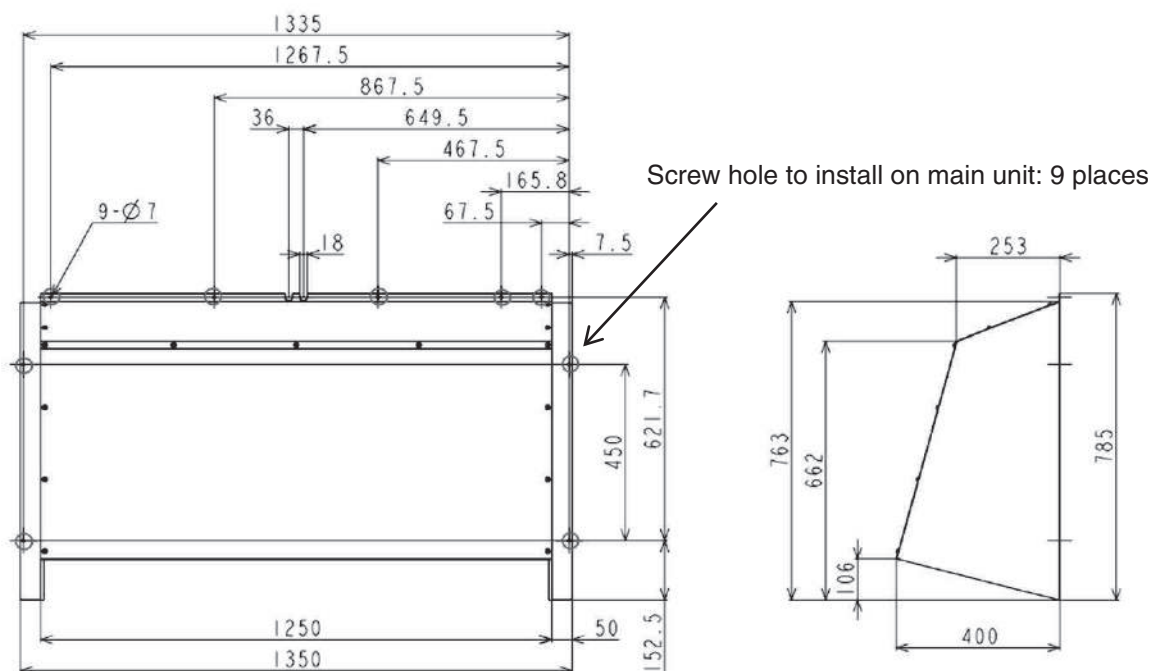
When installing the equipment in a snowy district, it is necessary to produce a snow hood at site, in order to protect the heat source unit from accumulating snow.

1) Outline of snow hood

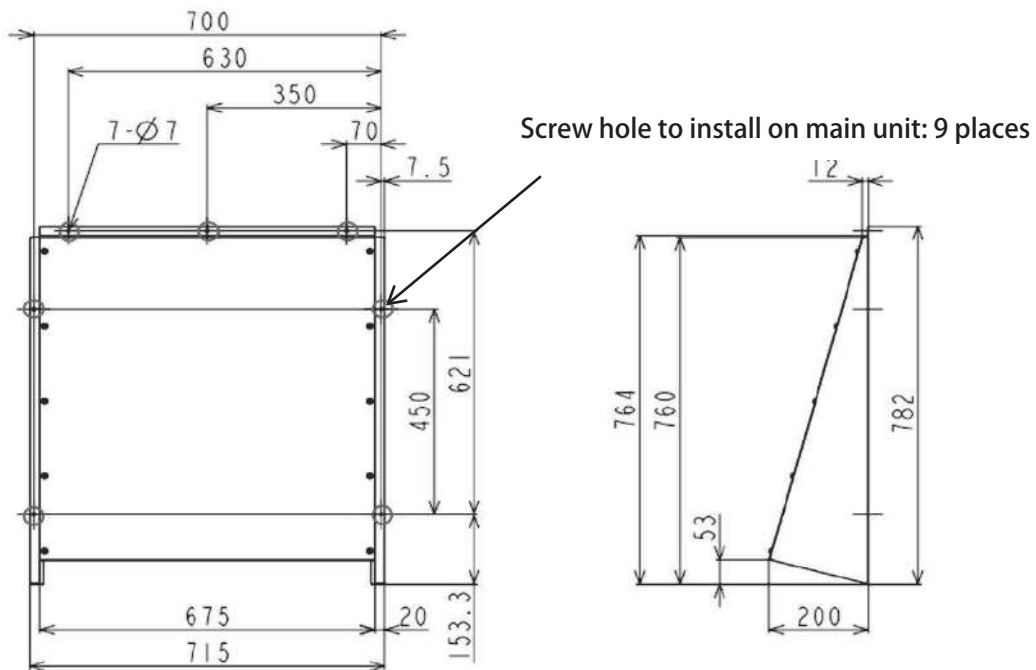


Installation of snow hood

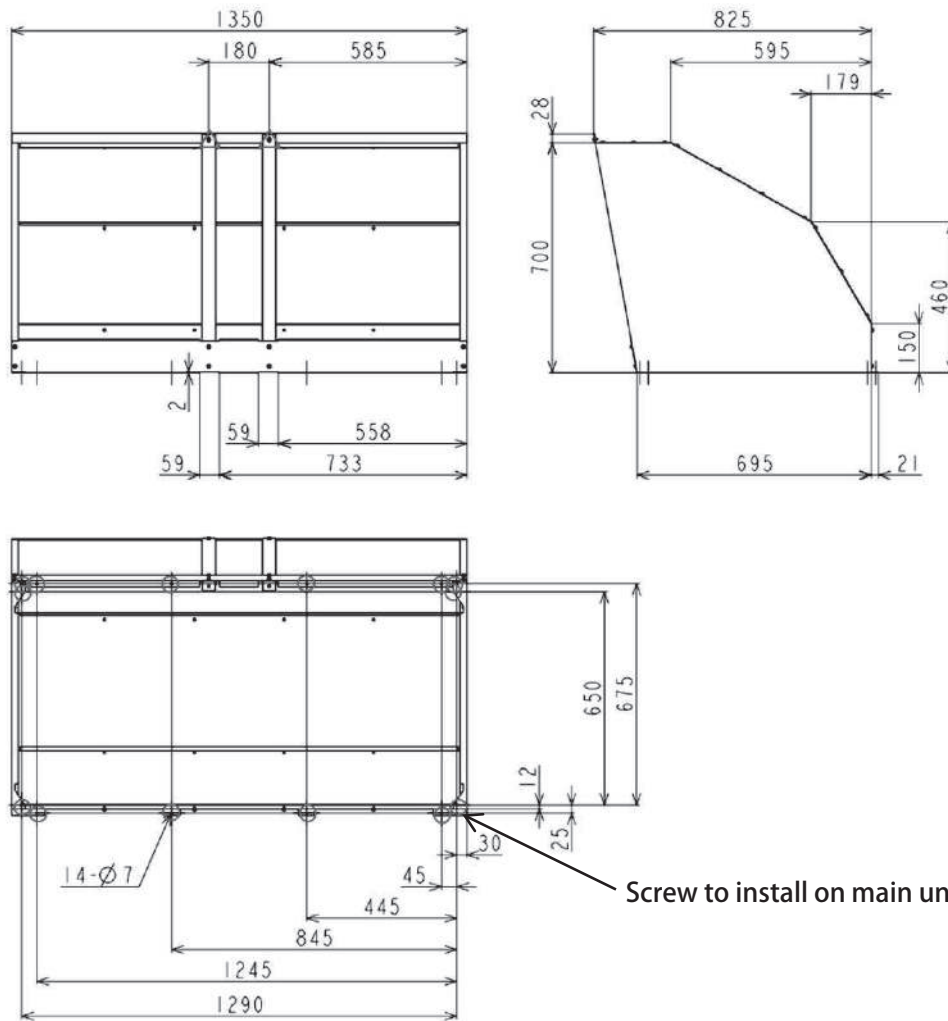
① Suction side (for front, rear) x 2



② Suction side (for right, left) x 2

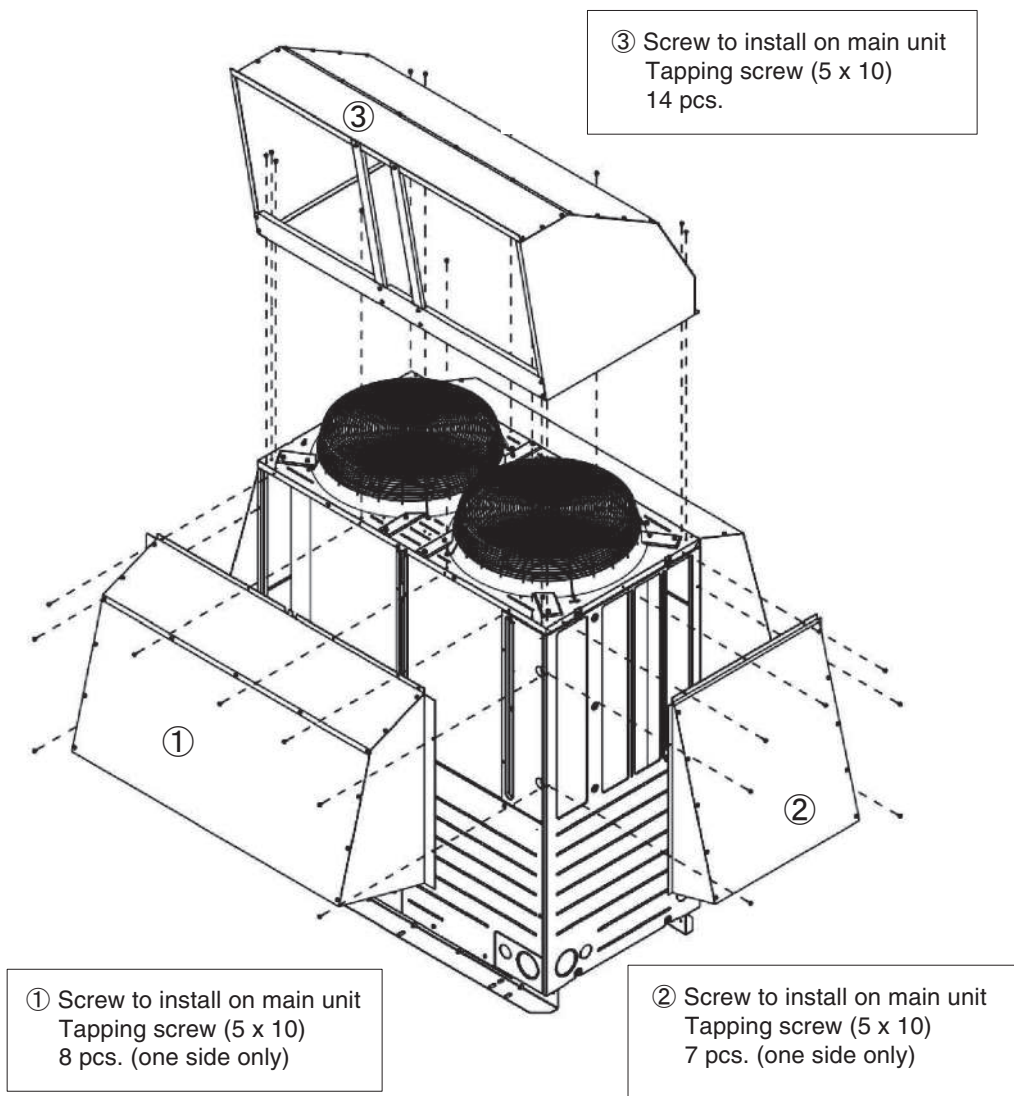


③ Outlet side x 1



2) Installation

- (1) Remove the fin guards from the front and rear of heat source unit.
- (2) Install the snow hood sections ①, ② and ③ on the heat source unit.
Provide following screws to install them.
These screws are not included in the accessory of the equipment.



< Caution >

- Ask a professional contractor to install the snow hood.
- Be sure to turn off the power source to the heat source unit before starting installation. (Accident prevention)
- Tighten installation screws securely not to become loose by vibration.
- Where the heat source unit may be buried under snow, install it on a frame.
- When making the snow hood with stainless steel, sufficient care should be taken to prevent secondary rusting caused by external contaminants such as salt or iron.
- Take care not to damage paint coating on the product when installing the snow hood. When it is damaged, carefully repair with touchup paint.
- Installation takes place at a high place, Utmost care should be taken for safety.

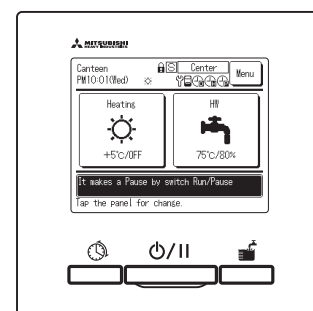
3.2 Installation work for remote control

PJZ012D132

This installation manual describes the installation methods and precautions related to the remote control. Use this manual together with the user's manuals for the heat pump unit and other option equipment. Please read this manual carefully before starting the installation work to install the unit properly.

1. Safety precautions

- Please read this manual carefully before the installation work to install the unit properly. Every one of the following instructions is important to be observed strictly.
 - ⚠ WARNING** Failure to follow these instructions may result in serious consequences such as death, severe injury, etc.
 - ⚠ CAUTION** Failure to follow these instructions may cause personal injury or property damage. It could have serious consequences depending on the circumstances.
- The pictograms used in the text have following meanings.
 - ⊘ **Never do.** ⓘ **Always follow the instructions given.**
- Keep this manual at a safe place where you can consult with whenever necessary. Show this manual to a installer when moving or repairing the unit. When the ownership of this unit is transferred, this "Installation Manual" should be given to a new owner.



⚠ WARNING

- The appliance shall be installed in accordance with national wiring regulations. ⓘ
- Ask a professional contractor to carry out the installation work according to the installation manual. Improper installation work may result in electric shocks, fire or break-down. ⓘ
- Shut off the main power before starting electrical work. Otherwise, it could result in electric shocks, break-down or malfunction. ⓘ
- Do not install the unit in inappropriate environment or where inflammable gas could generate, flow in, accumulate or leak. This unit should not be used in places where the air contains dense oil mist, steam, organic solvent vapor, corrosive gasses (such as ammonium, sulfuric compounds, and acid), or places where acidic or alkaline solutions or special sprays, etc. are used. Doing so may cause electric shocks, break-down, smoke or fire due to corrosion or deterioration of the units performance. ⓘ
- Do not install the unit where water vapor is generated excessively or condensation occurs. It could cause electric shocks, fire or break-down. ⓘ
- Use the specified cables for wiring, and connect them securely with care to protect electronic parts from external force. Improper connections or fixing could cause heat generation, fire, etc. ⓘ
- Seal the inlet hole for remote control cable with putty. If moisture, water, insect, etc. enters through the hole, it could cause electric shocks, fire or break-down. ⓘ
- When installing the unit at a hospital, telecommunication facility, etc., take measures to suppress noises. It could cause malfunction or break-down due to hazardous effects on the inverter, in-house power generator, high frequency medical equipment, etc. ⓘ
The influences transmitted from the remote control to medical or communication equipment could disrupt medical activities, video broadcasting or cause noise interference. ⓘ

⚠ CAUTION

- Do not install the remote control at following places. It could cause break-down or deformation of remote control. ⓘ
 - (1) Where it is exposed to direct sunlight
 - (2) Near the equipment to generate heat
 - (3) Where the surface is not flat
- Do not leave the remote control with its upper case removed. When the upper case is removed, put it in a packing box or packing bag to protect PCBs or other parts inside of it from dust, moisture, etc. ⓘ
- The appliance is not to be used by children or persons with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction. ⓘ
- Children shall be supervised not to play with appliance. ⓘ

2. Accessories & parts prepared at site

Accessories	Remote control main unit, wood screw ($\phi 3.5 \times 16$) 2 pcs., User's Manual, Installation Manual (in CD-R)
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Parts prepared on site

Item name	Q'ty	Remark
Switch box For 1 piece or 2 pieces (JIS C 8340)	1 pc.	There are not necessary when installing R/C directly on a wall
Thin steel conduit tube (JIS C 8305)	As required	
Lock nut, bushing (JIS C 8330)	As required	
Cable cover	As required	Necessary to run R/C cable on the wall
Putty	Suitably	For sealing gaps
Molly anchor	As required	
R/C cable ($0.3\text{mm}^2 \times 2$ cores) shielding wire (MVVS)	As required	Be sure to ground both ends. See right table when longer than 100m

The max size for the wires used in the R/C case is 0.5mm^2 .

Therefore when the cable length is longer than 100m, connect the wires from R/C to larger size ones near the outside of R/C.

When wires are connected, take measure to prevent water, etc. from entering inside of connected part.

< 200m	$0.5\text{mm}^2 \times 2$ cores shielding wire (MVVS)
< 300m	$0.75\text{mm}^2 \times 2$ cores shielding wire (MVVS)
< 400m	$1.25\text{mm}^2 \times 2$ cores shielding wire (MVVS)
< 600m	$2.0\text{mm}^2 \times 2$ cores shielding wire (MVVS)

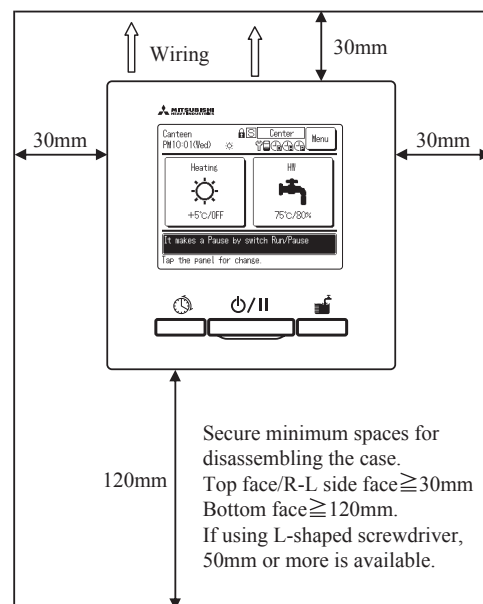
3. Installation place

Installing method [With using a switch box]
[Installed directly on a wall]

Wiring direction [Backward]
[Upper center] or [Upper left]

Cautions for selecting installation place

- (1) Installation surface must be flat and sufficiently strong.
R/C case must not be deformed.



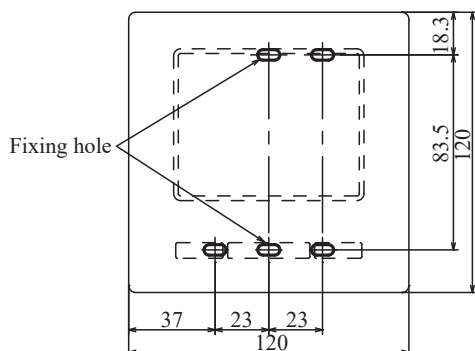
Request

Do not install the R/C at a place where it is exposed to direct sunlight or surrounding air in which temperature exceeds 40°C or drops below 0°C .

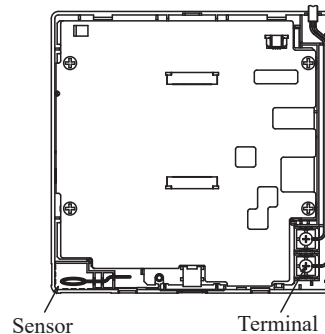
It could cause discoloration, deformation, malfunction or break-down.

4. Installation and wiring work

Dimensions (View from front side)



PCB side (View from rear side)



- ① To remove the upper case from the bottom case of R/C
 - Insert the tip of a flat head screwdriver or the like in the recess at the lower part of R/C and twist it lightly to remove

Take care to protect the removed upper case from moisture or dust !

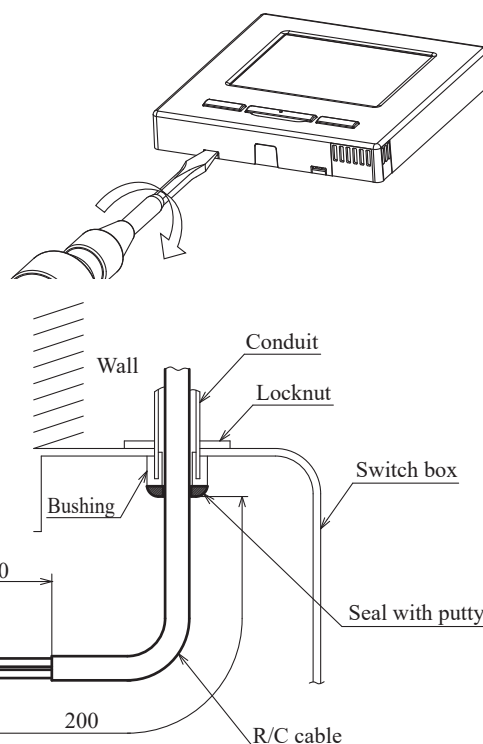
- ② Connect the wires from X and Y terminals of R/C to X and Y terminals of heat pump unit.
There is no polarity of R/C wiring (X and Y) .

In case of embedding wiring (When the wiring is retrieved backward)

- ③ Embed the switch box and the R/C wires beforehand.

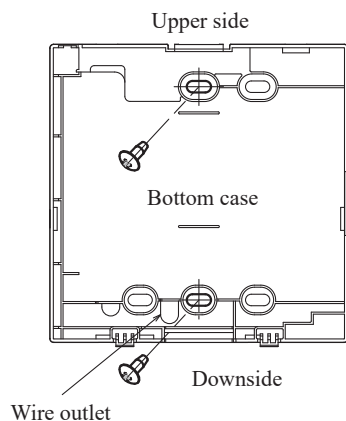
Seal the inlet hole for the R/C wiring with putty.

- If dust or insect enters, it could cause electric shocks, fire or break-down.

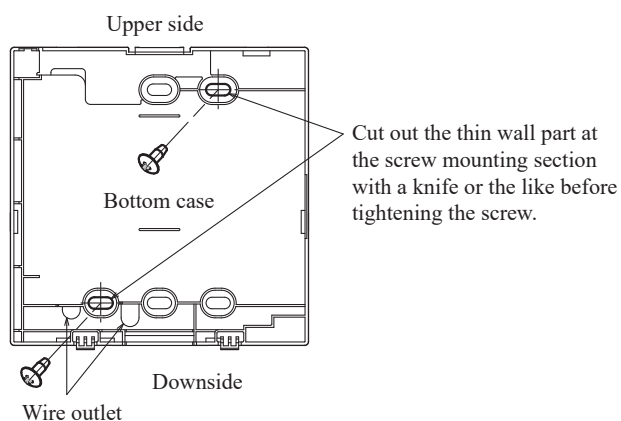


- ④ When wires are passed through the bottom case, fix the bottom case on the switch box at 2 places.

Switch box for 1

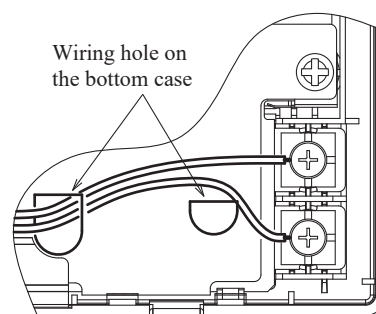


Switch box for 2



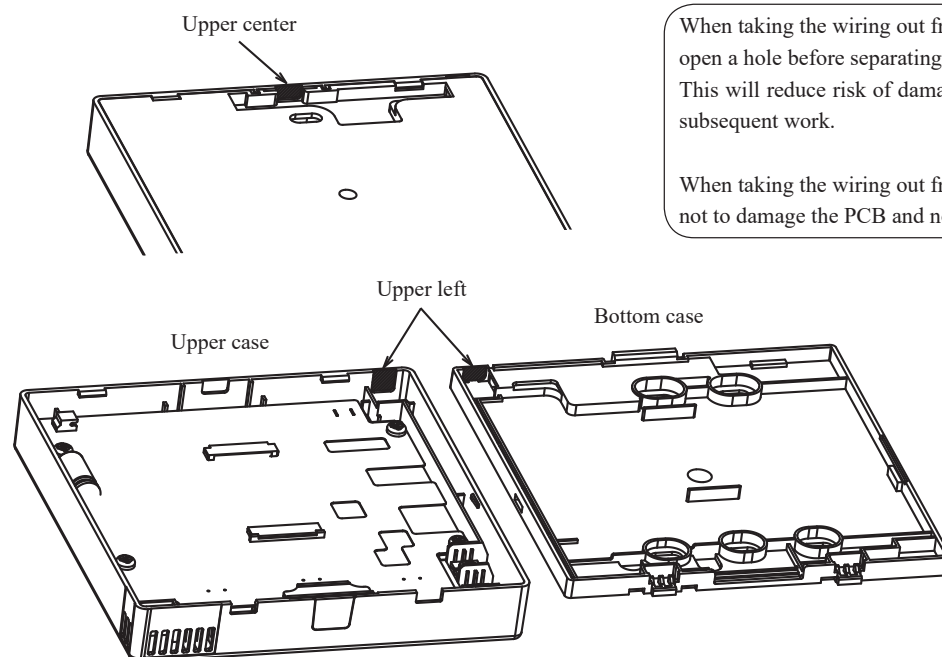
4. Installation and wiring work (Continue)

- ⑤ When fixing the bottom case diagonally at 2 places, cut out the thin wall part of the case.
- ⑥ Fix wires such that they will run around the terminal screws on the upper case of R/C.
- ⑦ Install the upper case with care not to pinch wires of R/C.



In case of exposing wiring (When the wiring is taken out from the "upper center" or "upper left" of R/C)

- ③ Cut out the thin wall parts of the cases for the hole size to fit to the wire size.



When taking the wiring out from the upper center, open a hole before separating the upper and bottom cases. This will reduce risk of damaging the PCB and facilitate subsequent work.

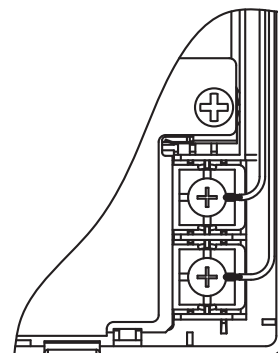
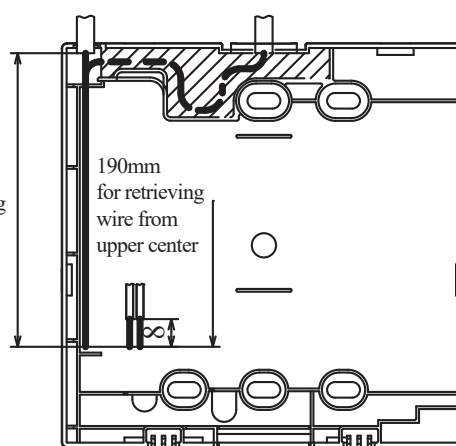
When taking the wiring out from the upper left, take care not to damage the PCB and not to leave any chips inside.

If the hole is cut too large, moisture, dust or insects may enter.
Seal gaps with putty or the like.



- ④ Fix the bottom case on a flat surface with wood screws
- ⑤ In case of the upper center, pass the wiring behind the bottom case (hatched section).
- ⑥ Fix wires such that the wires will run around the terminal screw of the upper case of R/C.
- ⑦ Install the upper case with care not to pinch wires of R/C.

120mm
for retrieving
wire from
upper left

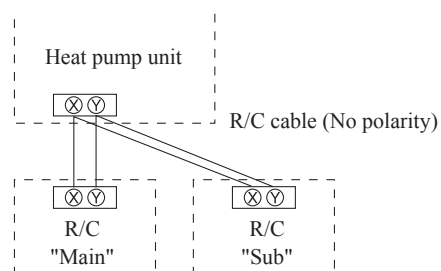


5. Main/Sub setting when more than one remote control is used

Up to two units of R/C can be used at the maximum for one heat pump unit or one group.

One is main R/C and the other is sub R/C.

Operation range is different depending on the main or sub R/C.



Set the "Main" and "Sub" with same procedure as shown in Section 6.

R/C function	Main	Sub
Run/Pause	☐	☐
Setting of hot water temp	☐	-
Setting of hot water amount	☐	-
Hot water amount	☐	☐
Heating ON/OFF	☐	-
Heating Set temp	☐	-
Schedule setting	☐	-
Operation to fill up	☐	☐
Test run	☐	-
Error history display	☐	☐
R/C function setting	☐	-

Note: Initializing of password

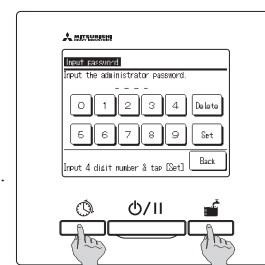
Administrator password (for daily setting items) and service password (for installation, test run and maintenance) are used

- Default setting of Administrator password is "0000". This setting can be changed (Refer to the Instruction Manual).

If the administrator password is forgotten, it can be initialized by pressing [Schedule setting] switch and [Operation to fill up] switch on the administrator password input screen simultaneously for 5 seconds.

- Service password is "9999", which cannot be changed.

When inputting the administrator password, the service password is also acceptable.



Note: Test run

When starting operation of the heat pump unit for the first time, [Water pump test run] and [Primary setting of operation] shall be done in advance.

Regarding the way for test run, please refer to the item [7. Installation setting and test run] in this manual.

6. Power source and initial setting

Set the main and sub R/C according to the display at the power on

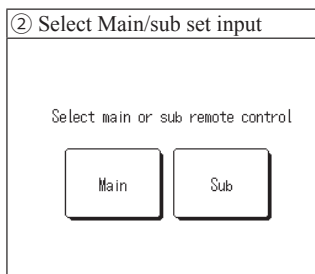
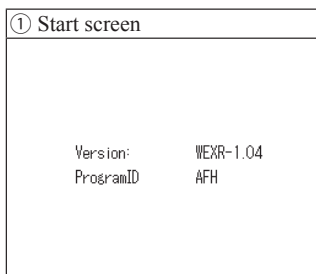
- (1) If the main and sub are not set yet, [Select Main/sub set input] screen is displayed. (Screen ②)

When tapping the [Main] or [Sub] button, the initial setting starts.

If wrong button is tapped by mistake, it is available to change the setting after completion of the initial setting.

- (2) If the main and sub have been set already, [Set continue acknowledge] screen is displayed. (Screen ⑨)

- (3) When using 2 sets of R/C, if the first one is set for the main, the other is set for the sub automatically.



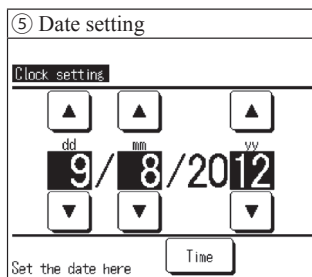
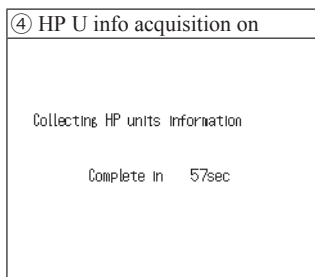
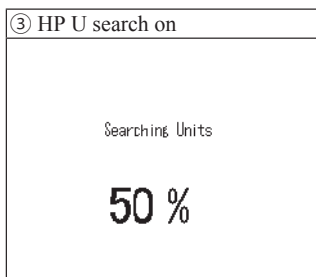
[Main] ⇒ ③ ⇒ ④ ⇒ ⑤ ⇒ ⑥ ⇒ ⑦ ⇒ ⑧

[Sub] ⇒ ⑪ ⇒ ⑤ ⇒ ⑥ ⇒ ⑧

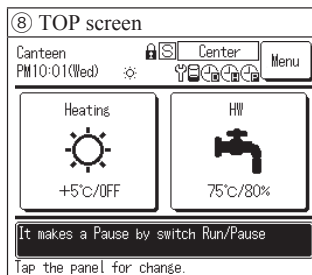
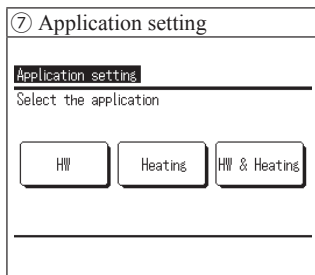
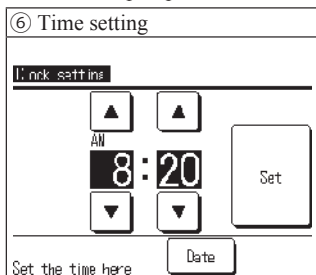
Caution

If only one set of R/C, tap [Main] button. In the state of initial setting, it will keep on waiting till either one of the buttons is selected.

If two sets of R/Cs are used, when either one of them is tapped, the setting starts.



*HP U: Heat pump unit

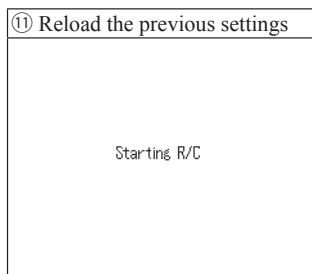
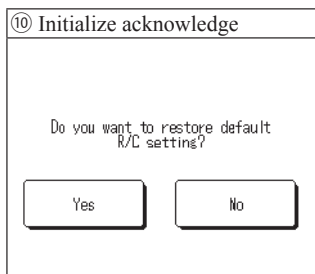
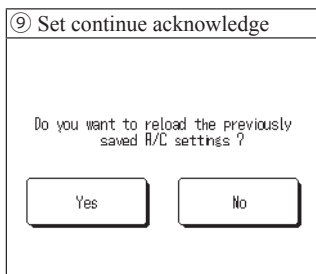


Caution

⑤ date setting and ⑥ time setting are necessary also for the sub R/C. Set these for both the main and the sub R/C.

HW: The HP U is used to make hot water.
Heating: The HP U is used for heating.
HW&Heating: The HP U is used for both HW and heating.

The mode of operation at the power on is [Pause]. (In Pause, the operation to top up does not start)



[Yes] Continue ⇒ ⑪ ⇒ ⑤ ⇒ ⑥ ⇒ ⑦ ⇒ ⑧

[No] Change ⇒ ⑩

If the screen is not tapped for 15seconds or more, [Yes] (Continue) is selected and the display changes to the screen ⑤.

[Yes] ⇒ ① ⇒ ②

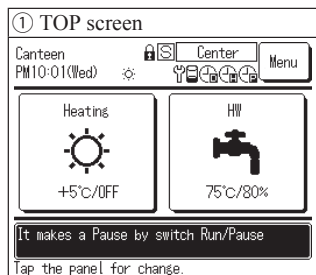
[No] ⇒ ⑨

If initializing, it restores to the factory default settings.

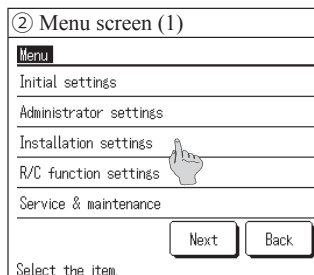
7. Installation settings and test run

[TOP screen] ⇒ [Menu] ⇒ [Installation setting]

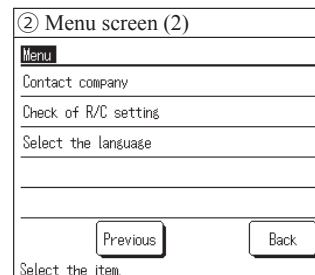
① TOP screen



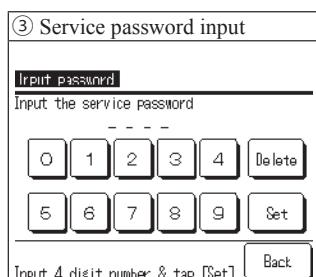
② Menu screen (1)



② Menu screen (2)

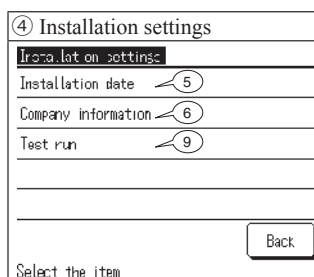


③ Service password input

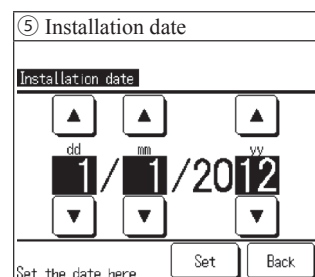


Service password is "9999".

④ Installation settings

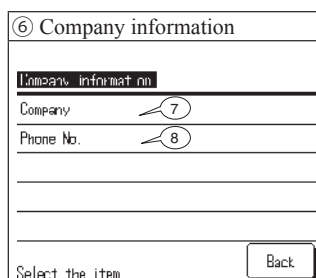


⑤ Installation date



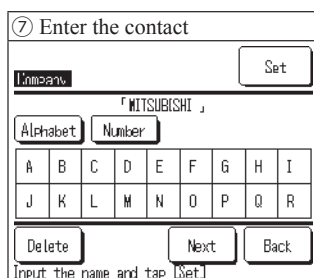
Set with [▲] [▼] buttons.
Tap [Set] to save.

⑥ Company information



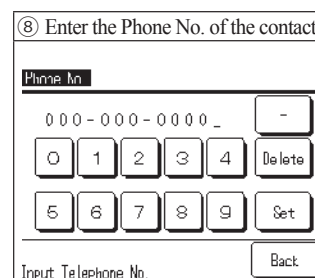
Set the Contact for the customer to ask servicing.

⑦ Enter the contact



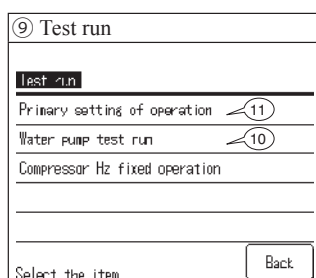
Enter the company name with up to 5x 2-byte letters (10x 1-byte letters).
Tap [Set] to save.

⑧ Enter the Phone No. of the contact



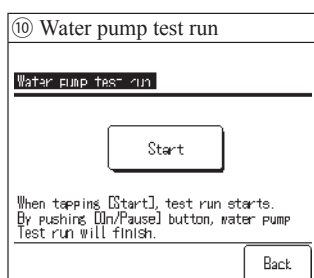
Enter the contact phone No. with up to 13x 1-byte letters.
Tap [Set] to save.

⑨ Test run



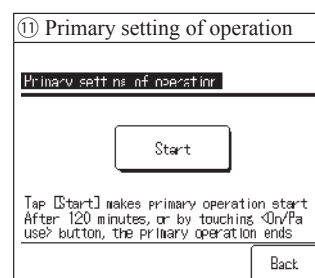
Move to the screen of a selected menu.

⑩ Water pump test run



After feeding water, please start [Water pump test run] and purge air.

⑪ Primary setting of operation



After end of [Water pump test run], please start [Primary setting of operation]. Please refer to next page for detail.

7. Installation settings and test run (Continue)

Test run procedure

* When operating the unit initially, [Water pump test run] and [Primary setting of operation] is required.

- (1) Please prepare for the test run according to instruction described on the installation manual of the heat pump unit.
- (2) Tap the **[Start]** button on the [⑩ Water pump test run] screen of item 7 [Installation settings and Test run].

Information

[Water pump test run] can be implemented with the DIP switch of the heat pump unit as well.

Please refer to the installation manual of the heat pump unit for detail.

- (3) Return to the TOP screen. When the [Water pump test run] starts, the message of "In water pump check operation" is displayed. (Screen ⑫)
Please purge air, and then open the drain valve and relief valve for the cylinder and check the water drain off continuously.
(If gurgling sound is heard or the drain is drawn off intermittently, purging air is not completed.)
- (4) After the end of the [Water pump test run], please stop the water pump.
When pushing the **[Run/Pause]** switch, the [Water pump test run] is stopped.
- (5) Tap the **[Start]** button on the [⑪ Primary setting of operation] screen of item 7 [Installation settings and test run].

Information

[Primary setting of operation] can be implemented with the DIP switch of the heat pump unit as well.

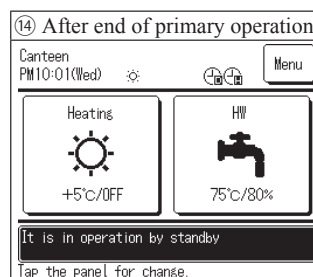
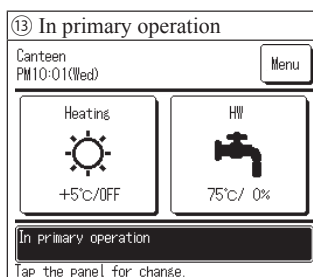
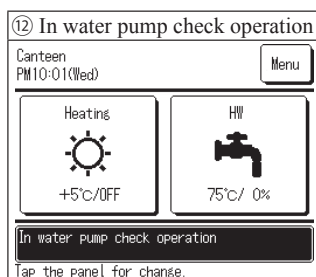
Please refer to the installation manual of the heat pump unit for detail.

- (6) Return to the TOP screen. When the [Primary setting of operation] starts, the message of "In Primary operation" is displayed. (Screen ⑬)
The actual hot water temperature during primary operation is different from the displayed hot water temperature on the TOP screen, because the heat pump unit is operated by changing hot water temperature during primary operation.
- (7) After the end of the [Primary setting of operation], The heat pump unit is paused and the message "In primary operation" is disappeared and the message of "It is in operation by standby" is displayed. (Screen ⑭)

If starting the operation to top up, pushing the **[Run/Pause]** switch.

However, if the primary operation does not completed within 120 minutes or this operation is stopped forcibly by pushing **[Run/Pause]** switch before completion, this operation ends and the heat pump unit pauses.

Please restart [Primary setting of operation] from the procedure (5).



- (8) After end of [Primary setting of operation], please clean up strainers in the water circuit.
After finishing the cleaning of strainers, please check no leakage in the system and purge air again.

Caution

- Because of the risk for the heat pump unit to have failure, after the completion of the [Water pump test run] and [Primary setting of operation], please start operation to top up.
- After the completion of the [Primary setting of operation], it does not start operation to top up, because the heat pump unit is pausing.
In case of staring operation, please push **[Run/Pause]** switch.
- Despite pausing, the water pump and compressor may start operation for preventing water in the water pipe from freezing.

8. User environment (Simplified setting for operation pattern)

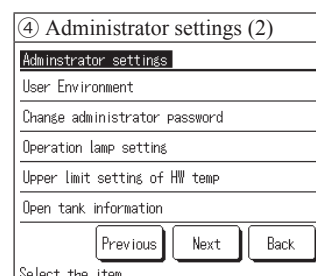
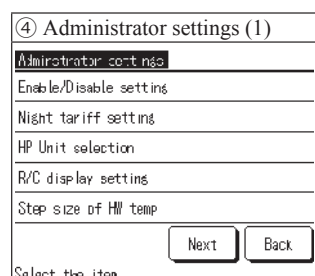
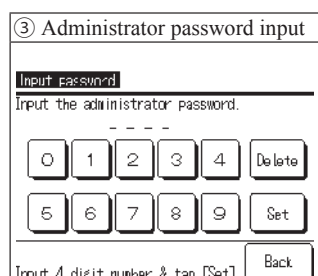
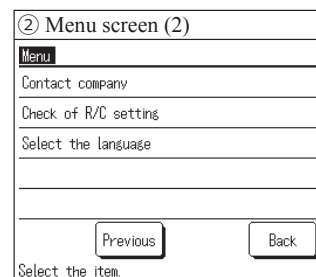
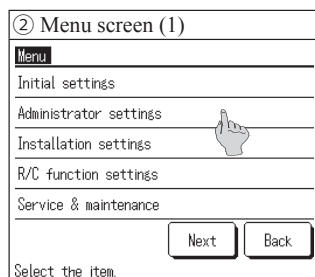
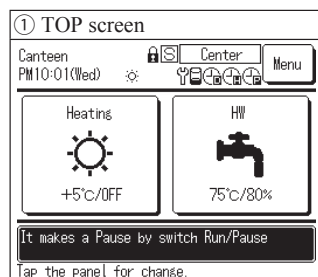
This heat pump unit is operated to top up hot water according to the target hot water amount set at each time zone.

By selecting the operation pattern for the typical business type which is similar to your actual usage pattern of hot water, you can set the operation pattern easily.

Setting method

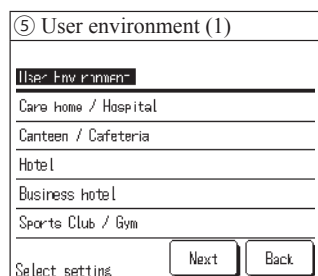
(1) [② Menu] ⇒ [③ Administrator password (Service password "9999")] ⇒ [④ Administrator settings] ⇒ [⑤ User environment]

And then select the business model, and tap **Yes** on the [⑥ User Environment acknowledge] screen

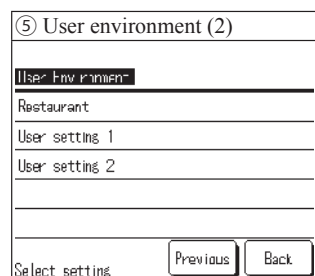


Factory default: "0000"

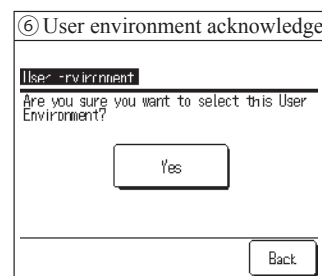
Service password "9999" is also acceptable.



By selecting the business type whose operation pattern is similar to yours, the operation pattern can be set easily.



By selecting user setting 1 or 2, you can save or load your operation pattern. For more detail please see the instruction manual.



When tapping **Yes**, the operation pattern is overwritten by the selected one. Refer to followings for details

(2) To edit the operation pattern set by [User environment], please edit it by following procedure.

Push the **[Schedule setting]** switch on the panel ⇒ [Setting of weekly operation pattern].

Target water level for the business model

Time	Default value	Care home/hospital	Canteen/cafeteria	Restaurant	Hotel	Business hotel	Sports Club/gym	Sports Club/gym	HW temperature (common)
22:00	100%	60%	60%	60%	40%	40%	40%	40%	65°C
0:00	100%	100%	100%	100%	100%	100%	100%	100%	75°C
4:00	100%	100%	100%	100%	100%	100%	100%	100%	65°C
8:00	30%	80%	80%	80%	80%	40%	100%	100%	65°C
10:00	30%	50%	60%	80%	70%	40%	80%	80%	65°C
13:00	30%	30%	40%	60%	60%	100%	60%	60%	65°C
16:00	30%	30%	20%	40%	50%	100%	40%	40%	65°C
19:00	30%	30%	20%	30%	40%	40%	30%	30%	65°C

9. R/C function settings

[TOP screen] ⇒ [Menu] ⇒ [R/C function settings]

① TOP screen

Canteen PM10-01(Wed) Center Menu

Heating +5°C/0FF HW 75°C/80%

It makes a Pause by switch Run/Pause
Tap the panel for change.

② Menu screen (1)

Menu

Initial settings
Administrator settings
Installation settings
R/C function settings
Service & maintenance

Next Back

Select the item.

② Menu screen (2)

Menu

Contact company
Check of R/C settings
Select the language

Previous Back

Select the item.

③ Service password input

Input password

Input the service password

0 1 2 3 4 Delete

5 6 7 8 9 Set

Input 4 digit number & tap [Set] Back

④ R/C setting menu

R/C function settings

Main/Sub of R/C 5
External input 6
Auto-restart 7

Back

Select the item

⑤ Main/sub of R/C

Main/Sub of R/C

Main
Sub

Back

Select setting

The service password is "9999".
(Unable to change)

⑥ External input

Internal input

Invalid

All units

Back

Select setting

When several heat pump unit is connected, with this function, the range to apply the external input can be set.

[Individual]: This is applied only to the HP unit received the input signal

[All units]: This is applied to all HP units connected in the system.

⑦ Auto-restart

Auto-restart

Valid
Invalid

Back

Select setting

If power failure occurs during operation

[Valid]: It returns to the state before the power failure, soon after power recovery.

[Invalid]: It pauses after power recovery

Information

What is the Auto-restart?

This is the function to restart the unit automatically under the same operating state as that before power failure, when power is recovered, by memorizing the operating state before power failure. In case that the setting of [Auto-restart] is [Valid], even though the power failure occurs, the unit can restart automatically after power recovery.

Factory default: [Valid]

Information

Regarding the following settings for daily use, please refer to the user's manual.

• Initial settings

Clock setting, Date and Time display, Contrast, Backlight, Controller sound, Priority setting and Summer time.

• Schedule setting

Setting of weekly schedule (HW), Setting of weekly schedule (Heating), Setting of day off, Setting of day off and Setting of peak-cut.

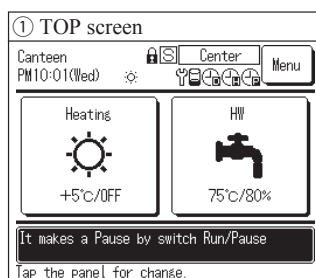
• Administrator settings

Enable/Disable setting, Step size of HW temp, R/C display setting, HW unit selection, User environment, Change administrator password, Operation lamp setting, Open tank information, Application setting and Cancel weekly timer (HW).

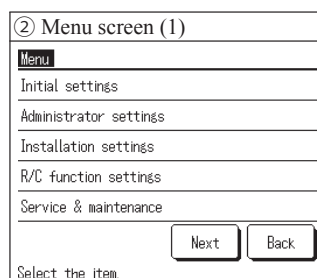
10. Service & maintenance

[TOP screen] ⇒ [Menu] ⇒ [Service & Maintenance]

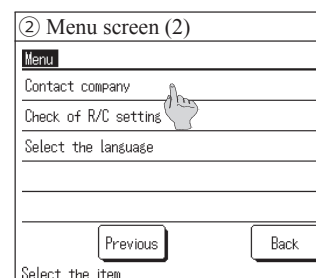
① TOP screen



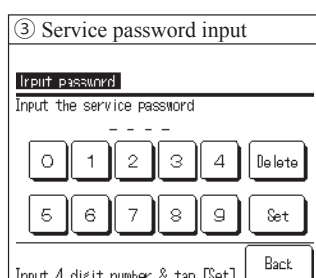
② Menu screen (1)



② Menu screen (2)

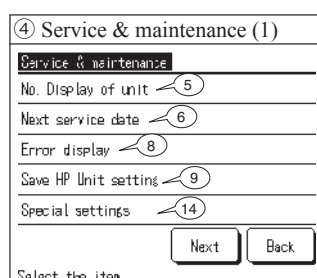


③ Service password input



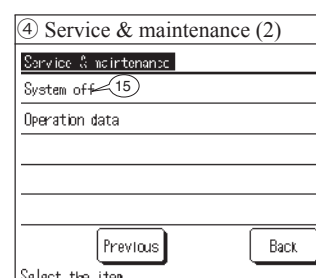
The service password is "9999".
(Unable to change)

④ Service & maintenance (1)

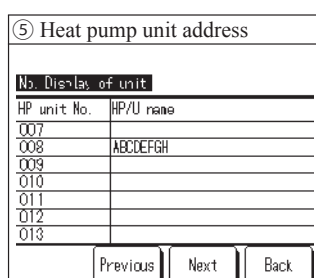


Move to the screen of a selected menu.

④ Service & maintenance (2)

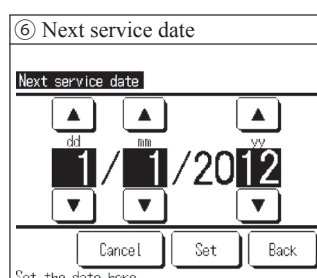


⑤ Heat pump unit address



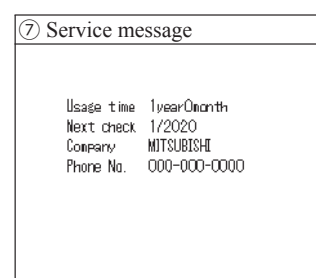
When 8 or more units are connected,
the 8th and the subsequent units are
displayed on the next page.

⑥ Next service date

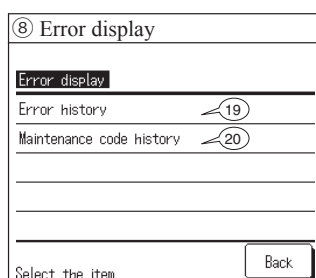


If next service date is entered, messages
are displayed at the every Run/Pause of
operation on the service month. ⑦
If the [Cancel] button is tapped,
messages are not displayed.

⑦ Service message

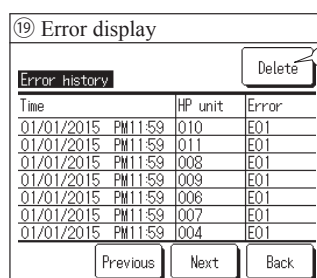


⑧ Error display



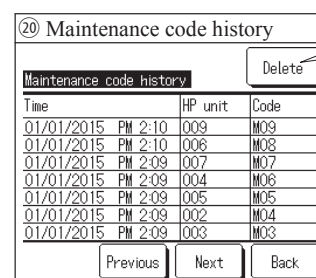
Move to the screen of a selected menu.

⑨ Error display



Date and time of error occurrence,
HP unit address and Error code are
displayed.

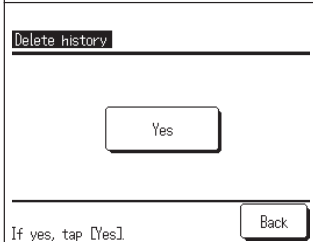
⑩ Maintenance code history



Date and time of maintenance code
occurrence, HP unit address and
maintenance code are displayed.

10. Service & maintenance (Continue)

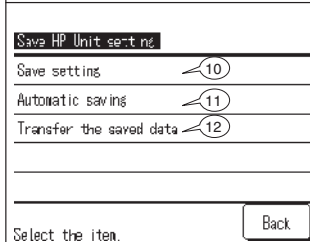
⑨ Delete history acknowledge



If yes, tap [Yes].

When tapping YES, history is deleted.

⑩ Save HP Unit setting



Select the item.

[Saving HP unit setting]

The data of all heat pump units connected is saved in the R/C.

[Automatic saving]

The time to save the data of the heat pump units automatically can be set.

At the set time, the data are saved everyday. (* Factory default: 24:00)

[Transfer the saved data]

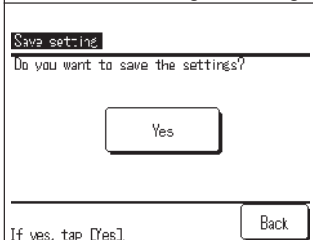
The data saved in the R/C is transferred to the heat pump unit.

In case of several heat pump units, the data can be transferred individually.

Information

The remote control can save the cumulative operation hours of the components for water and refrigerant circuit memorized in the heat pump unit as backup. If the PCB of the heat pump unit has malfunction, the data saved in R/C can be written in the new PCB of the heat pump unit with the [Transfer the saved data] function.

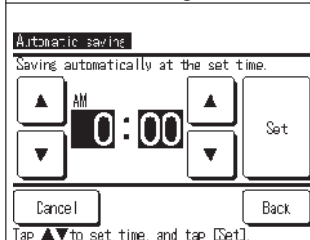
⑪ Save HP Unit setting acknowledge



If yes, tap [Yes].

When tapping [Yes], the setting of the heat pump unit connected is saved.

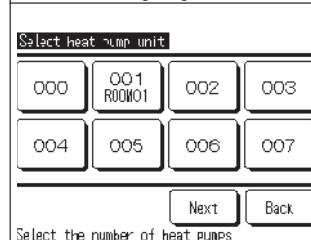
⑫ Automatic saving



Tap ▲▼ to set time, and tap [Set].

After setting the time and tapping [Set], the time to save automatically can be set.

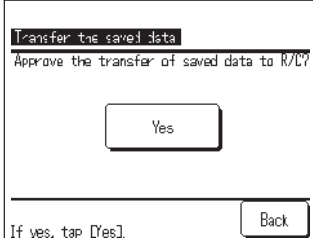
⑬ Select heat pump unit



Select the number of heat pumps.

If several heat pump units are connected, the unit to be sent the saved data can be selected.

⑭ Transfer the saved data acknowledge

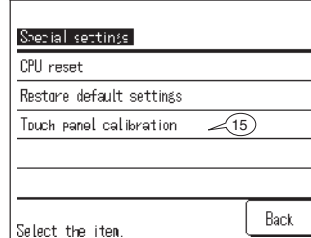


If yes, tap [Yes].

When tapping [Yes], the following data is transferred to the heat pump unit selected.

- Hot water set temperature
- Cumulative operation hours of compressor
- Cumulative operation hours of water pump
- HP 7-segment P01, P78, P79 data
- CW FV1 compensation value
- Upper limit of HW temperature

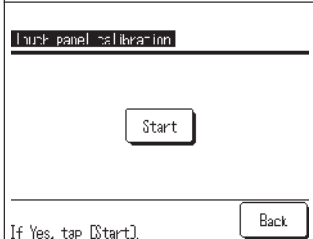
⑮ Special setting



Select the item.

Move to the screen of a selected menu.

⑯ Touch panel calibration



If Yes, tap [Start].

Adjust the position if the display and the touch position are unmatched.

[CPU reset]

The microcomputer of the heat pump unit connected is reset.

(Like a state of recovery after power fail)

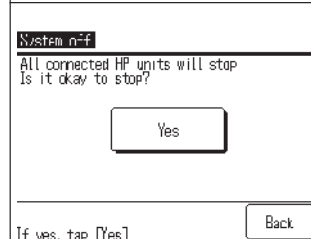
[Restore default settings]

The settings of the R/C and the HP unit connected are restored to the factory settings.

[Touch panel calibration]

Adjust the position if the display and the touch position are unmatched.

⑰ System OFF



If yes, tap [Yes].

When tapping [Yes], all HP Units connected are stopped.

With this, anti-freezing operation cannot work as well.

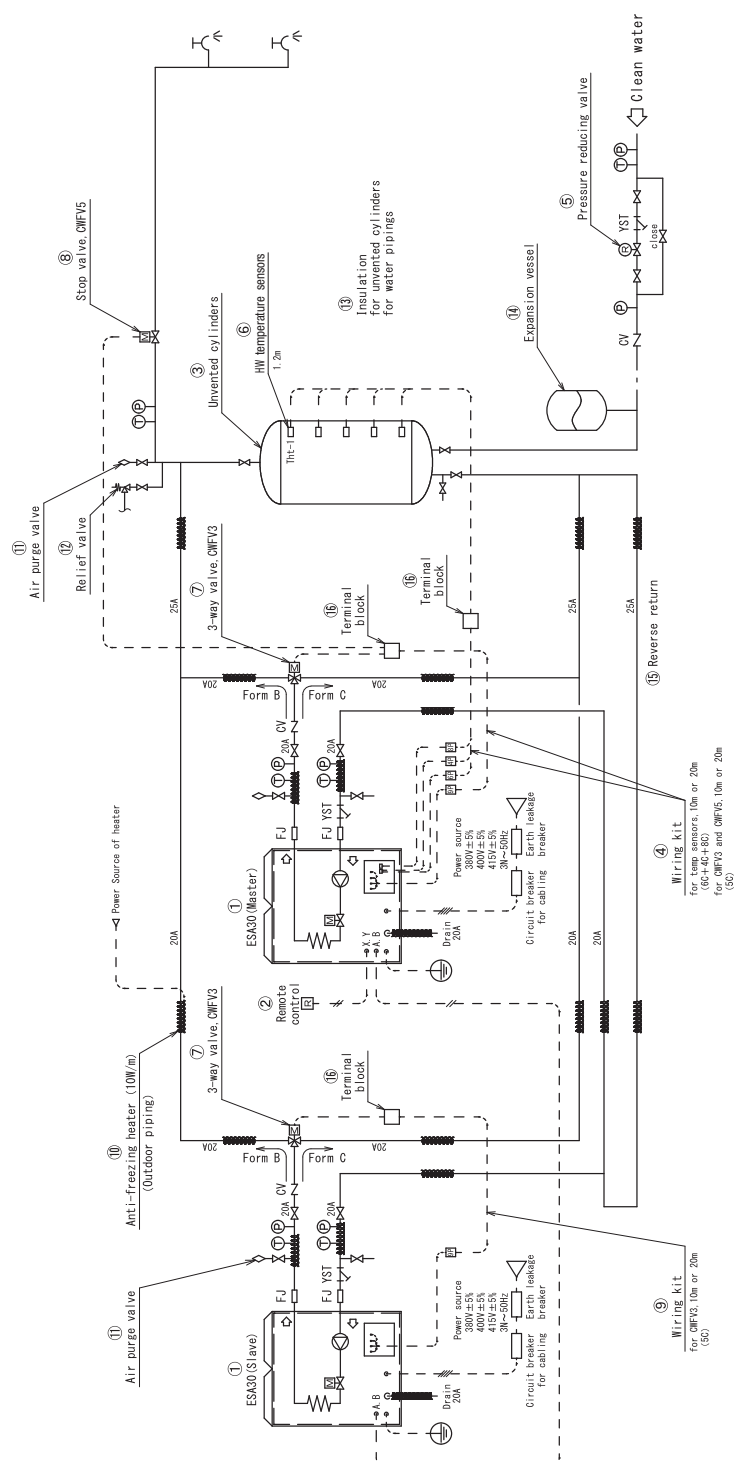
If leaving the hot water supply system for long period, be sure to drain off.

3.3 Setting and operation modes for unvented cylinder and configuration of master-slave units

(1) Introduction

With the sealed master-slave connection, a heat pump water heater is set as the master unit for a unvented type hot water cylinder, and up to 3 heat pump water heaters are connected as slave units to the master unit. Where two or more heat pump water heaters can be connected as master units to a hot water storage cylinder, each master heat pump water heater starts or stops independently depending on the hot water storage temperature, set by remote control. With the master-slave connection, however, the master unit controls collectively the start and stop of its slave units. In this case, project design, installation and maintenance is simplified compared to the case where two or more master units are connected to a single hot water storage cylinder. It is in fact sufficient for the hot water temperature sensors to be connected to the master unit only.

(2) System diagram



(3) Component list

	Part name	Model	General description
①	Heat pump water heater	ESA30EH2-25	For outdoor air temperature -25°C
②	Remote control for heat pump water heater (Option part)	RC-Q1EH2	For setting hot water amount and setting hot water temperature.
③	Unvented cylinder (Locally procured)	—	Refer to the specifications of unvented cylinder mentioned on 'page77.
④	Wiring kit for unvented cylinder (Option part)	MTH-Q1E (20m length of wire) or MTH-Q2E (10m length of wire)	For connecting heat pump water heater with unvented cylinder • Connect to the water temperature sensor of unvented cylinder • Connect to the 3-way valve for switching to anti-freezing circuit and control it
⑤	Pressure reducing valve (Locally procured)	—	Connecting pipe size $\geq 32A$ Setting pressure is to be set lower than 500kPa at the inlet of the heat pump water heater and lower than the design pressure of the cylinders. Also please be considered that the head difference of the heat pump water heater and the cylinders and the tolerance of the relief valve (especially lower side)
⑥	Hot water temperature sensor (Option part)	MTH-Q3E	Mounting or pasting on the unvented cylinder for detecting hot water temperature in the cylinder. 1.25m length x 9
⑦	3-way valve, CWFV3 (Option part)	MTH-Q4E	For switching to anti-freezing circuit (wiring length 0.7m, AC200V, 50mA)
⑧	Stop valve of hot water supply, CWFV5 (Option part)	MTH-Q5E	If the multiple heat pump water heaters are connected, it is necessary to use at the hot water supply line. (wiring length 0.7m, AC200V, 50mA)
⑨	Wiring kit for CWFV3	MTH-Q6E (20m length of wire) MTH-Q7E (10m length of wire)	MTH-Q1E or -Q2E has only one set of relay wiring for CWFV3 (MTH-Q4E). For the master-slave connection, provide an MTH-Q6E or MTH-Q7E for each slave unit.
⑩	Anti-freezing water heater (Locally procured)	—	When outdoor air temperature becomes below 0°C, be sure to install this heater on the water pipe (10W/m)
⑪	Air purge valve (Locally procured)	—	For purging the air in the hot water system which is generated during heating up the water in the unit or is mixed in the system when feeding water. Each valve is required for each cylinder.
⑫	Relief valve (Locally procured)	—	For preventing from increasing pressure in the system during heating up the water. Working pressure is to be set lower than 500kPa at the inlet of the heat pump water heater and lower than the design pressure of the cylinders. Also please be considered that the head difference of the heat pump water heater and the cylinders and the tolerance of the relief valve
⑬	Insulation (Locally procured)	—	Heat resistance $\geq 120^{\circ}C$ • For the cylinder shell: 50mm or thicker glass wool whose density is 16kg/m ³ . • For the cylinder end plate: 50mm or thicker glass wool whose density is 24kg/m ³ . • For the water piping: 30mm or thicker glass wool whose density is 48kg/m ³ .
⑭	Expansion vessel (Locally procured)	—	—
⑮	Reverse return (Locally procured)	—	When two more master units are connected to a tank, employ the reverse return circuit at the water supply side, in order to reduce the difference in pressure losses among respective heat source unit systems.
⑯	Terminal block (Locally procured)	—	—

(4) Address setting

PCB	SW1, 2 SW4-7, SW4-8	Set the heat pump water heater No. by the combination of SW settings.
-----	------------------------	---

* Rotary switches SW1 and SW2 only are not used for the address No. setting.

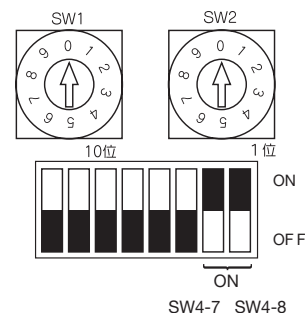
Address setting method

- ① A remote control is necessary for the master unit. Up to 16 units of remote control can be connected at the maximum.
- ② Up to 3 slave units can be connected.
- ③ SW1 and SW2 need to be set in the same way for master and slave units in the same system. Take care not to duplicate the No. with other systems.
- ④ Set SW1 and SW2 as →

SW1	SW2
0	0
0	5
1	0
1	5
2	0
2	5

Either one of listed at left. No. other combination is allowed.
In order to use all addresses available, master unit address can start from 00.

- ⑤ It is necessary to use SW4-7 and SW4-8 for the setting of slave units. For master unit, set SW4-7: OFF and SW4-8: OFF.



When there are 8 units for 3 systems (3 master units, 1 slave unit, 1 slave unit and 3 slave units)

Hot water supply system	Heat source water heater	SW1	SW2	SW4-7	SW4-8	Network address
A	Master	0	0	OFF	OFF	00
	Slave 1	0	0	ON	OFF	01
B	Master	1	0	OFF	OFF	10
	Slave 1	1	0	ON	OFF	11
C	Master	2	0	OFF	OFF	20
	Slave 1	2	0	ON	OFF	21
	Slave 2	2	0	OFF	ON	22
	Slave 3	2	0	ON	ON	23

Same combination must be used on each system.

Caution

Address Nos. of slave units are the master unit address No. +1 to +3. When setting the address No. for master unit, take care not to duplicate it with those of other systems. You cannot operate if there is a duplication. (Error display: E-31)

Master unit must be OFF.

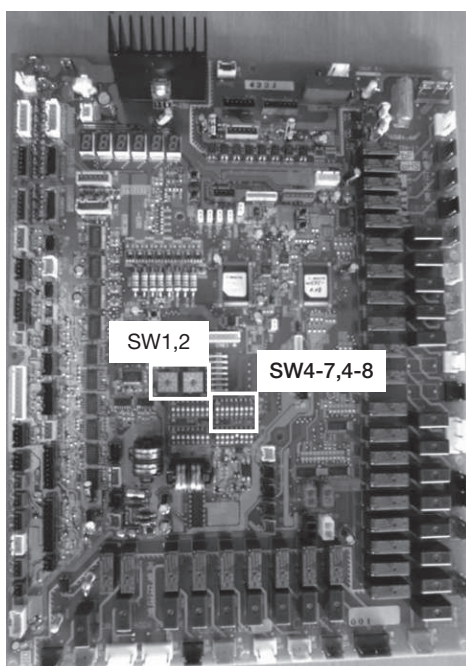
Set slave units as shown in the following list.

This list shows an example. Address Nos. of slave units on the network are the master unit address No. +1 to +3.

When the address Nos. of slave unit exceed 31, however, it is set starting from 00 onward

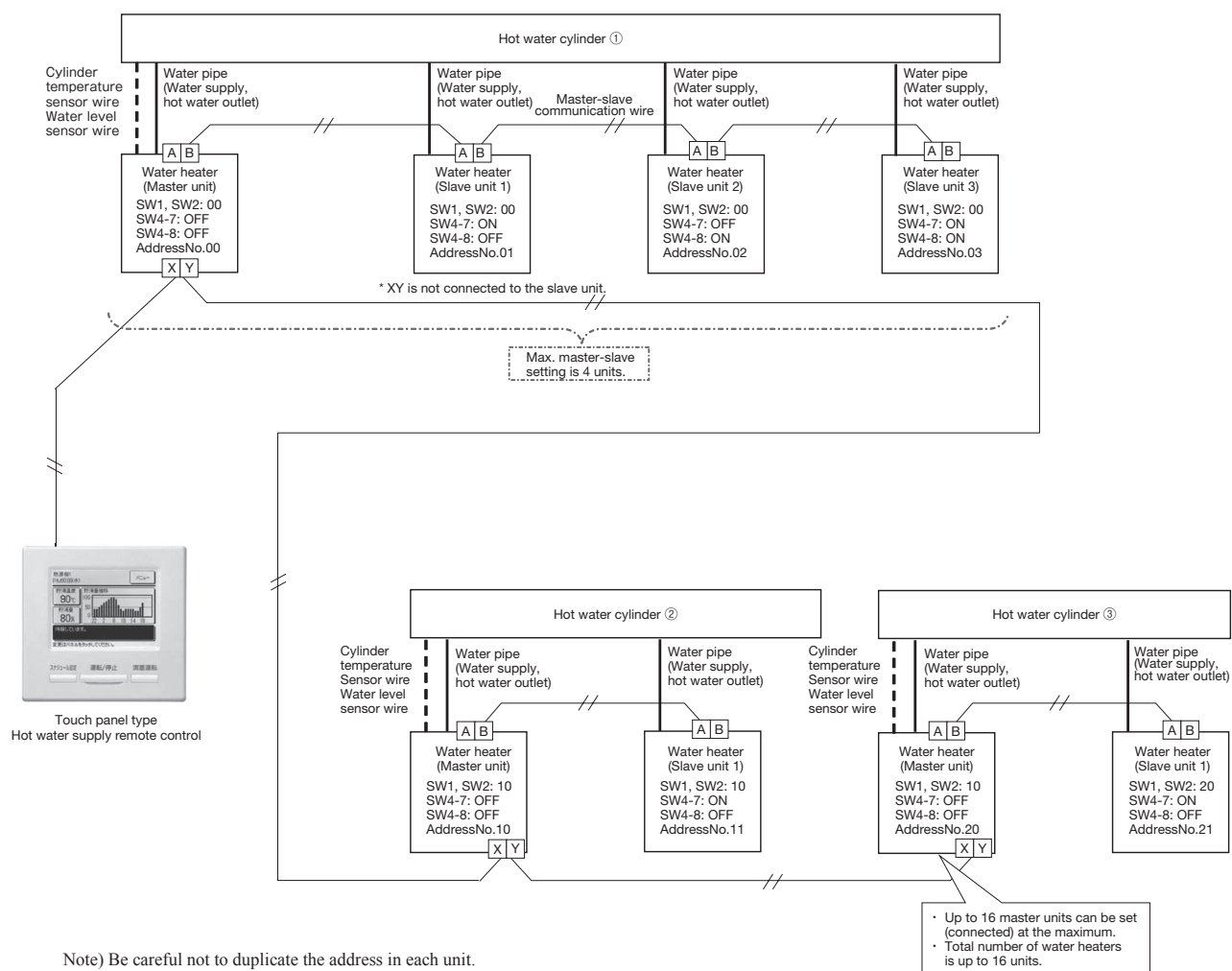
When using continued address Nos., take care not to duplicate the address No. of master unit on the hot water supply system B with those of slave units on the hot water supply system A.

This is all for the address setting for master and slave units.



	SW4-7	SW4-8
Master	OFF	OFF
Slave 1	ON	OFF
Slave 2	OFF	ON
Slave 3	ON	ON

Example of address setting for multiple unit connection



Note) Be careful not to duplicate the address in each unit.

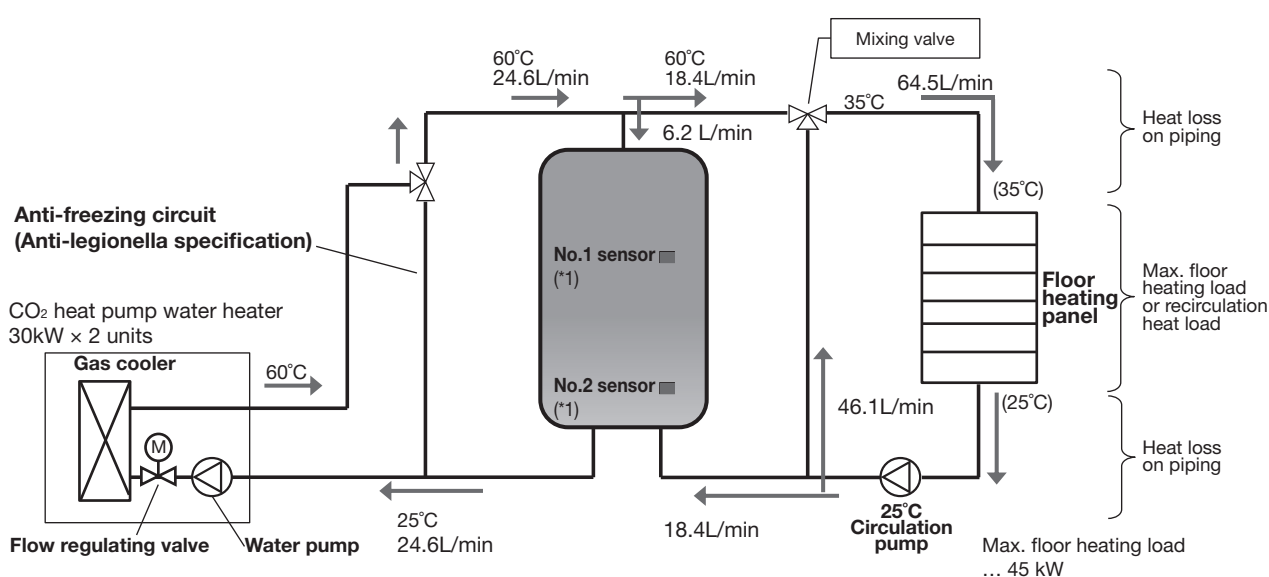
3.4 Design guidelines for CO₂ heat pump water heater in top up operation mode for heating applications

(1) Introduction

Example and feasibility study of CO₂ heat pump water heater for low temperature or unvented floor heating calculations based on the following conditions:

- Max. floor heating load
= Max floor heating panel load + Heat loss from piping = 45 kW
- Floor heating system (including piping system) with temperature conditions under max. load of 35°C at 64.5 L/min for the supply flow 25°C for the return flow

Since the range of hot water temperatures available from CO₂ heat pump water heater is from 60°C to 90°C, the hot water at 35°C required for the supply flow of floor heating is produced by mixing hot water stored in the cylinder 60°C (in the figure) with the low temperature hot water at 25°C of the return flow from the floor heating panel.



(2) Water quality criteria

Makeup water and primary water shall be within the range of water quality criteria mentioned below.
If water quality is outside this range, there is the possibility of scaling and corrosion to be foaming.

	Item	unit	Tolerated value		Risk	
			Cyclic water	Make up water	Corrosion	Scale-forming
Standard items	pH at 25°C	u.pH	7.0-8.0	7.0-8.0	✓	✓
	Electric conductivity (20°C)	mS/m	≤27	≤27	✓	✓
	Electric conductivity (25°C)	mS/m	≤30	≤30		
	Chloride ion	mgCl-/L	≤30	≤30	✓	
	Sulphate ion	mgSO ₄ ²⁻ /L	≤30	≤30	✓	
	Acid consumption (pH4,8)	mgCaCO ₃ /L	≤50	≤50		✓
	Sulphate ion ÷ Acid consumption		≤0.5	≤0.5		✓
	Total Hardness	mgCaCO ₃ /L	≤70	≤70		✓
	Calcium Hardness	mgCaCO ₃ /L	≤50	≤50		✓
	Ionic Silica	mgSiO ₂ /L	≤20	≤20		✓
	Residual Chlorine	mgCl/L	≤0.1	≤0.3	✓	

(3) Water piping connection

The distance between heat pump water heater and hot water storage unit should be as shorter as possible from a view point of energy saving. Please decide the pipe size and length in order for pipe resistance to be lower than allowable external head (at the maximum flow volume) of heat pump water heater as shown below.

(i) Allowable external head

Allowable external head: 5mAq (49kPa) at 17 L/min (Maximum flow volume)

(ii) Pressure loss of the pipe, joint and option part

① Pressure loss of pipe

Typical pressure loss is shown in following table. Please select the size of hot water supply pipe and return pipe by referring following table

Nominal diameter	Flow volume (L/min)	Rough indication of pipe friction resistance per unit length
20A	20	0.1mAq (1kPa)/m
25A	40	0.1mAq (1kPa)/m
32A	80	0.1mAq (1kPa)/m
40A	120	0.15mAq (1.5kPa)/m
50A	160	0.06mAq (0.6kPa)/m
65A	160	0.02mAq (0.2kPa)/m

② Rough indication about the equivalent pipe length corresponding to the pressure loss of joints.

Nominal diameter	Equivalent pipe length (m)			
	Elbow	Gate valve	Check valve (Swing type)	Y-type strainer
20A	0.75	0.15	1.6	2.18
25A	0.9	0.18	2.0	3.00
32A	1.2	0.24	2.5	4.62
40A	1.5	0.30	3.1	5.47
50A	2.1	0.39	4.0	8.00
65A	2.4	0.48	4.6	11.50

* 15A=DN15=15mm=1/2in
 20A=DN20=20mm=3/4in
 25A=DN25=25mm=1in
 32A=DN32=32mm=1-1/4in
 40A=DN40=40mm=1-1/2in
 50A=DN50=50mm=2in
 65A=DN65=65mm=2-1/2in

③ Pressure loss of option part

3-way valve, CWFV3 : 0.9mAq (9.2kPa) at 17 L/min

Stop valve of hot water supply, CWFV5 : 0.04mAq (0.35kPa) at 17 L/min

(4) Determination of the number of heat pump water heaters

Heating capacity of the heat pump water heater is more necessary than the maximum floor heating load (including heat loss from piping).

Heating capacity necessary for heat pump water heater[kW] $\geq$ Max. floor heating load [kW]

⇒ Max. floor heating load is 45kW, outdoor temperature is -10°C and heating capacity of a heat pump water heater is 28.5kW under this condition. (water temperature ;outlet 65°C/feed 5°C)

Correction coefficient is 0.90 at relative humidity 78% and heating capacity after correction is 25.65 kW. As a result, two heat pumps are necessary.

So please be careful at the time of selection of heat pump water heater number. (Please inquire for details.)

(5) Operation control of CO₂ heat pump water heater (Detection of reach and un-reach temperature)

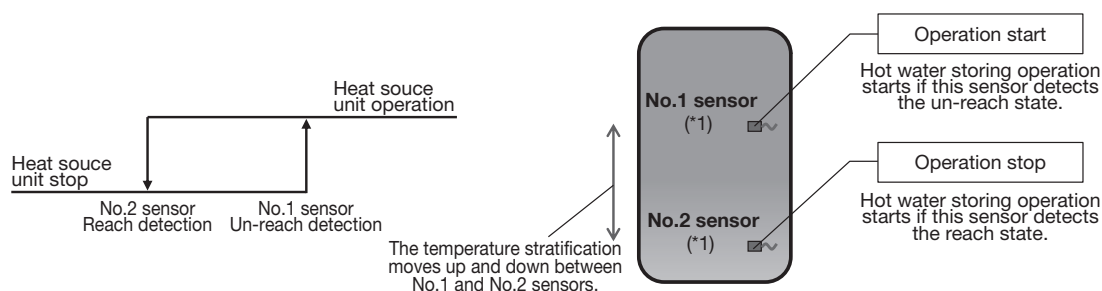
For continuous loads, such as for under floor heating, it is necessary to provide a specific control, which starts operation when No. 1 sensor attached to the cylinder detects the state of un-reached temperature, and stops operation when No. 2 sensor detects the state of reached temperature. This is to protect the compressor avoiding the compressor to frequently starts and stops. (See following figure.)

Setting method: This is done by setting P78 on the 7-segment display of CO₂ heat pump water heater control. (Ref: Engineering data in English, [(i) In case that 1 set of 500L cylinder is installed] page 100)

⇒ Because the minimum hot water storing sensor is 20% according to the following table, when a pair of sensors are used (P78 = 80).

CO₂ heat pump water heater operation control

The table below shows the No. temperature sensors and their position on the cylinder.



Total number of sensors installed								
Sensor No.	2 pcs.	3 pcs.	4 pcs.	5 pcs.	6 pcs.	7 pcs.	8 pcs.	9 pcs.
Tht-1	20%	20%	20%	20%	10%	20%	10%	10%
Tht-2	100%	60%	50%	40%	30%	30%	20%	20%
Tht-3		100%	75%	60%	40%	40%	30%	30%
Tht-4			100%	80%	60%	50%	50%	40%
Tht-5				100%	70%	65%	60%	50%
Tht-6					100%	80%	70%	60%
Tht-7						100%	80%	70%
Tht-8							100%	80%
Tht-9								100%

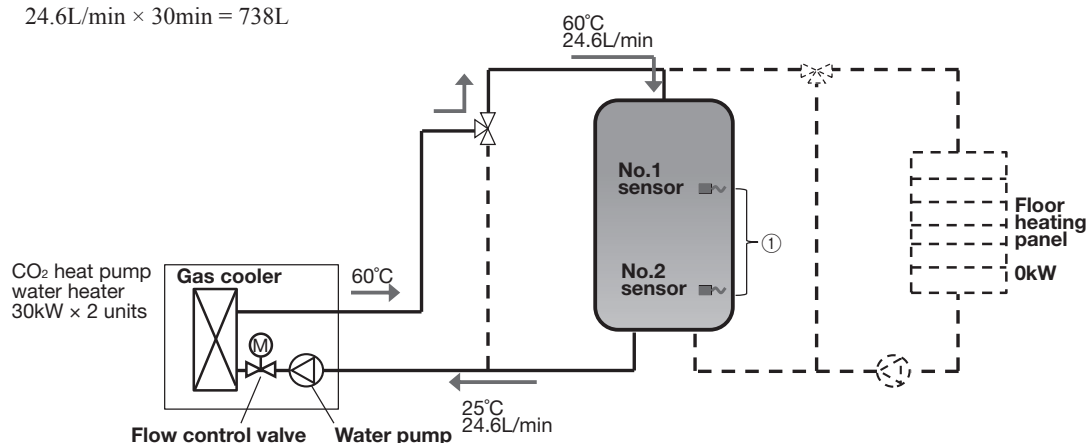
(6) Determination of hot water storage cylinder capacity

(a) Volume of water necessary to operate for 30 minutes continuously

In order to protect the compressor, it is necessary to enough provide the volume of water (Section ① in the figure) so that it takes more than 30 minutes from the start of operation upon the detection of the state of un-reached by No. 1 sensor till No. 2 sensor detects the state of reached value. In this case, it is assumed as safety margin that the load from the under floor heating panel is 0 kW and the heat source unit is in operation.

⇒ When CO₂ heat pump water heater is operated for 30 minutes under no load with the rate of flow to the cylinder at 24.6 L/min (sum of two units with heating capacity of 30 kW, entry water temperature at 25°C, supply hot water temperature at 60°C), the volume of water required between No. 1 sensor and No. 2 sensor is:

$$24.6\text{L/min} \times 30\text{min} = 738\text{L}$$



(b) Quantity of heat to be retained always in the cylinder

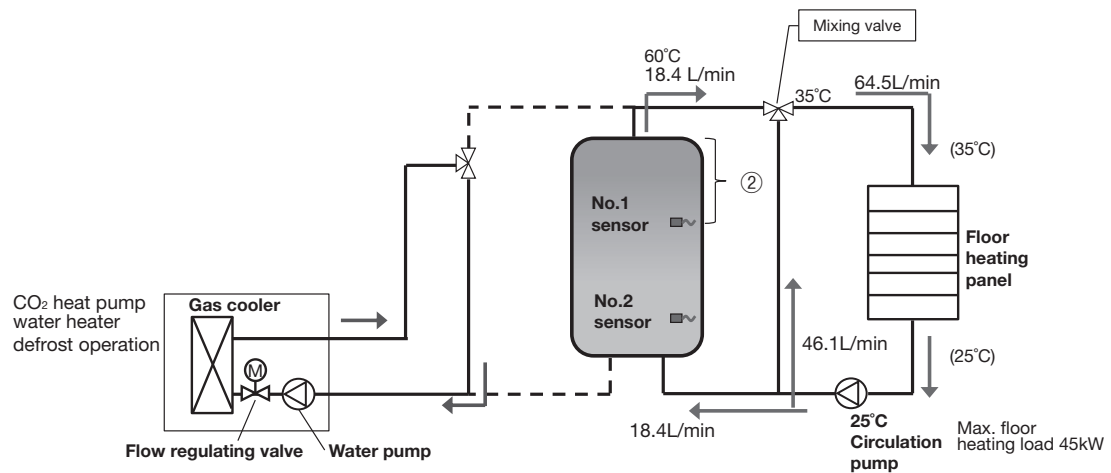
It is always necessary for the cylinder to retain enough heat that can cover the following energy requirements:

- (i) Quantity of heat energy that can be supplied to the load for 10 minutes, till the discharge hot water temperature stabilizes after start up operation of heat pump water heater.
- (ii) Quantity of heat energy that can be supplied to the load during the defrost operation (20 minutes normally)

From (i) and (ii) above, for safety margin, the volume of water, required equivalent to the quantity of heat that can meet the maximum load for 20 minutes, is defined above No. 1 sensor (Section ② in the figure).

⇒ Flow rate of hot water at 60°C necessary at the maximum load of floor heating is 18.4 L/min.

Volume of water in the cylinder which is necessary to meet the load for 20 minutes, is: $18.4\text{L/min} \times 20\text{min} = 368\text{L}$

**(7) Storage cylinder capable of maintaining the temperature stratification**

The cylinder needs to have the hot water storing capacity determined in the section [3] and the characteristics that can maintain the thermal stratification in the state that CO₂ heat pump water heater is operating under the maximum load of floor heating.

⇒ The cylinder needs to have the characteristics which can maintain the temperature stratification (layer of hot water at 60°C) in the cylinder when the hot water at 60°C from CO₂ heat pump water heater is stored in the cylinder at the rate of 6.2 L/min (=24.6 L/min - 18.4 L/min) and the water at 25°C is returned at the rate of 18.4 L/min from the floor heating to the cylinder, and the water at 25°C is returned at the rate of 24.6 L/min from the cylinder to CO₂ heat pump water heater.

(See the figure in the section “[0] Introduction”.)

(8) Calculation of the amount of energy saving per year

Please be aware that if the return water temperature rises, i.e. during part load or intermediate season, there is a higher possibility that it might enter the unit, causing either a drop in capacity or COP. (Especially when return temperature are higher than +35°C)

When calculating the yearly estimated energy saving, it is necessary to check the return water temperature on a wide range of load conditions.

3.5 External input and output

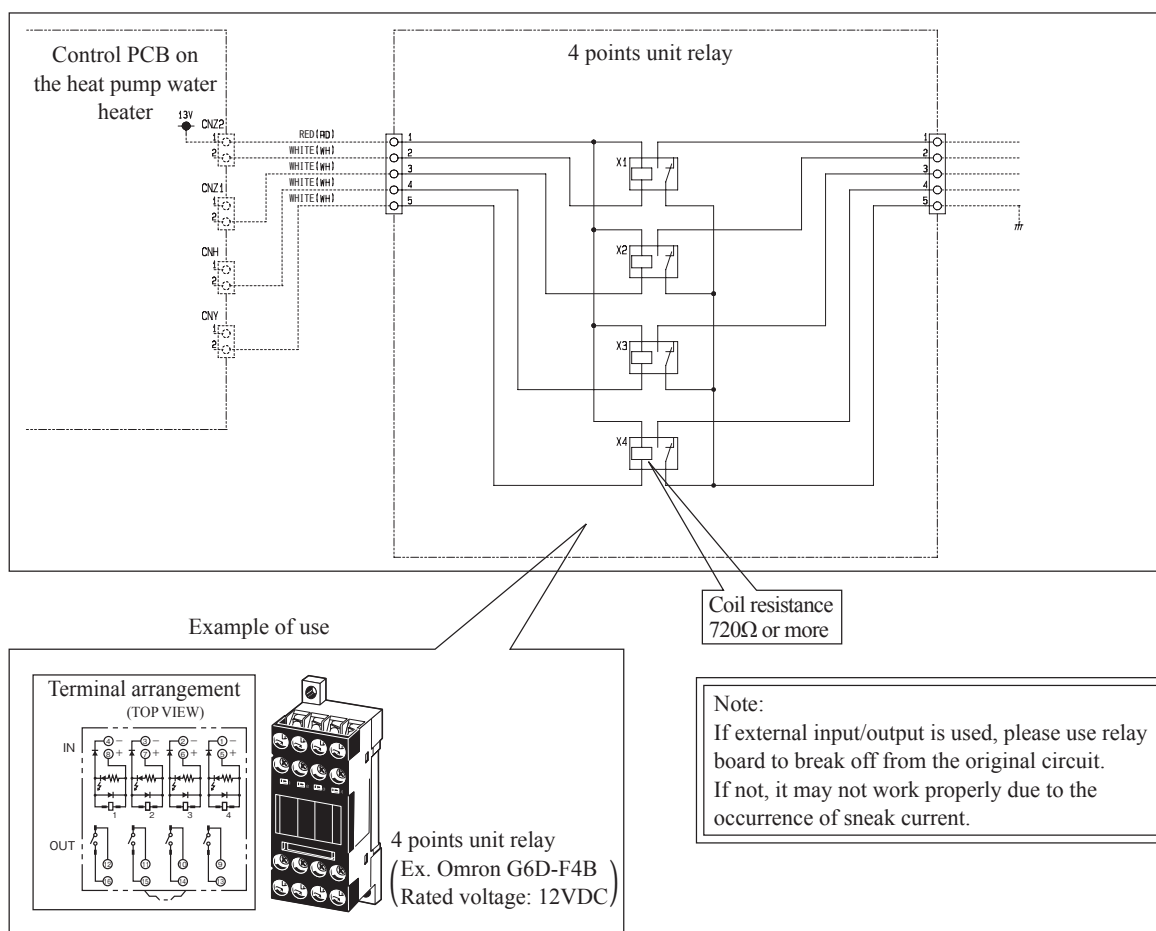
(1) External input terminal specifications

Name	Usage (★Factory default)	Specifications	Remarks
External input	CNS1 All system stop input (★ Short)	No voltage contact (DC12V)	When CNS1 is opened, it makes all system stopped. Anti-freezing water operation is also canceled.
	CNS2 Demand input (★Short)		When CNS2 is opened, demand input is available. Set the demand % with SW4-5 and SW4-6.
	CNS3 Snow prevention fan control input (★ Open)		Set it to master and slave units individually.
	CNG1 Start operation input (★ Open)		When CNG1 is shorted, the unit starts operation. After operation, when CNG2 is shorted, the unit is paused. (In this case, even if CNG1 is opened again, the unit does not become paused). In reverse, after CNG2 is shorted, even if CNG2 is opened again, the unit does not start operation.
	CNG2 Pause operation input (★ Open)		
External output	CNH Operation output	DC12V output (10mA)	Operation signal is also output during antifreezing operation.
	CNY Error output		—
	CNZ1 Set with 7-segment control (*1)		★0: Operation output
	CNZ2		★1: Error output

(*1) 0: Operation output, 1: Error output, 2: Compressor On output, 3: Fan On output, 4: Dry-up water output, 5: Water pump (DCWP) operation command output, 6: Anti-freezing water circuit output, 7: Defrost operation output, 8: Output of operation to top up, (9: Output of operation to keep warm) 10: Anti-freezing operation output, 11: Anti-freezing heater output, (12: Overflow output), 13: Auto-backup operation output, 14: Remote control On output, 15: Hot water amount output 16: Heating operation output (for space heating)

() for open tank only

Also AC200V external output (page 141)



(2) Control of CO₂ heat pump water heater operation by external input and output

(a) Outline

- This chapter explains how to control Start ⇔ Stop operation of CO₂ heat pump water heater from the user's control panel. When controlling the unit via the control panel and external input, however, the temperature detection in the cylinder using the temperature sensors can be disabled.

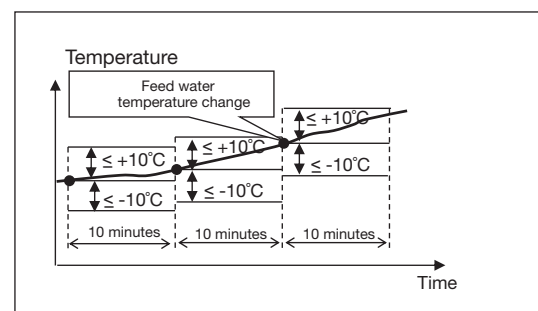
(b) Fundamental concept and precaution

- CO₂ heat pump water heater controls Start ⇔ Stop operation by judging the stored amount of hot water based on the temperatures detected by the cylinder temperature sensors.
When controlling operations with external inputs, however the detection using the cylinder temperature sensors can be disabled and, control is by commands made from the control panel.
- Since the hot water temperature of CO₂ heat pump water heater cannot be set on the control panel, it is necessary remote control (RC-Q1EH2).
- Since the operation command to CO₂ heat pump water heater gives the first priority to the “last tap on the button”, it is necessary to adjust at site such that the hot water supply remote control will not be operated by anything other than the hot water temperatures. It is necessary also to disable the auto-restart function from the remote control.
- Take care not to set repeat starts and stops of operation frequently in order to protect CO₂ heat pump water heater's compressor.

Once the CO₂ heat pump water heater has been paused, do not restart operation for at least 30 minutes.

It is necessary also to design the system such that once the CO₂ heat pump water heater has been started, operation will be continued for at least 30 minutes.

- Design the system such that the feed water temperature to CO₂ heat pump water heater is no higher than 62°C and that the range of variation in the feed water temperature will be within ±10°C in any 10 minutes interval.



(c) Specifications of external input

- It is necessary to use CNG1 and CNG2 on the control PCB installed in the CO₂ heat pump water heater.
 - CNG1 ... Operation is input when this is short-circuited. Level input. Operation, however, will not stop even if the circuit is put to open after it was short-circuited.
 - CNG2 ... Pause is input when this is short-circuited. Level input. Operation, however, will be left in the state of pause even if the circuit is put to open after it was short-circuited.
 - * Each input is judged at the rising edge of level input.
 - * It is prohibited to input signals at CNG1 and CNG2 simultaneously. If this is attempted, the pause takes the priority. When changing from the operation input to the pause input, open CNG1 once and then short-circuit CNG2.
 - * External inputs to CNG1 and CNG2 become valid approx. 1 minute after the power source is turned on to CO₂ heat pump water heater.
 - * Confirm that the code Nos. of 7-segment indicator are as shown at right. * P28 is 3 and P29 is 4.
- <Terminology>
- Pause ⇒ There is no hot water operation to fill up, but the antifreeze operation is conducted with the water pump even if the compressor is stopped.
 - System full-stop ⇒ Even the anti-freezing operation is disabled. * This is prohibited, therefore, to use in the operation control with external input.

Table: External inputs/outputs

	Name	Purpose (Factory default)	Specification	Caution
External input	CNS1(Green)	System full-stop input (Factory default: Shorted)	Non-voltage contact (DC 12 V)	Stopped when open. Anti-freezing operation is also cancelled.
	CNS2(Red)	Derate input (Factory default: Shorted)		Input when open. Set demand ratio with SW4-5, 4-6.
	CNS3(Brown)	Snow protection fan control input (Factory default: Shorted)		Set with main and sub devices respectively.
External output	CNH(Blue)	Operation output	DC 12 V output (10 mA)	This is output even during anti-freezing operation.
	CNY(White)	Error output		—
	CNZ1, CNZ2 (Red) (Black)	(7-segment setting *1)		(Provide Molex: 5557-2R or 5556T at site.)

(*1) 0: Operation output, 1: Error output, 2: Compressor ON output, 3: Fan ON output, 4: Drought output
 5: Water pump (DCWP) command output, 6: CWFV3 bypass output, 7: Defrost operation output,
 8: Hot water operation to fill up output, 9: Heat retention operation output, 10: Anti-freezing operation output,
 11: Anti-freezing heater output, 12: Water overflow output, 13: Auto backup operation output,
 14: Remote control ON output, 15: Hot water amount output, 16: Heating operation output (for space heating)

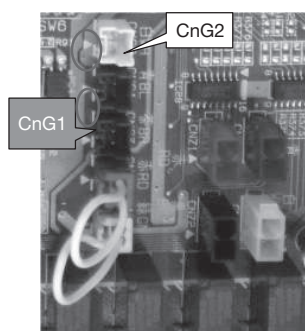
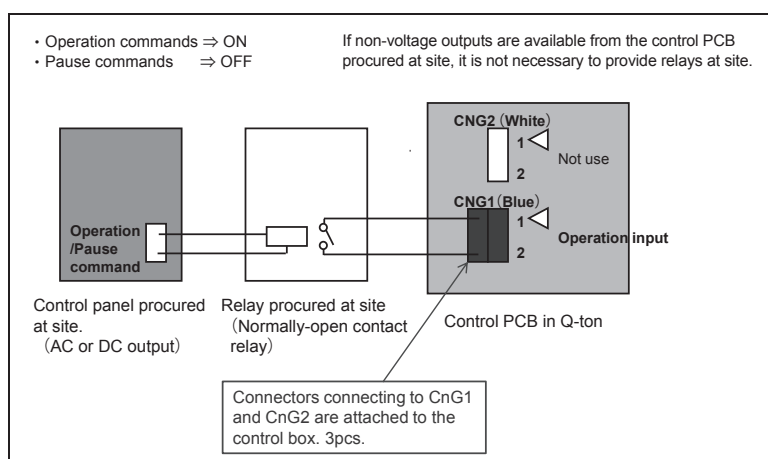


Fig. Control PCB in CO₂ heat pump water heater



(d) Other setting (Mandatory)

- Turn the DIP switch : SW5-6 to ON
- Set 7-segment: P01 at “0”. Since the cylinder temperature information to the hot water supply is deprived, oPE-32 is displayed always on the PCB of hot water supply unit. This is normal.
- Setting of hot water supply remote control: After turning on the power source, set the master remote control and the date/time. To enable controls from the control panel procured at site, “disable” the power interruption backup. Do not use also the pause setting for the schedule. Just set the water storage temperature using the remote control.

3.6 Guideline for indoor installation of CO₂ heat pump water heater

CO₂ heat pump water heater uses a natural refrigerant, CO₂ (carbon dioxide). Although CO₂ refrigerant itself is not toxic, a higher concentration of CO₂ refrigerant causes various adverse influences on human body if it is inhaled. Also to consider, the outdoor unit produces condensation water that needs to be drained properly.

When the outdoor unit is installed indoors, such as in a machinery room or in an occupied space, it is necessary to take the following safety measures into consideration, in accordance with EN 378.

One or more appropriate measures (alternative provisions) might be required - a gas detection device in conjunction with

- Ventilation (natural / mechanical)
- Safety shut off valves
- Safety alarm

Points for indoor installation

- Provide emergency measures against leakage of CO₂ gas.
- The room must be ventilated sufficiently, and CO₂ heat pump water heater must not be exposed to exhaust air flow from other equipment.
- Condensation water to be drained properly.

(1) Mechanical ventilation as a safety measurement to protect from refrigerant leakage

Please ensure that the following minimum mechanical ventilation air flow (m³/h) is respected, based on the indoor type of installation of the CO₂ heat pump water heater.

① Machinery room

A machinery room is an enclosed room or space, sealed from public areas and not accessible to the public, which is intended to contain components of the refrigerating system.

Air from machinery rooms shall be vented outdoors using mechanical ventilation in case of a release of refrigerant due to leaks of components.

The minimum mechanical ventilation air flow shall be

$$\dot{V} = 0.014 \times m^{2/3} \times 3600$$

where

$\dot{V}$ is the mechanical ventilation air flow m³/h;

m is the mass of refrigerant charge (kg) in the refrigerating system with the largest charge, any part of which is located in the machinery room.

For Q-ton, it is 8.5kg;

0.014 is a conversion factor with units of m³/s·kg^{2/3}

$$\dot{V} = 0.014 \times 8.5^{2/3} = 0.0583 [\text{m}^3/\text{s}] = 209.9 [\text{m}^3/\text{h}]$$

② Occupied space

An occupied space is a space in a building which is bounded by walls, floors and ceilings and which is occupied by persons for a significant period.

Where the CO₂ heat pump water heater is in or the piping passes through an occupied space having a volume of such size that the total charge exceeds the allowable charge specified in EN 378-1:2016, C.3, then the alternative provisions in EN 378-3:2016 Clause 6 may be applied to ensure safety.

The minimum mechanical ventilation air flow shall be

$$V = \frac{10}{RCL}$$

where

V is the mechanical ventilation air flow in m³/h;

10 is the expected maximum leak rate, in kg/h

RCL is the Refrigerant concentration limit in kg/m³. For Q-ton, it is 0.072(kg/m³).

$$V = \frac{10}{0.072} = 138.9 [\text{m}^3/\text{h}]$$

(2) Indoor ventilation capability and safety

Since the unit is a CO₂ heat pump water heater, cold air is released from the top fan when hot water is produced. If there is neither other heat source nor room ventilation, dewing or freezing could occur in the room, which could cause problems to other equipment.

⇒ There is actually a report that the fuel pipe of boiler was frozen in a boiler room.

Set the ventilation capacity estimating this cooling capacity to be 20 kW/unit.

Where there is no other heat source and outdoor air is introduced, the maximum ventilation capacity is required to be max. 260 m³/min for each CO₂ heat pump water heater. (This is the blow air capacity which is stated in the specifications.) It should be noted that the blow air capacity of CO₂ heat pump water heater varies roughly as follows depending on atmospheric temperatures.

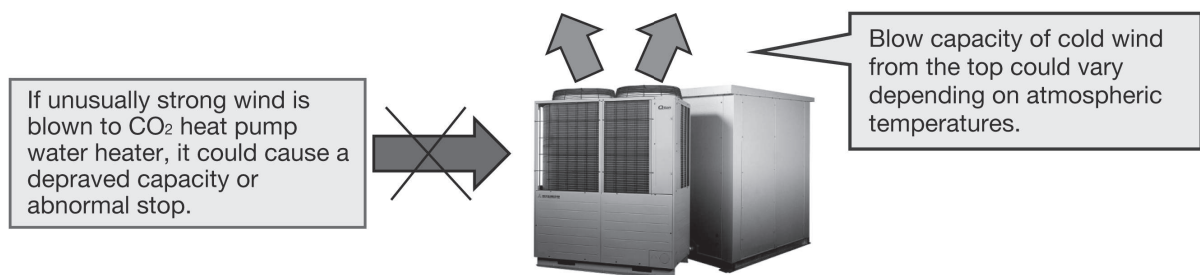
Atmospheric temperature: 16°C or lower ⇒ 260 m³/min

25°C or lower ⇒ 30 – 260 m³/min

25°C or higher ⇒ 30 m³/min or less

When the atmospheric temperature is higher than 25°C, the blow air capacity is lowered to reduce the refrigerant pressure. (This is same as the heating operation of air-conditioner in the summer season.)

Control installed in CO₂ heat pump water heater controls the fan motor so as to detect the atmospheric temperature and adjust it to provide necessary air blow capacity. Take care not to blow unusually strong wind to CO₂ heat pump water heater from external equipment.



(3) Drain water disposal

Drain water is released from the piping of CO₂ heat pump water heater, accumulator vessel or other.

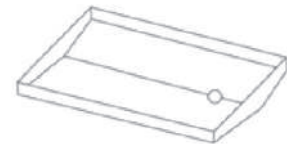
- Dewing water from the outdoor unit's heat exchanger and piping in summer
- In winter, drain water is released from frozen water during the defrost operation in addition to the above.

*The melting water and drain water are released from the drain outlet on the base.

- * Where the unit is installed indoors, the drain water should be collected by drain pan (locally procured) to dispose properly.



Collective drain pan (locally procured)



HA05950

[Condition of dewing water in summer]

- Where drain water causes any problem even at an outdoor installation, use a collective drain pan or other containing means.
- Where drain water may freeze, provide an anti-freezing means such as a heater.

Summary of safety design requirements

- (1) Secure the following indoor installation space to protect against a leakage of refrigerant.
Floor space of 191 m² or more and space volume of 287 m³ for each CO₂ heat pump water heater
- (2) Unless the above space is available, provide a ventilation with a capacity of 31 m³/min or more for each CO₂ heat pump water heater.
- (3) Monitor the CO₂ concentration with an alarm type detector, which should be installed not higher than 0.3 m above the floor.
- (4) CO₂ heat pump water heater needs a cooling capacity of 20 kW/unit and sufficient ventilation during the hot water supply operation. Take care not to blow the ventilated air to CO₂ heat pump water heater.
- (5) Dispose drain water released from CO₂ heat pump water heater properly.
Water is released also from the drain ports located near the hot water and water supply outlets. Same care must be taken to this water.

4. SERVICING

4.1 General description of servicing

(1) Test run

(a) Kinds of test run (Definition of terms)

Terms	Starting method	Ending method	Operation mode after test run	Complement
1. Water pump test run - Operation of the water pump only - Operation for purging air in the water circuit	At Run or Pause, start test run with one of following procedures ① Start operation from [Water pump test run] function of the R/C ② Switch ON the DIP switch SW5-2 on the PCB of the heat pump water heater	① Switch OFF the DIP switch SW5-2 on the PCB of the heat pump water heater ② Pause operation by pushing the <u>Run/Pause</u> switch of R/C	Return to the status (Run or Pause) before starting test run	<Action at water pump test run> Water pump: Operated at 3000min ⁻¹ Flow regulator (CWDV1): Fully open
2. Primary setting of operation - Corresponding to the case that the installation was done without observing installation limitation. - Judging the stability of the supply hot water temperature by operating the compressor and water pump at a certain speed. - Above operation ends after 30 minutes have elapsed at the minimum, but if the stability of the supply hot water temperature cannot be judged, it operates for 120 minutes at the maximum. - After the end of operation, correct the opening of flow regulator.	Despite Run or Pause, start operation with one of following methods ① Start operation from [Primary setting of operation] function of R/C ② Switch ON the DIP switch SW5-1 on the PCB of the heat pump water heater	① Switch OFF the DIP switch SW5-1 on the PCB of the heat pump water heater	Pause	Despite the "primary setting of operation" does not end (In case of ending condition ① – ④), it moves to normal operation * If the supply hot water temperature is not stable, It is possible to correct the opening of flow regulator by implementing [Primary setting of operation] again * It is possible to start [Primary setting of operation] from operating status.
		② Pause operation by pushing the <u>Run/Pause</u> switch of R/C	Pause	
		③ Send pause operation command by the external input	Pause	
		④ After 120 minutes have elapsed. (Forcible stop by time-up)	Pause	
		⑤ End operation normally	Pause	Move to normal operation
3. Normal operation (Test run) Collect the operation data by operating normal operation.	① Start operation by pushing [Manual operation to fill up] switch on R/C	① Pause operation by pushing the <u>Run/Pause</u> switch of R/C	Pause	Even if the operation starts by pushing <u>Run/Pause</u> switch, when the hot water amount in the cylinder is more than the target hot water amount, it cannot be operated. (the message of "It is in operation by standby" is displayed) In this case, collect the operation data by pushing [Manual operation to fill up] switch.
		② Hot water amount reaches the target hot water amount	Standby	
		③ End operation to fill up	Standby	

Note 1) [Water pump test run] and [Primary setting of operation] can be started with the R/C or the PCB of the heat pump water heater, and can be end with both the R/C and the PCB of the heat pump water heater (Ex. To start with the R/C and to end with the PCB of heat pump water heater is also available.)

Note 2) [Water pump test run] and [Primary setting of operation] can be set from the master heat pump water heater only.

Note 3) If the [Primary setting of operation] is not completed, it can not go to [Normal operation]

Note 4) During the [Primary setting of operation], no adjustment of the valve opening is done.

Note 5) [Normal operation (fill up)] is forcibly stopped by time up after 10 hours have elapsed.

(b) Test run procedure

- a. After completion of installation work, check water can be supplied to the hot water supply system and turn the power ON. After setting the [Date] and the [Time], the following TOP screen (Screen 1-1) is displayed on the R/C.

* At this time, The mode of operation is [Pause]

Caution 1

After servicing, according to this test run procedure, implement [Water pump test run] and [Primary setting of operation] as well. Furthermore, check no error is existing on the R/C setting of [Date] and/or [Time]

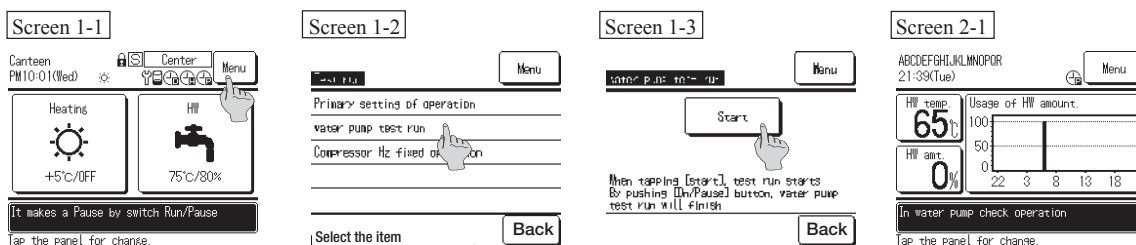
If wrong setting of [Date] and/or [Time] is done, it may cause to charge higher tariff than anticipated by the customer because the night tariff is not applied.

- b. Implement water pump test run

Check the heat pump unit is in Pause mode and **switch ON the SW5-2 on the PCB of the heat pump unit.**

* Please check the message of "It makes a pause by switch Run/Pause" displayed on the display section of the TOP screen of R/C (Screen 1-1)

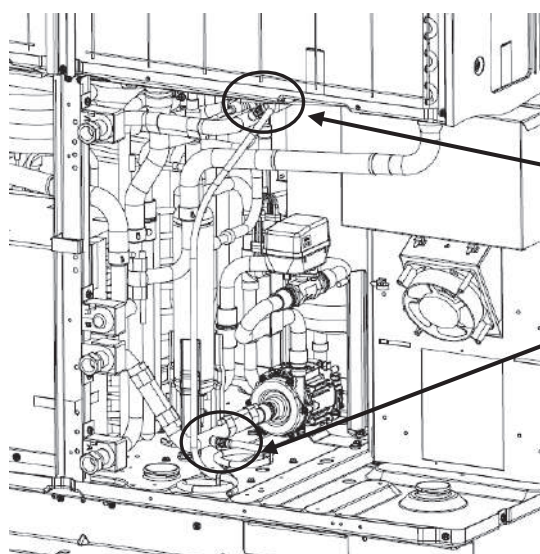
Water pump test run can also be done with R/C. Implement [Water pump test run] according to the following procedure. Check the message [In Pause mode] (screen 1-1) ⇒ [Menu] ⇒ [Installation setting] ⇒ [Input service password (9999)] ⇒ [Test run] (screen 1-2) ⇒ Water pump test run] (screen 1-3)



During pause, the message "It makes a pause by switch Run/Pause" is displayed on the TOP screen.

- c. When starting water pump test run, the message of "In water pump check operation" is displayed on the TOP screen (Screen 2-1) At this time, purge air by operating the water pump.

- Air purge valve of heat pump unit (refer to the Figure 1 mentioned below.)
- Open the relief valve and drain valves of cylinder and secondary side of hot water supply system, and **check the water drawn off continuously.** (If gurgling sound can be heard, purging air is not completed.)



Air purge valve

* At water pump test run, only this valve should be opened.

Drain valve

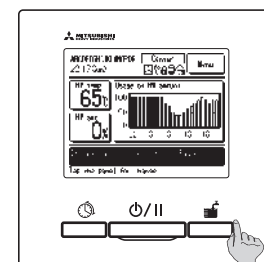
* When draining the heat pump unit, open this valve together with air purge valve.

Figure 1. Figure removed rear panel and right side panel of the heat pump water heater

- d. After the end of water pump test run, **switch OFF the SW5-2 on the PCB of the heat pump water heater** and stop operation of water pump test run.

Screen 3-1

If stopping this operation with R/C, push **Run/Pause** switch at the TOP screen (Screen 3-1).



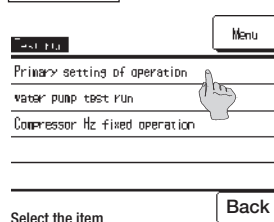
- e. Please start [Primary setting of operation]

[Primary setting of operation] can be done by **switching ON the SW5-1 on the PCB of the heat pump water heater.**

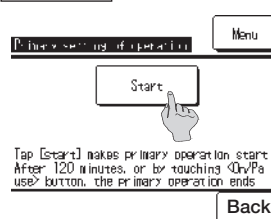
If starting this operation with R/C, it can be done according to the following procedure.

[Menu] ⇒ [Installation setting] ⇒ [Input service password (9999)] ⇒ [Test run] (Screen 4-1) ⇒ [Primary setting of operation] (Screen 4-2)

Screen 4-1



Screen 4-2

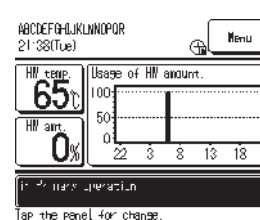


- f. When the heat pump water heater starts operation of [Primary setting of operation], the message of "In Primary operation" is displayed on the TOP screen (Screen 5-1).

When the operation is completed, the heat pump water heater pauses and the message to "In Primary operation" is disappeared.

After ending [Primary setting of operation], please **switch OFF the SW5-1 on the PCB of the heat pump water heater.**

Screen 5-1



Caution 2

After the end of operation, even if the current hot water amount is less than the set hot water amount, the operation to top up can not start, because the heat pump water heater is in "Pause mode".

However, **the water pump may start operation for preventing the water in the water pipe from freezing.**

Caution 3

If [Primary setting of operation] is not done, **the anti-freezing operation cannot start during "Pause".**

(for preventing from breakdown of water pump due to a shortage of water)

If it is in danger of freezing water in the water pipe or when keep the system for long period without any operation, be sure to drawn off the water from the hot water supply system and turn the power OFF.

Caution 4

After completion of [Primary setting of operation], "2" is displayed at [Primary setting operation status] of Mente PC data

If this operation is not executed, "0" is displayed. If this operation is interrupted, "1" is displayed.

	Primary setting of operation		2	
--	------------------------------	--	---	--

* They are displayed on the [RAMDATA INDOOR] sheet

Note : The operation status of [Primary setting of operation] can also be checked with 7-segment display P30 as follows.

Not executed: P30-00
Interrupted: P30-01
Completed: P30-02

- g. After completion of [Primary setting of operation], **make setting of the operation pattern with R/C according to the hot water supply load to meet customer's requirement** and start operation with [Run/Pause] switch (Screen 3-1).

Caution 5

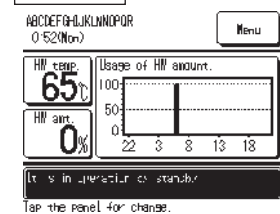
If the hot water amount in the cylinder is more than the target hot water amount, the unit does not start operation.

In this case, **the message of " It is in operation by standby" is displayed on the TOP screen of R/C** (Screen 6-1)

When the message of " It is in operation by standby", please start operation to fill up by pushing [Manual operation to fill up] switch. (Screen 6-2)

When the heat pump water heater starts operation, the message of " In operation to fill up" is displayed (Screen 6-3).

Screen 6-1

**Caution 6**

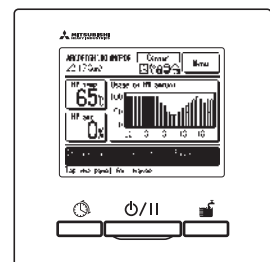
If the hot water amount is 100%, the operation to fill up does not start operation.

Please ask the customer to use hot water to be at most 90% of hot water amount with mutual consent.

Fill up operation is forcibly stopped by time up after 10 hours have elapsed.

- h. Check the operation status of the heat pump water heater with Mente PC and check each function is working properly.

Screen 6-2

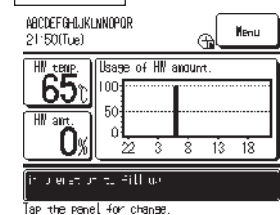
**Caution 7**

Check following 2 points

- Protection control of compressor is activated or not.
- Check the controllability of hot water temperature by changing the setting temperature of hot water to 2 kinds of set points (ex. 65°C and 80°C) with R/C.

Furthermore, please check no problem such as leak and etc on the hot water supply system according to the inspection report of CO₂ heat pump water heater.

Screen 6-3

**Caution 8**

If implementing the manual operation to fill up, please stop the operation by pushing [Run/Pause] switch.

Furthermore check the message of " It is in operation by standby" is displayed on the TOP screen of R/C.

If the message of " It makes a Pause by switch Run/Pause" is displayed, the operation to fill up does not be implemented. Please be careful.

(In such case, please start operation by pushing [Run/Pause] switch.)

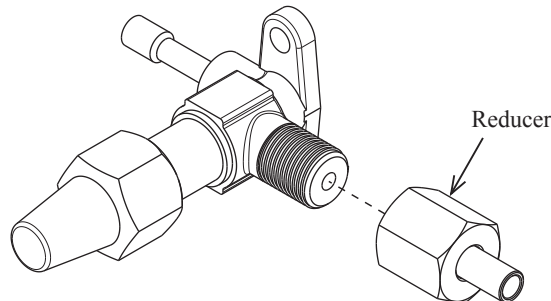
- i. After end of the test run, **please clean up the strainers in the hot water supply system.**
After cleaning the strainers, **please implement [Water pump test run] and purge air again according to the item a-c of working procedure mentioned above, and check no leak.**

(c) Standard operation data

	Air temperature			Water temperature		Operating state							<Reference>	
	DB	WB	℃	Inlet temperature	Outlet temperature	Compressor speed	HP	MP	LP	EEVG opening	EEVH opening	Tho-D	Tho-S	Water pump
	℃	℃	℃	℃	℃	rps	MPa	MPa	MPa	Pulse	Pulse	℃	℃	min ⁻¹
Operation to top up in summer	25	21	24	65	65	83	10.35	5.81	4.45	260	310	86	17	2400
Operation to top up in intermediary season	16	12	17	65	65	80	9.89	5.37	4.16	190	380	85	12	2300
Operation to top up in winter	7	6	9	90	90	88	11.65	4.60	3.46	170	230	114	6	2500
Operation to top up at frosting	2	1	5	90	90	104	11.44	4.05	3.04	130	170	125	-2	2300
Operation to top up in winter at cold region	-7	-8	5	90	90	104	10.68	3.59	2.28	130	120	125	-12	2800
Operation to top up in winter at cold region ①	-15	-	5	90	90	104	9.95	3.37	1.83	150	90	121	-19	2500
Operation to top up in winter at cold region ②	-25	-	5	90	90	100	9.66	2.73	1.35	160	80	121	-28	3800
Operation to top up at overload	43	26	29	90	90	96	11.47	5.22	4.04	340	280	103	11	2400

(2) Method to purge CO₂ refrigerant

- (a) Turn the power ON at the state that SW5-7 on the PCB of the heat pump water heater is switched ON.
With this procedure, operation is prohibited and EEVG1, EEVH1 and EEVH2 become fully opened.
- (b) Turn the power OFF for safety.
- (c) A joint (Reducer) to install on the service valve is included in the accessories. When performing the airtight test or vacuuming, finish the connection form of the joint according to purposes.



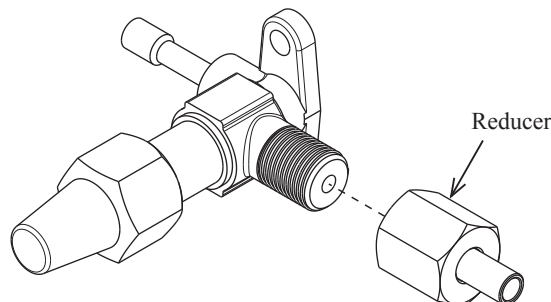
- (d) Open the service valve little by little and purge the CO₂ refrigerant
(Note) If purging CO₂ refrigerant instantly, a lot of refrigerant oil may be purged together with the CO₂ refrigerant like dry ice. Accordingly be sure to purge it little by little.
And then, since CO₂ is 1.5 times as heavy as the air, do not purge it at a place such as manhole where CO₂ may stay.
- (e) After purging almost of all amount of refrigerant charged in the heat pump water heater, attach a gauge manifold and purge the residual refrigerant merged into the refrigerant oil by using evacuation pump.
- (f) After completion of purging work, switch OFF the SW5-7 on the PCB of the heat pump water heater.

(3) Method of air tightness test

- (a) Please use nitrogen (N₂) gas for air tightness test with preparing new N₂ gas bomb.
(Note) There are 2 kinds of N₂ gas bombs. One of them has 19MPa inner pressure and the other has 15MPa inner pressure.
Please use 2 bombs of 15MPa inner pressure one, which is containing 7m³ N₂ gas, for this air tightness test.
- (b) Turn the power ON at the state that SW5-7 on the PCB of the heat pump water heater is switched ON.
With this procedure, operation is prohibited and EEVG1, EEVH1 and EEVH2 becomes fully opened.
- (c) Switch ON the SW5-8 on the PCB of the heat pump water heater.
With this procedure, **only the EEVG1 becomes fully closed.** (It makes the high pressure side separated from the low pressure side)
- (d) Turn the power OFF for safety.
- (e) Connect the new N₂ gas bomb to the service valves of both high pressure side and low pressure side with charging hoses through a gauge manifold.
- (f) Firstly implement air tightness test for only the high pressure side. Increase to 8.5MPa slowly and keep for 10 minutes. And then increase to 14MPa more slowly and keep for 10 minute and check no pressure drop.
- (g) After that implement air tightness test for the low pressure side with keeping high pressure side as it is.
Increase to 8.5MPa slowly and keep 10 minutes and check no pressure drop.
- (h) Purge N₂ gas by opening the gauge manifold little by little.
- (i) After completion of purging work, switch OFF the SW5-7 and SW5-8 on the PCB of the heat pump water heater.

(4) Method of charging refrigerant

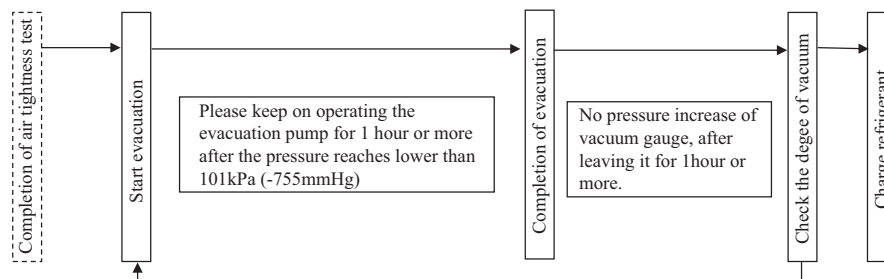
- (a) Turn the power ON at the state that SW5-7 on the PCB of the heat pump water heater is switched ON.
With this procedure, operation is prohibited and EEVG1, EEVH1 and EEVH2 becomes fully opened.
- (b) Turn the power OFF for safety.
- (c) A joint (Reducer) to install on the service valve is included in the accessories. When performing the airtight test or vacuuming, finish the connection form of the joint according to purposes.



[Caution] The cautionary note for evacuation is same as that for R410A.

[Evacuation] Implement evacuation sufficiently for removing moisture in the refrigeration circuit.
 * If the content percentage of moisture is high, it may cause clogging of EEVs and/or capillary tubes
 * Turn the power ON after switching ON the SW5-7 and open EEVs fully.

<Work flow>



If the vacuum gauge shows pressure increase, it could have any moisture remaining or leaks in the refrigerant circuit. Please find leak point and after rectification, evacuate again.

- (d) Charge refrigerant through the service valve of high pressure side. (Charging amount is 8.5kg. Normally it takes several minutes to complete charging)

[Caution] Be sure to use the CO₂ refrigerant with 99.99% of purity and to use the siphon type bomb.

[Reason] Because of charging refrigerant at liquid stage, the siphon type bomb shall be used.

And then it shall be charged through the service valve of high pressure side in order to avoid liquid flooding.
 (Do not heat the refrigerant bomb higher than 40℃ .)

- (e) After charging refrigerant, shut the service valve and disconnect the gauge manifold.

[Caution] For your safety, remove the gauge manifold and check the pressure with Mente PC at the test run after charging refrigerant.

- (f) Tighten the cap of service valve securely.

[Caution] Tightening torque of cap is 13N•m. On the other hand the service valve should be opened/closed manually.

- (g) After completion of charging work, switch OFF the SW5-7 on the PCB of the heat pump water heater.

(5) Draining

- (a) Turn the power OFF.

- (b) Close the gate valve for the heat pump water heater. (Gate valve shall be equipped on site)

- (c) Open the service panel of heat pump water heater and open the drain valve (lower side) and air purge valve (upper side) located in the heat pump water heater.

- (d) After draining off, close the drain valve and air purge valve.

(6) Charging water to the unvented cylinder

- (a) Check the power turned OFF.

- (b) Check the drain valve and air purge valve closed.

- (c) Open the gate valve for the heat pump water heater. (Water flow into the heat pump water heater)

- (d) Open the air purge valve located in the heat pump water heater and check water comes out continuously.

- (e) For the purpose of cleaning the cylinder, before the [Water pump test run], please drain off the water from the cylinder by opening the drain valve at the bottom of the cylinder and charge water to the cylinder again.

- (f) After turning the power ON, implement the [Water pump test run]

- (g) Open the drain valve again and check water is drawn off continuously.

(Note) In case of unvented cylinder, please check air purge twice, due to the feature of unvented cylinder.

- (h) After completion of air purge, stop the [Water pump test run]

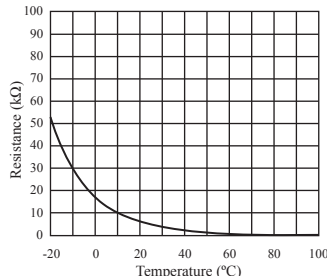
4.2 Error code list

Remote control Error code	LED on heat pump water heater		7-segment display	Contents of inspection
	Green	Red		
No display	Keep flashing	Stay off	Normal	Power line anomaly No display
E1	Keep flashing	Stay off	Normal	Communication error between remote control and heat pump water heater
E10	Keep flashing	Stay off	Normal	Excessive connected number of heat pump water heaters to the remote control
E31	Keep flashing	1-time flash	E31	Duplicated address No. of heat pump water heater Address setting error of heat pump water heater
E32	Keep flashing	1-time flash	E32	Open phase on power source Reverse phase on power source
E36	Keep flashing	1-time flash	E36-1	Discharge pipe temperature anomaly (Tho-D1)
E37	Keep flashing	1-time flash	E37-1	Heat exchanger temperature sensor 1 fault (Tho-R1)
		2-time flash	E37-2	Heat exchanger temperature sensor 2 fault (Tho-R2)
		3-time flash	E37-3	Heat exchanger temperature sensor 3 fault (Tho-R3)
		4-time flash	E37-4	Heat exchanger temperature sensor 4 fault (Tho-R4)
		5-time flash	E37-5	Fault of inlet water temperature sensor 1 on gas cooler (Tho-W1)
		6-time flash	E37-6	Fault of outlet water temperature sensor 2 on gas cooler (Tho-W2)
		Keep flashing	E37-7	Fault of inlet gas temperature sensor 1 on gas cooler (Tho-G1)
			E37-9	Fault of outlet gas temperature sensor 3 on gas cooler (Tho-G3)
E38	Keep flashing	1-time flash	E38	Outdoor air temperature sensor fault (Tho-A)
E39	Keep flashing	1-time flash	E39-1	Discharge pipe temperature sensor fault (Tho-D1)
		3-time flash	E39-3	Fault of inlet temperature sensor 1 on intermediate receiver (Tho-M1)
E40	Keep flashing	1-time flash	E40	High pressure anomaly (HP switch 63H1-1 activated)
E41	Keep flashing	1-time flash	E41-1	Power transistor overheat (for CM1) (5 times within 60 minutes)
E42	Keep flashing	1-time flash	E42-1	Current cut (for CM1)
E45	Keep flashing	1-time flash	E45-1	Communication error between inverter PCB and control PCB (CM1) High pressure anomaly (HP switch 63H1-1 activated)
E48	Keep flashing	1-time flash	E48-1	Outdoor fan motor 1 anomaly (FMo1)
		2-time flash	E48-2	Outdoor fan motor 2 anomaly (FMo2)
E49	Keep flashing	1-time flash	E49-1	Low pressure anomaly (LP sensor PSL1 activated)
E50	Keep flashing	1-time flash	E50	Flow volume anomaly in heating operation
E51	Keep flashing	1-time flash	E51-1	Power transistor 1 overheat (for CM1) (15 minutes continuously)
E52	Keep flashing	1-time flash	E52-1	Fault of hot water temperature sensor 1 on unvented cylinder (Tht-1)
		2-time flash	E52-2	Fault of hot water temperature sensor 2 on unvented cylinder (Tht-2)
		3-time flash	E52-3	Fault of hot water temperature sensor 3 on unvented cylinder (Tht-3)
		4-time flash	E52-4	Fault of hot water temperature sensor 4 on unvented cylinder (Tht-4)
		5-time flash	E52-5	Fault of hot water temperature sensor 5 on unvented cylinder (Tht-5)
		6-time flash	E52-6	Fault of hot water temperature sensor 6 on unvented cylinder (Tht-6)
		Keep flashing	E52-7	Fault of hot water temperature sensor 7 on unvented cylinder (Tht-7)
			E52-8	Fault of hot water temperature sensor 8 on unvented cylinder (Tht-8)
			E52-9	Fault of hot water temperature sensor 9 on unvented cylinder (Tht-9)
E53	Keep flashing	1-time flash	E53-1	Suction pipe temperature sensor 1 fault (Tho-S1)
		3-time flash	E53-3	Injection inlet temperature sensor 1 fault (Tho-inj1)
E54	Keep flashing	1-time flash	E54-1	Disconnection of low pressure sensor 1(PSL) Anomalous output of low pressure sensor 1
		2-time flash	E54-2	Disconnection of high pressure sensor 1(PSH) Anomalous output of high pressure sensor 1
		3-time flash	E54-3	Disconnection of intermediate pressure sensor 1(PSM) Anomalous output of intermediate pressure sensor 1
E55	Keep flashing	1-time flash	E55-1	Under-dome temperature sensor 1 fault (Tho-C1)
E56	Keep flashing	1-time flash	E56-1	Power transistor temperature sensor 1 fault (Tho-P1)
E58	Keep flashing	1-time flash	E58-1	Compressor anomaly by loss of synchronism (CM1)
E59	Keep flashing	1-time flash	E59-1	Compressor start-up failure (CM1)

Remote control Error code	LED on heat source water heater		7-segment display	Content of inspection
	Green	Red		
E60	Keep flashing	1-time flash	E60-1	Rotor position detection failure (CM1)
E61	Keep flashing	1-time flash	E61-1	Communications error between the master unit and slave unit 1
		2-time flash	E61-2	Communications error between the master unit and slave unit 2
		3-time flash	E61-3	Communications error between the master unit and slave unit 3
E63	Keep flashing	1-time flash	E63	Emergency stop , AF anomaly (set at adding active filter)
E64	Keep flashing	1-time flash	E64	Water pump anomaly (no operation)
				Water pump anomaly (excessive operation)
E89	Keep flashing	1-time flash	E89	Communication error between control PCB and CPU
No hot water comes out (1)	Keep flashing	Stay off	Normally	See troubleshooting (Page 192)
No hot water comes out (2)	Keep flashing	Stay off	Normally	See troubleshooting (Page 193)
No hot water comes out (3)	Keep flashing	Stay off	Normally	See troubleshooting (Page 194)
Anomalous sound and vibration (1)	Keep flashing	Stay off	Normally	See troubleshooting (Page 195)
Anomalous sound and vibration (2)	Keep flashing	Stay off	Normally	See troubleshooting (Page 196)

Maintenance code

Maintenance code is the signal to prompt service and maintenance, not to show anomaly.

7-segment display	Remote control display	Item	Remark
No.	No.		
Compressor operation hours			
oPE-1	M1	<In case that SW6-8 is OFF> When the cumulative operation hours of compressor has elapsed 5,000hr since the last maintenance, and it is between 4,900hr and 5,100hr. <In case that SW6-8 is ON> When the cumulative operation hours of compressor has elapsed 2,000hr since the last maintenance, and it is between 1,900hr and 2,100hr.	Synchronizing with the timing of alarming malfunction by the simple remote monitoring equipment
oPE-2	M2	<In case that SW6-8 is OFF> When the cumulative operation hours of compressor has elapsed 10,000hr since the last maintenance. <In case that SW6-8 is ON> When the cumulative operation hours of compressor has elapsed 5,000hr since the last maintenance	
oPE-3	M3	When the cumulative operation hours of compressor has elapsed 30,000hr since the last maintenance.	
Water pump operation hours			
oPE-11	M11	When the cumulative operation hours of water pump has elapsed 5,000hr since the last maintenance, and it is between 4,900hr and 5,100hr.	Synchronizing with the timing of alarming malfunction by the simple remote monitoring equipment
oPE-12	M12	When the cumulative operation hours of water pump has elapsed 10,000hr since the last maintenance.	
oPE-13	M13	When the cumulative operation hours of water pump has elapsed 20,000hr since the last maintenance.	
Setting error			
oPE-20	M20	Setting error for type of cylinder	Check setting of SW3-3 is OFF for sealed cylinder
oPE-21	M21	Setting error of heat pump water heater model	Kept SW4-1, -2, -3, -4 "OFF" (Factory default)
Error information			
oPE-30	M30	Detection of AF error	But E63 is not displayed
oPE-32	M32	Detection of drying up water	It is always displayed at test run
oPE-33	M33	Detection of disconnection of cylinder water temperature sensor	
oPE-34	M34	Detection of suspension of water supply	
oPE-35	M35	Detection of water pump error	
oPE-36	M36	Detection of excessive water flow during heating mode	Check the local equipment and adjust the water flow rate.
oPE-40	M40	· Message of [disconnection of cylinder temperature sensor] Hot water temperature sensor on the cylinder (Tht-1 to Tht-9) may be disconnected. Characteristics of HW temperature sensor 	· Check the connection and the characteristics of all hot water temperature sensors on the cylinder and if there is a problem, connect it securely or replace it. · If no problem on sensors, replace control PCB.

4.3 Troubleshooting

Error code	LED	Green	Red	Content
Remote control: No error code	Heat pump water heater	Keep flashing	Stay off	Power source anomaly (Power source to remote control)

1.Applicable model	5.Troubleshooting	
All models	Diagnosis	Countermeasure
2.Error detection method	<pre> graph TD D1{Is there no loose connection of wiring harness for remote control?} -- YES --> C1[Correct it.] D1 -- NO --> D2{Is there no disconnection or short circuit of wiring harness for remote control?} D2 -- YES --> C2[Replace wiring harness.] D2 -- NO --> P1[Disconnect the wiring harness] P1 --> D3{Is the voltage between X and Y terminals of heat pump water heater DC15V or higher?} D3 -- YES --> C3[Replace remote control.] D3 -- NO --> D4{Is the voltage between ① and ② of CN18V on the control PCB DC18V?} D4 -- YES --> C4[Replace control PCB.] D4 -- NO --> C5[Replace power PCB.] </pre>	
3. Condition of error displayed		
4.Presumable cause	• Disconnection or short circuit of remote control wiring harness • Remote control anomaly • Malfunction by noise • Power PCB anomaly • Disconnection of wiring harness • Control PCB anomaly	

Note:

Error code	LED	Green	Red	Content
Remote control: No display	Heat pump water heater	Keep flashing	Stay off	No display on the remote control

1.Applicable model	5.Troubleshooting				
All models (In case of no display on the remote control)	<table> <tr> <th>Diagnosis</th><th>Countermeasure</th></tr> <tr> <td> No display on the remote control after the power is supplied NO Is there DC10V or higher voltage on the connecting terminal of remote control? YES → Remote control anomaly NO After disconnecting the remote control, can DC10V or higher voltage be detected on the R/C wiring? YES → Remote control anomaly NO Is the connecting wire between the remote control and the heat pump water heater connected properly? YES → Connecting wire disconnection NO Is there DC15V or higher voltage between X and Y terminals of heat pump water heater? YES → Replace remote control. NO Is the voltage between ① and ② of CN18V on the control PCB DC18V? NO → Replace power PCB. YES → Replace control PCB. </td><td></td></tr> </table>	Diagnosis	Countermeasure	No display on the remote control after the power is supplied NO Is there DC10V or higher voltage on the connecting terminal of remote control? YES → Remote control anomaly NO After disconnecting the remote control, can DC10V or higher voltage be detected on the R/C wiring? YES → Remote control anomaly NO Is the connecting wire between the remote control and the heat pump water heater connected properly? YES → Connecting wire disconnection NO Is there DC15V or higher voltage between X and Y terminals of heat pump water heater? YES → Replace remote control. NO Is the voltage between ① and ② of CN18V on the control PCB DC18V? NO → Replace power PCB. YES → Replace control PCB.	
Diagnosis	Countermeasure				
No display on the remote control after the power is supplied NO Is there DC10V or higher voltage on the connecting terminal of remote control? YES → Remote control anomaly NO After disconnecting the remote control, can DC10V or higher voltage be detected on the R/C wiring? YES → Remote control anomaly NO Is the connecting wire between the remote control and the heat pump water heater connected properly? YES → Connecting wire disconnection NO Is there DC15V or higher voltage between X and Y terminals of heat pump water heater? YES → Replace remote control. NO Is the voltage between ① and ② of CN18V on the control PCB DC18V? NO → Replace power PCB. YES → Replace control PCB.					
2.Error detection method					
3. Condition of error displayed					
4.Presumable cause					
• Blown fuse • Noise filter PCB anomaly • Disconnection of wire between PCBs • Power PCB anomaly • Remote control anomaly • Disconnection of remote control wire • Heat pump unit control PCB anomaly					

Note:

Error code	LED	Green	Red	Content
Remote control: E1 7-segment display: No display	Heat pump water heater	Keep flashing	Stay off	Communication error between remote control and heat pump water heater

1. Applicable model	5. Troubleshooting	
All models	Diagnosis	Countermeasure
2. Error detection method	<pre> graph TD A{Does it return correctly by resetting power?} -- YES --> B[Malfunction by noise Check circumference environment.] A -- NO --> C{Does the remote control reset and start automatically?} C -- YES --> D[Remote control anomaly → Replace remote control. (Heat pump water heater is normal.)] C -- NO --> E[Replace control PCB or replace remote control.] </pre> * Check whether the message of "It is in operation by standby" is still displayed on the remote control, after 3 minutes or more have elapsed.	
3. Condition of error displayed		
Same as above		
4. Presumable cause		
- Anomaly of communication circuit between remote control and heat pump water heater - Noise		

Note: If the heat pump water heater cannot communicate with remote control normally for 180 seconds, the PCB of the heat pump water heater automatically resets and starts

Error code	LED	Green	Red	Content
Remote control: E10	Heat pump water heater	Keep flashing	Stay off	Excessive No. of heat pump water heaters connected to one remote control

1.Applicable model	5.Troubleshooting	
All models	Diagnosis	Countermeasure
2.Error detection method	<pre> graph LR A{Are more than 17 sets of heat pump water heaters connected to one remote control?} -- NO --> B[Remote control anomaly → Replace remote control.] A -- YES --> C[Reduce connecting No. of units to 16 sets or less.] </pre>	
When more than 17 sets of heat pump unit connected to one remote control are detected.		
3. Condition of error displayed		
Same as above		
4.Presumable cause		
• Excessive No. of units are connected • Remote control anomaly		

Note:

Error code	LED	Green	Red	Content
Remote control: E31 7-segment display: E31	Heat pump water heater	Keep flashing	1- time flash	Duplicated address No. of heat pump water heater Address setting error of heat pump water heater

1.Applicable model	5.Troubleshooting				
All models	<table border="1"> <thead> <tr> <th>Diagnosis</th><th>Countermeasure</th></tr> </thead> <tbody> <tr> <td> Save the Mente PC data of 30 minutes before stopping Reset the power and start operation again. * Caution The addresses are not confirmed without resetting the power Does the same error reccur? Is E31 diplayed? NO YES Check the address No. of heat pump water heaters in the same system. Are there any duplicated address No.? YES NO </td><td> • Check the operation status and record it. • Check it occurs soon after power ON or during operation. • Check current status of connection and address. Start test run Take no action to correct. Because it is judged that the power resetting was not done after changing address No. Correct the address No. Replace control PCB of heat pump water heater.* * Before replacement of PCB, please check any malfunction on the rotary switch for address setting. (We have an experience in past times that there were the cases that the rotary switch was damaged. </td></tr> </tbody> </table>	Diagnosis	Countermeasure	Save the Mente PC data of 30 minutes before stopping Reset the power and start operation again. * Caution The addresses are not confirmed without resetting the power Does the same error reccur? Is E31 diplayed? NO YES Check the address No. of heat pump water heaters in the same system. Are there any duplicated address No.? YES NO	• Check the operation status and record it. • Check it occurs soon after power ON or during operation. • Check current status of connection and address. Start test run Take no action to correct. Because it is judged that the power resetting was not done after changing address No. Correct the address No. Replace control PCB of heat pump water heater.* * Before replacement of PCB, please check any malfunction on the rotary switch for address setting. (We have an experience in past times that there were the cases that the rotary switch was damaged.
Diagnosis	Countermeasure				
Save the Mente PC data of 30 minutes before stopping Reset the power and start operation again. * Caution The addresses are not confirmed without resetting the power Does the same error reccur? Is E31 diplayed? NO YES Check the address No. of heat pump water heaters in the same system. Are there any duplicated address No.? YES NO	• Check the operation status and record it. • Check it occurs soon after power ON or during operation. • Check current status of connection and address. Start test run Take no action to correct. Because it is judged that the power resetting was not done after changing address No. Correct the address No. Replace control PCB of heat pump water heater.* * Before replacement of PCB, please check any malfunction on the rotary switch for address setting. (We have an experience in past times that there were the cases that the rotary switch was damaged.				
2.Error detection method					
The microcomputer recognizes the address No. set on each heat pump water heater and checks whether any duplicated address is exsisting in the same system.					
3. Condition of error displayed					
When the duplicated address No. is detected in the same system					
4.Presumable cause					
• Mistake of setting address on heat pump water heater • More than 17 units of heat pump water heater are connected.					

Note: After correction, reset the power and check no error is displayed.
Addresses are not confirmed without resetting the power.

Error code	LED	Green	Red	Content
Remote control: E32 7-segment display: E32	Heat pump water heater	Keep flashing	1-time flash	Open phase of power line

1.Applicable model	5.Troubleshooting	
All models	Diagnosis	Countermeasure
2.Error detection method	Save the Mente PC data of 30 minutes before stopping Is the primary side of power source voltage between phases OK? NO YES Reset the power source and restart Is E32 displayed? YES NO	
3. Condition of error displayed	• Check the operation status and record it. • Check it occurs soon after power ON or during operation or during stopping. (When asking the customer to make rectification, it is much easier to explain the situation with these data.) Ask the customer to make rectification Check it under the operating conditions 30 minutes before error occurred as possible as you can. Replace control PCB. Check operation without any rectifications.	
4.Presumable cause		
• Power source voltage failure on primary side		
• Control PCB anomaly		

Note:

Error code	LED	Green	Red	Content	Discharge pipe temperature anomaly
Remote control: E36 7-segment display: E36	Heat pump water heater	Keep flashing	1-time flash		

1.Applicable model	5.Troubleshooting	
All models	Diagnosis	Countermeasure
2.Error detection method	Is there any leak of refrigerant? YES Specify the leak point and rectify it. NO Is the refrigerant amount charged properly? NO Check the refrigerant amount and charge additionally. YES Is the sensor connector inserted to the connector on control PCB properly? NO Check the connector and wiring harness and rectify it. YES Is there any anomaly of discharge pipe temperature sensor? YES Check the output and replace the sensor. NO Does the valve of gas injection circuit (SVINJ1) activate normally? NO Check the coil of solenoid valve or the sensor and replace it. YES Do EEVH1 and EEVH2 activate normally? NO Check the body of EEV and the coil activation and the sensor and then replace it. YES ※Refer to “Note”. Check if SV-OIL1 is in normal operation. NO Check SV-OIL1 coil and replace. YES Is water circuit normal? (Is high pressure normal?) NO Rectify the water circuit. YES It might be compressor failure. Please correct the data and ask further investigation to MTH.	
3. Condition of error displayed		
If discharge pipe temperature sensor detects 135°C or higher for 2 seconds or compressor stops 3 times within 100 minutes		
4.Presumable cause		
- Discharge pipe temperature sensor anomaly - Control PCB anomaly - Leakage of refrigerant - Lack of air flow volume - Injection circuit malfunction - Excessive suction superheat due to malfunction of EEV operation. - Oil return line malfunction		

Note: ※Winding wire resistance $1250\Omega \pm 10\%$ (20°C)

Error code	LED	Green	Red	Content
Remote control: E37 *1 7-segment display: E37-1 to -9	Heat pump water heater	Keep flashing	*2	Outdoor heat exchanger sensor (Tho-R1, 2, 3, 4) anomaly Gas cooler temperature sensor (Tho-G1, 3, Tho-W1, 2) anomaly

*1 E37-1 to -4: Tho-R1 to -R4, E37-5, -6: Tho-W1, -W2, E37-7, -9: Tho-G1, -G3

*2 According to the kinds of sensors, from 1 to 6-time flash or keep flashing

1. Applicable model	5. Troubleshooting				
All models	<table> <tr> <th>Diagnosis</th><th>Countermeasure</th></tr> <tr> <td> Save the Mente PC data of 30 minutes before stopping <pre> graph TD A[Save the Mente PC data of 30 minutes before stopping] --> B{Is the connector of the anomalous sensor connected properly?} B -- NO --> C[Insert the connector securely] B -- YES --> D{Are the characteristics of sensor OK? *3} D -- NO --> E[Replace the temperature sensor.] D -- YES --> F[Replace the control PCB of heat pump water heater.] </pre> *3 Check several times to prove any poor connection [Temperature-resistance characteristics] Air heat exchanger temperature sensor (Tho-R1 to -R4) Gas cooler temperature sensor (Tho-G3 and Tho-W1) Gas cooler temperature sensor (Tho-G1 and Tho-W2) </td><td> • Check the operation status and record it. • Check it occurs soon after power ON or during operation or during stopping. • Check sensing value • Compare the temperature shown in Mente PC data to the actual temperature measured with thermometer. Insert the connector securely Replace the temperature sensor. Replace the control PCB of heat pump water heater. </td></tr> </table>	Diagnosis	Countermeasure	Save the Mente PC data of 30 minutes before stopping <pre> graph TD A[Save the Mente PC data of 30 minutes before stopping] --> B{Is the connector of the anomalous sensor connected properly?} B -- NO --> C[Insert the connector securely] B -- YES --> D{Are the characteristics of sensor OK? *3} D -- NO --> E[Replace the temperature sensor.] D -- YES --> F[Replace the control PCB of heat pump water heater.] </pre> *3 Check several times to prove any poor connection [Temperature-resistance characteristics] Air heat exchanger temperature sensor (Tho-R1 to -R4) Gas cooler temperature sensor (Tho-G3 and Tho-W1) Gas cooler temperature sensor (Tho-G1 and Tho-W2)	• Check the operation status and record it. • Check it occurs soon after power ON or during operation or during stopping. • Check sensing value • Compare the temperature shown in Mente PC data to the actual temperature measured with thermometer. Insert the connector securely Replace the temperature sensor. Replace the control PCB of heat pump water heater.
Diagnosis	Countermeasure				
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2. Error detection method					
Detection of the anomalously low temperature (resistance value) of heat exchanger temperature sensors and gas cooler temperature sensors					
3. Condition of error displayed					
If the sensor detects anomalously low temperature for 20 seconds continuously after power ON. Or if the sensor detects anomalously low temperature for 20 seconds continuously during normal operation after 2 minutes has elapsed since compressor ON.					
4. Presumable cause					
• Broken sensor harness or the internal wire of sensing section (Check the molded section as well.) • Disconnection of sensor harness connection (connector) • Control PCB anomaly					

Note:

Error code	LED	Green	Red	Content
Remote control: E38 7-segment display: E38	Heat pump water heater	Keep flashing	1-time flash	Outdoor air temperature sensor (Tho-A) anomaly

1. Applicable model	5. Troubleshooting																				
All models	<table> <tr> <th>Diagnosis</th><th>Countermeasure</th></tr> <tr> <td> Save the data 30 minutes before stopping into the Mente PC <pre> graph TD A[Save the data 30 minutes before stopping into the Mente PC] --> B{Is the connector of the anomalous sensor connected properly?} B -- NO --> C[Insert the connector securely.] B -- YES --> D{Are the characteristics of sensor OK? *1} D -- NO --> E[Replace the temperature sensor (Tho-A).] D -- YES --> F[Replace the control PCB of heat pump water heater.] </pre> *1 Check several times to prove any poor connection [Temperature-resistance characteristics] Outdoor air temperature sensor (Tho-A) <table border="1"> <caption>Approximate data points from the graph</caption> <thead> <tr> <th>Temperature (°C)</th> <th>Resistance (kΩ)</th> </tr> </thead> <tbody> <tr><td>-20</td><td>50</td></tr> <tr><td>0</td><td>20</td></tr> <tr><td>20</td><td>10</td></tr> <tr><td>40</td><td>5</td></tr> <tr><td>60</td><td>2</td></tr> <tr><td>80</td><td>1</td></tr> <tr><td>100</td><td>0.5</td></tr> </tbody> </table> </td><td> • Check the operation status and record it. • Check it occurs soon after power ON or during operation or during stopping. • Check sensing value • Compare the temperature shown in Mente PC data to the actual temperature measured with thermometer. Insert the connector securely. Replace the temperature sensor (Tho-A). Replace the control PCB of heat pump water heater. </td></tr> </table>	Diagnosis	Countermeasure	Save the data 30 minutes before stopping into the Mente PC <pre> graph TD A[Save the data 30 minutes before stopping into the Mente PC] --> B{Is the connector of the anomalous sensor connected properly?} B -- NO --> C[Insert the connector securely.] B -- YES --> D{Are the characteristics of sensor OK? *1} D -- NO --> E[Replace the temperature sensor (Tho-A).] D -- YES --> F[Replace the control PCB of heat pump water heater.] </pre> *1 Check several times to prove any poor connection [Temperature-resistance characteristics] Outdoor air temperature sensor (Tho-A) <table border="1"> <caption>Approximate data points from the graph</caption> <thead> <tr> <th>Temperature (°C)</th> <th>Resistance (kΩ)</th> </tr> </thead> <tbody> <tr><td>-20</td><td>50</td></tr> <tr><td>0</td><td>20</td></tr> <tr><td>20</td><td>10</td></tr> <tr><td>40</td><td>5</td></tr> <tr><td>60</td><td>2</td></tr> <tr><td>80</td><td>1</td></tr> <tr><td>100</td><td>0.5</td></tr> </tbody> </table>	Temperature (°C)	Resistance (kΩ)	-20	50	0	20	20	10	40	5	60	2	80	1	100	0.5	• Check the operation status and record it. • Check it occurs soon after power ON or during operation or during stopping. • Check sensing value • Compare the temperature shown in Mente PC data to the actual temperature measured with thermometer. Insert the connector securely. Replace the temperature sensor (Tho-A). Replace the control PCB of heat pump water heater.
Diagnosis	Countermeasure																				
Save the data 30 minutes before stopping into the Mente PC <pre> graph TD A[Save the data 30 minutes before stopping into the Mente PC] --> B{Is the connector of the anomalous sensor connected properly?} B -- NO --> C[Insert the connector securely.] B -- YES --> D{Are the characteristics of sensor OK? *1} D -- NO --> E[Replace the temperature sensor (Tho-A).] D -- YES --> F[Replace the control PCB of heat pump water heater.] </pre> *1 Check several times to prove any poor connection [Temperature-resistance characteristics] Outdoor air temperature sensor (Tho-A) <table border="1"> <caption>Approximate data points from the graph</caption> <thead> <tr> <th>Temperature (°C)</th> <th>Resistance (kΩ)</th> </tr> </thead> <tbody> <tr><td>-20</td><td>50</td></tr> <tr><td>0</td><td>20</td></tr> <tr><td>20</td><td>10</td></tr> <tr><td>40</td><td>5</td></tr> <tr><td>60</td><td>2</td></tr> <tr><td>80</td><td>1</td></tr> <tr><td>100</td><td>0.5</td></tr> </tbody> </table>	Temperature (°C)	Resistance (kΩ)	-20	50	0	20	20	10	40	5	60	2	80	1	100	0.5	• Check the operation status and record it. • Check it occurs soon after power ON or during operation or during stopping. • Check sensing value • Compare the temperature shown in Mente PC data to the actual temperature measured with thermometer. Insert the connector securely. Replace the temperature sensor (Tho-A). Replace the control PCB of heat pump water heater.				
Temperature (°C)	Resistance (kΩ)																				
-20	50																				
0	20																				
20	10																				
40	5																				
60	2																				
80	1																				
100	0.5																				
2. Error detection method																					
Detection of anomalously low temperature (resistance) of outdoor air temperature sensor (Tho-A)																					
3. Condition of error displayed																					
If the sensor detects anomalously low temp for 20 seconds continuously after power ON. Or if the sensor detects anomalously low temp for 20 seconds continuously during normal operation after 2 minutes has elapsed since compressor ON.																					
4. Presumable cause																					
• Broken sensor harness or the internal wire of sensing section (Check the molded section as well.) • Disconnection of sensor harness connection (connector) • Control PCB anomaly																					

Note:

Error code	LED	Green	Red	Content
Remote control: E39 *1 7-segment display: E39-1, 3	Heat pump water heater	Keep flashing	*2	Discharge pipe temperature sensor (Tho-D1) anomaly Intermediate receiver inlet temperature sensor (Tho-M1) anomaly

*1 E39-1: Tho-D1, E39-3: Tho-M1

*2 E39-1: 1-time flash, E39-3: 3-time flash

1. Applicable model	5. Troubleshooting	
All models	Diagnosis	Countermeasure
2. Error detection method	Save the Mente PC data of 30 minutes before stopping <pre> graph TD A[Save the Mente PC data of 30 minutes before stopping] --> B{Is the connector of the anomalous sensor connected properly?} B -- NO --> C[Insert the connector securely.] B -- YES --> D{Are the characteristics of sensor OK? *3} D -- NO --> E[Replace the temperature sensor (Tho-D1 and/or Tho-M1).] D -- YES --> F[Replace the control PCB of heat pump water heater.] </pre> *3 Check several times to prove any poor connection [Temperature-resistance characteristics] Discharge pipe temperature sensor (Tho-D1) Intermediate receiver inlet temperature sensor (Tho-M1)	
3. Condition of error displayed	• Check the operation status and record it. • Check it occurs soon after power ON or during operation or during stopping. • Check sensing value • Compare the temperature shown in Mente PC data to the actual temperature measured with thermometer.	
4. Presumable cause	• Broken sensor harness or the internal wire of sensing section (Check the molded section as well.) • Disconnection of sensor harness connection (connector) • Control PCB anomaly	

Note:

Error code	LED	Green	Red	Content
Remote control: E40 7-segment display: E40	Heat pump water heater	Keep flashing	1-time flash	High pressure anomaly (63H1-1 activated)

1.Applicable model	5.Troubleshooting
All models	
2.Error detection method	
When high pressure switch 63H1-1 is activated	
3. Condition of error displayed	
- High pressure increases to 14MPa or higher. 63H1-1 is activated 5 times within 60 minutes. 63H1-1 is activated for 60minutes continuously.	
4.Presumable cause	
- Short-circuit of air flow at air heat exchanger/Disturbance of air flow/Clogging filter/Fan motor anomaly - Control PCB anomaly - Disconnection of high pressure switch connector - Breakage of high pressure switch harness/Disconnection of connector - Closed service valves - High pressure sensor anomaly - Oil return line malfunction	Diagnosis <pre> graph TD Start([Save the data 30 minutes before stopping into the Mente PC]) --> D1{Is 63H1-1 activated at 14MPa or higher?} D1 -- YES --> C40[7-segment : Check C40] D1 -- NO --> D2{Is the fuse F2 blown?} D2 -- YES --> CM1[Check the cause of F2 blown.] D2 -- NO --> D3{Does the sensing value of high pressure sensor show 14MPa? (Is 63H1-1 normal?)} D3 -- YES --> D4{Is 63H1-1 normal? Are the connector and the wiring harness of 63H1-1OK?} D3 -- NO --> D5{Is there loose connection of 63H1 at the connector on the PCB or disconnection of 63H1 wire?} D4 -- YES --> CM2[Connect the connector securely. Rectify the disconnection of 63H1 wire.] D4 -- NO --> CM3[If it is a fault of connector or disconnection of wiring harness, rectify it. Since the wrong assembling of high pressure switch is suspected, check it as well.] D5 -- YES --> CM2 D5 -- NO --> CM3 C40 --> D6{Does the unit stop, when the high pressure increases to 14MPa?} D6 -- YES --> D7{Is the feed water OK?} D7 -- NO --> CM4[Check the disruption of feed water. Secure a supply of feed water.] D7 -- YES --> D8{Check if SV-OIL1 is in normal operation.} D8 -- NO --> CM5[Check SV-OIL1 coil and replace.] D8 -- YES --> D9{Does the refrigerant circuit get clogged?} D9 -- YES --> CM6[Clear the clog. [Check items] Gas cooler, Strainer, Lack of water, Clogging of gas cooler] D9 -- NO --> CM6 </pre> Countermeasure - Check the operation status and record it. - Check the sensing value of high pressure when 63H1-1 is activated. - Check the activated pressure of high pressure switch (63H1-1) with the sensing value of high pressure sensor. - Check the cause of F2 blown. - Check wiring mistake and short-circuit of AC200V line. Especially check wiring mistake of option parts CWFV3 and V5. - After checking, replace fuse F2. - High pressure sensor anomaly is suspected. - After restarting operation, check the high pressure sensor itself. (If the high pressure sensor has anomaly, replace it.) - Connect the connector securely. Rectify the disconnection of 63H1 wire. - If it is a fault of connector or disconnection of wiring harness, rectify it. Since the wrong assembling of high pressure switch is suspected, check it as well. - Replace control PCB. - Check the disruption of feed water. Secure a supply of feed water. - Check SV-OIL1 coil and replace. - Clear the clog. [Check items] Gas cooler, Strainer, Lack of water, Clogging of gas cooler * From the viewpoint of safety, pressure cannot be measured with pressure gauge during operation. Please check pressure during stopping operation

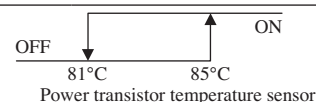
Note: If the same error does not reappear, continue to get data with Mente PC.

※Winding wire resistance $1250\Omega \pm 10\%$ (20°C)

Error code	LED	Green	Red	Content
Remote control: E41 (E51) 7-segment display: E41 (E51) -1	Heat pump water heater	Keep flashing	1-time flash	Power transistor overheat

1.Applicable model	5.Troubleshooting	
All models	Diagnosis	Countermeasure
2.Error detection method	Save the Mente PC data of 30 minutes before stopping Is the outdoor fan of heat pump water heater rotating? NO YES Reset the power source and restart operation After restarting operation, does the same error reappear? NO YES Is the inverter cooling fan rotating? NO YES Is DC15V of power source voltage detected at the C19 terminal of inverter PCB? NO YES After power OFF Is the connection of power transistor sensor connector OK? (Check short circuit and disconnection of wiring harness) NO YES Is the characteristics of power transistor temperature sensor OK?* NO YES Is the power transistor mounted properly? (Check tightning of screws and application of silicon for radiation) NO YES	
When anomalously high temperature is detected		
3. Condition of error displayed	• Check the operation status and record it. • Check the power transistor temperature. • Check the operation of outdoor fan of heat pump water heater and the operation of inverter cooling fan. Rectify it according to the troubleshooting procedure of E48. Restart operation under the operating conditions 30 minutes before error occurred as possible as you can. Wait and see. (If possible, collect the operation data continuously.) If it does not run despite its operation range, check the voltage at connector. If 220/240V is detected, replace fan motor. If 0V is detected, replace control PCB. After checking loose connection of connector or disconnection of wiring harness, replace inverter PCB.	
Error signal from power transistor is detected 5 times within 60minutes. (E41) Or error signal from power transistor is detected for 15 minutes continuously (E51)		
4.Presumable cause		
• Power transistor anomaly • Power transistor temperature sensor anomaly • Anomalous power source to inverter PCB	* See characteristic of sensor on page 179 for details.	
	Apply the silicon for radiation to the power transistor and mount the power transistor on to the radiation fin securely.	
	Replace the power transistor.	

Note: Inverter cooling fan is operated under the condition mentioned at right.
If the same error does not reappear, continue to get data with Mente PC.



Error code	LED	Green	Red	Content
Remote control:E42 7-segment display:E42	Heat pump water heater	Keep flashing	1-time flash	Current cut

1.Applicable model	5.Troubleshooting				
All models	<table border="1"> <thead> <tr> <th>Diagnosis</th><th>Countermeasure</th></tr> </thead> <tbody> <tr> <td> Save the Mente PC data of 30 minutes before stopping Is the winding wire resistance and the meggar check of motor insulation of compressor OK? ※Refer to "Note" NO → YES → Is the fan of heat pump water heater rotating? NO → YES → Reset the power source and restart operation Does E42 recur? NO → YES → Is the connection of cylinder cable normal? (Disconnection, contact failure & etc...) NO → YES → Do you have an inverter checker for judging inverter PCB anomaly? * See checking method on page 194. YES → Is the checked result of inverter PCB OK? NO → YES → NO → Turn the power source OFF and check the 2nd layer of the control ** Measure the resistance of power transistor module (Does it short circuited?) Short-circuited → Normal → </td><td> - Check the operation status and record it. - Is anomalous pressure detected? - Does the fan motor of heat pump water heater run? Replace compressor. Replace oil separator capillary tube, strainer and SV-OIL1 coil also if necessary. Rectify it according to the troubleshooting procedure of E48. Restart operation under the operating conditions 30 minutes before error occurred as possible as you can. Wait and see. (If possible, collect the operation data continuously.) Insert the connector securely. Replace power transistor. Replace inverter PCB. Replace power transistor. Check the short-circuit of power transistor by disconnecting the cables of compressor. Check the resistance of P-U, P-V, P-W, N-U, N-V, N-W and P-N. (See page 194 for details.) Replace inverter PCB. </td></tr> </tbody> </table>	Diagnosis	Countermeasure	Save the Mente PC data of 30 minutes before stopping Is the winding wire resistance and the meggar check of motor insulation of compressor OK? ※Refer to "Note" NO → YES → Is the fan of heat pump water heater rotating? NO → YES → Reset the power source and restart operation Does E42 recur? NO → YES → Is the connection of cylinder cable normal? (Disconnection, contact failure & etc...) NO → YES → Do you have an inverter checker for judging inverter PCB anomaly? * See checking method on page 194. YES → Is the checked result of inverter PCB OK? NO → YES → NO → Turn the power source OFF and check the 2nd layer of the control ** Measure the resistance of power transistor module (Does it short circuited?) Short-circuited → Normal →	- Check the operation status and record it. - Is anomalous pressure detected? - Does the fan motor of heat pump water heater run? Replace compressor. Replace oil separator capillary tube, strainer and SV-OIL1 coil also if necessary. Rectify it according to the troubleshooting procedure of E48. Restart operation under the operating conditions 30 minutes before error occurred as possible as you can. Wait and see. (If possible, collect the operation data continuously.) Insert the connector securely. Replace power transistor. Replace inverter PCB. Replace power transistor. Check the short-circuit of power transistor by disconnecting the cables of compressor. Check the resistance of P-U, P-V, P-W, N-U, N-V, N-W and P-N. (See page 194 for details.) Replace inverter PCB.
Diagnosis	Countermeasure				
Save the Mente PC data of 30 minutes before stopping Is the winding wire resistance and the meggar check of motor insulation of compressor OK? ※Refer to "Note" NO → YES → Is the fan of heat pump water heater rotating? NO → YES → Reset the power source and restart operation Does E42 recur? NO → YES → Is the connection of cylinder cable normal? (Disconnection, contact failure & etc...) NO → YES → Do you have an inverter checker for judging inverter PCB anomaly? * See checking method on page 194. YES → Is the checked result of inverter PCB OK? NO → YES → NO → Turn the power source OFF and check the 2nd layer of the control ** Measure the resistance of power transistor module (Does it short circuited?) Short-circuited → Normal →	- Check the operation status and record it. - Is anomalous pressure detected? - Does the fan motor of heat pump water heater run? Replace compressor. Replace oil separator capillary tube, strainer and SV-OIL1 coil also if necessary. Rectify it according to the troubleshooting procedure of E48. Restart operation under the operating conditions 30 minutes before error occurred as possible as you can. Wait and see. (If possible, collect the operation data continuously.) Insert the connector securely. Replace power transistor. Replace inverter PCB. Replace power transistor. Check the short-circuit of power transistor by disconnecting the cables of compressor. Check the resistance of P-U, P-V, P-W, N-U, N-V, N-W and P-N. (See page 194 for details.) Replace inverter PCB.				
2.Error detection method					
Detect the anomalous output current of inverter with the sensor built in the power transistor					
3. Condition of error displayed					
If the error signal (47A or higher output current of inverter) is detected 4 times within 15 minutes.					
4.Presumable cause					
- Compressor anomaly - Leak of refrigerant - Power transistor anomaly - Anomalous power voltage to the inverter PCB - Fan motor anomaly					

Note: Despite the insulation failure of compressor, there is a case of compressor failure. If the same error recurs after replacement of electrical components, please replace compressor. If the same error does not reappear, continue to get data with Mente PC.

※ Winding wire resistance : 0.726Ω (20℃) Motor insulation resistance : Several tens MΩ

Error code	LED	Green	Red	Content
Remote control: E45 7-segment display: E45-1	Heat pump water heater	Keep flashing	1-time flash	Communication error between inverter PCB and control PCB High pressure anomaly (63H1-1 activated)

1.Applicable model	5.Troubleshooting			
All models	Diagnosis		Countermeasure	
2.Error detection method	<pre> graph TD Start([Save the data 30 minutes before stopping into the Mente PC]) --> LED2{Is the LED 2 on the control PCB flashing?} LED2 -- NO --> ReplaceCtrl[Replace control PCB.] LED2 -- YES --> LED1{Is the LED 1 on the inverter PCB flashing?} LED1 -- NO --> ReplaceInv[Replace inverter PCB. Check the cause of F2 blown. Check wiring mistake and short circuit of AC200V line. Especially check wiring mistake of option parts CWFV3 and V5. After checking, replace fuse F2. Restart operation under the operating conditions of 30 minutes before error occurred as possible as you can.] LED1 -- YES --> FuseF2{Is the fuse F2 blown?} FuseF2 -- NO --> ResetPower[Reset the power source and restart] FuseF2 -- YES --> ResetPower ResetPower --> Recur{Does E45 recur?} Recur -- NO --> Wait[Wait and see. (If possible, collect the operation data continuously.)] Recur -- YES --> Pressure{Does 63H1 activate at the pressure 14MPa or higher?} Pressure -- YES --> Sensor{Does the high pressure sensor (PSH1) show 14MPa?} Sensor -- NO --> SensorAnomaly[High pressure sensor anomaly is suspected. After restarting operation, check the high pressure sensor itself. (If the high pressure sensor has anomaly, replace it.)] Sensor -- YES --> FeedWater{Is the feed water OK? • Is the feed water pressure 100kPa or higher? • Was air purge done? • Does water stoppage occur?} FeedWater -- NO --> FeedWaterAnomaly[Check the disruption of feed water. Secure a supply of feed water.] FeedWater -- YES --> Refrigerant{Does the refrigerant circuit get clogged?} Refrigerant -- YES --> ClearClog[Clear the clog.] Refrigerant -- NO --> Connector{Is there loose connection of 63H1at the connector on the PCB or disconnection of 63H1 wire?} Connector -- YES --> ConnectSecure[Connect the connector securely. Rectify the disconnection of 63H1 wire.] Connector -- NO --> GoNext[Go to next page] </pre>		• Check the operation status and record it.	
3. Condition of error displayed				
Same as above				
4.Presumable cause				
• Disconnection of signal wiring harness • Control PCB anomaly • Inverter PCB anomaly • Anomaly of inrush current suppression resistance				

Note: If the same error does not reappear, continue to get data with Mente PC.

Error code Remote control: E45 7-segment display: E45-1	LED Heat pump water heater	Green Keep flashing	Red 1-time flash	Content Communication error between inverter PCB and control PCB High pressure anomaly (63H1-1 activated)
---	--	-----------------------------------	--------------------------------	---

1.Applicable model	5.Troubleshooting
All models	
2.Error detection method	
3. Condition of error displayed	
4.Presumable cause	

Diagnosis	Countermeasure
From previous page (Check after Power OFF) Is the connection of wiring harness and connector between inverter PCB and control PCB NO YES Is the inrush current suppression resistance YES NO Is the connection of wiring harness between diode module and inverter PCB OK ? NO YES Is the DIP switch setting of inverter PCB correct?* NO YES * See following for [Setting of DIP switch on inverter PCB] JSW10-1 OFF JSW11-1 ON -2 OFF -2 ON -3 OFF -3 ON -4 OFF -4 OFF	Check the disconnection of wiring harness and loose connection of connector. If there is a problem, collect it. Disconnect the wiring harness connected to resistance and check the resistance value between terminals of resistance. If the resistance is broken, replace it. If the resistance is broken, check the wiring harness between diode module and inverter PCB as well. Check the disconnection of wiring harness and loose connection of connector. If there is a problem, correct it. Correct the setting of DIP switch. Replace inverter PCB.

Error code	LED	Green	Red	Content
Remote control: No display *1 7-segment display: E48-1, 2	Heat pump water heater	Keeps flashing	*1 1, 2 times	Heat pump water heater DC fan motor anomaly (1/2)

*1 E48-1: FMO1/ 1 time flashing, E48-2: FMO2/ 2 time flashing

1.Applicable model	5.Troubleshooting and countermeasure (Both fan motors should be inspected regardless of E48-1 and E48-2.)	
All models	Diagnosis	Countermeasure
2. Error detection method	Save the Mente PC data of 30 minutes before stopping ※1 Is there DC325V output on the fan motor? NO Is the power source fuse on power PCB burned out? NO Is there any scratch on the coating of the wiring and/or is it disconnected? YES Replace the fuse YES Repair wiring. NO Replace the power PCB. ※2 Is there short-circuit on the fan motor power source resistance? YES Replace the fan motor. NO Does the fan motor of heat pump water heater rotate smoothly when turning it by hand? NO Replace the fan motor. YES Turn off the unit, disconnect CNFAN1 & CNFAN2 from control PCB and turn the unit back on again. Is there DC15V on CN15V-2 on control PCB? NO Is CN15V-2 connected on power PCB? YES Replace the power PCB. NO Connect CN15V-2 on power PCB. ※3 Is there DC15V output for the control PCB? NO Replace the control PCB. YES ※2 Is there a short-circuit on the resistance of the fan motor signal wiring? YES Replace the fan motor. NO A See next page.	
3. Condition of error displayed		
4.Presumable cause		

Note: ※1 Measurement item Connector of power source wiring for fan motors (RED-BLACK)
 ※2 Refer to resistance on another table. (Next page)
 ※3 Measurement item Between 1-6 pin of CNFAN connector for control PCB
 If the same error does not reappear, continue to get data with Mente PC.

Error code	LED	Green	Red	Content
Remote control: No display *1 7-segment display: E48-1, 2	Heat pump water heater	Keeps flashing	*1 1, 2 times	Heat pump water heater DC fan motor anomaly (2/2)

*1 E48-1: FMO1/ 1 time flashing, E48-2: FMO2/ 2 time flashing

1. Applicable model	5. Troubleshooting and countermeasure (Both fan motors should be inspected regardless of E48-1 and E48-2.)	
All models	Diagnosis	Countermeasure
2. Error detection method		
• When fan speed command is 400rpm or lower and over current status is detected 10 times continuously.		
• When actual fan speed is 100rpm or lower for 30 seconds.		
3. Condition of error displayed		
Same as above		
4. Presumable cause		
• Disconnection of wiring or loose connection of connector		
• Fan motor anomaly		
• Control PCB anomaly		
• Power PCB anomaly		

Note: ※4 Speed command voltage 0-7.5 [V]

※5 Checking by Mente PC or 7-segment.

If the same error does not reappear, continue to get data with Mente PC.

Separate table: Fan motor resistance value (Reference value ※)

Terminal	Signal	Measurement point	Part number for fan motor
Electric source	VM	Between 1 pin and 2 pin of power source terminal (GND)	Red - Black 1MΩ and over
Control	Vcc	Between 1 pin and 2 pin of power source terminal (GND)	White - Black 7.7kΩ ± 20%
	REV	Between 2 pin and 2 pin of power source terminal (GND)	Orange - Black 1MΩ and over
	VSP	Between 3 pin and 2 pin of power source terminal (GND)	Yellow - Black 200kΩ ± 10%
	FG	Between 4 pin and 2 pin of power source terminal (GND)	Blue - Black 1MΩ and over
	OVERC	Between 5 pin and 2 pin of power source terminal (GND)	Green - Black 1MΩ and over
	GND	Between 6 pin and 2 pin of power source terminal (GND)	Pink - Black 1Ω and lower

※ Measurement value varies depending on measurement equipment used. This value is to inspect obvious anomaly e.g. short-circuit, etc., and then it's not the one to guarantee to judge right and wrong.

Error code	LED	Green	Red	Content
Remote control: E49 7-segment display: E49-1	Heat pump water heater	Keep flashing	1-time flash	Low pressure anomaly

1.Applicable model	5.Troubleshooting				
All models	<table border="1"> <thead> <tr> <th>Diagnosis</th><th>Countermeasure</th></tr> </thead> <tbody> <tr> <td> Before starting operation, is the power to the heat pump water heater turned ON? NO → YES → Is the refrigerant amount adequate? (If recharging refrigerant after rectification, check whether the specified refrigerant amount was charged.) NO → YES → Is there any leak of refrigerant? Is balancing pressure higher or lower than the pressure of saturated temperature?* YES → NO → * In case of 31°C or lower Reset the power source and restart operation Does low pressure become altered after starting operation? NO → YES → Is the connection of low pressure sensor connector OK? NO → YES → Does the opening of EEVH1, H2 change? NO → YES → Is the EEV coil OK? (Check continuity) NO → YES → </td><td> The refrigerant may be accumulated in the accumulator. After supplying power for more than 6 hours, restart operation. Purge refrigerant and recharge refrigerant properly. Refrigerant is leaking. Specify the leak point and after rectifying the leak point, recharge refrigerant properly. Correct the connection. Check the low pressure sensor. If it has a problem, replace the sensor. Check connection of connectors and characteristics of sensors of Th-R1, -R2, -R3 and -R4. Replace EEV coil. Clogging of strainer or anomaly of the EEV body may cause. Check them. If it has a problem, replace it. </td></tr> </tbody> </table>	Diagnosis	Countermeasure	Before starting operation, is the power to the heat pump water heater turned ON? NO → YES → Is the refrigerant amount adequate? (If recharging refrigerant after rectification, check whether the specified refrigerant amount was charged.) NO → YES → Is there any leak of refrigerant? Is balancing pressure higher or lower than the pressure of saturated temperature?* YES → NO → * In case of 31°C or lower Reset the power source and restart operation Does low pressure become altered after starting operation? NO → YES → Is the connection of low pressure sensor connector OK? NO → YES → Does the opening of EEVH1, H2 change? NO → YES → Is the EEV coil OK? (Check continuity) NO → YES →	The refrigerant may be accumulated in the accumulator. After supplying power for more than 6 hours, restart operation. Purge refrigerant and recharge refrigerant properly. Refrigerant is leaking. Specify the leak point and after rectifying the leak point, recharge refrigerant properly. Correct the connection. Check the low pressure sensor. If it has a problem, replace the sensor. Check connection of connectors and characteristics of sensors of Th-R1, -R2, -R3 and -R4. Replace EEV coil. Clogging of strainer or anomaly of the EEV body may cause. Check them. If it has a problem, replace it.
Diagnosis	Countermeasure				
Before starting operation, is the power to the heat pump water heater turned ON? NO → YES → Is the refrigerant amount adequate? (If recharging refrigerant after rectification, check whether the specified refrigerant amount was charged.) NO → YES → Is there any leak of refrigerant? Is balancing pressure higher or lower than the pressure of saturated temperature?* YES → NO → * In case of 31°C or lower Reset the power source and restart operation Does low pressure become altered after starting operation? NO → YES → Is the connection of low pressure sensor connector OK? NO → YES → Does the opening of EEVH1, H2 change? NO → YES → Is the EEV coil OK? (Check continuity) NO → YES →	The refrigerant may be accumulated in the accumulator. After supplying power for more than 6 hours, restart operation. Purge refrigerant and recharge refrigerant properly. Refrigerant is leaking. Specify the leak point and after rectifying the leak point, recharge refrigerant properly. Correct the connection. Check the low pressure sensor. If it has a problem, replace the sensor. Check connection of connectors and characteristics of sensors of Th-R1, -R2, -R3 and -R4. Replace EEV coil. Clogging of strainer or anomaly of the EEV body may cause. Check them. If it has a problem, replace it.				
2.Error detection method					
Detection of anomalously low pressure • LP≤1.0MPa is detected for 30 seconds continuously • LP≤0.003MPa is detected for 5 seconds continuously					
3. Condition of error displayed					
If error signal is detected 5 times within 60 minutes					
4.Presumable cause					
• Leak of refrigerant • EEV anomaly					

Note:

Error code	LED	Green	Red	Content
Remote control: E52 * 1 7-segment display: E52-1 to -9	Heat pump water heater	Keep flashing	* 2	Anomaly of hot water temperature sensor for unvented cylinder (Tht-1 to -9)

* 1 E52-1 to -9: Tht-1 to -9,

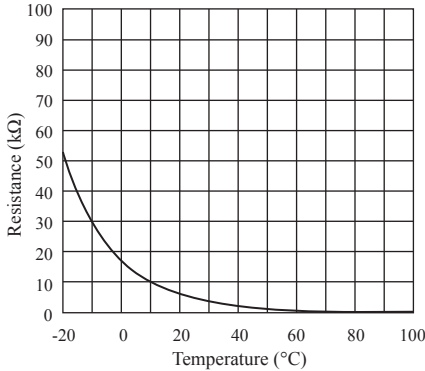
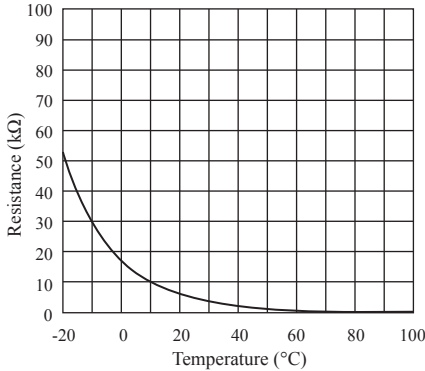
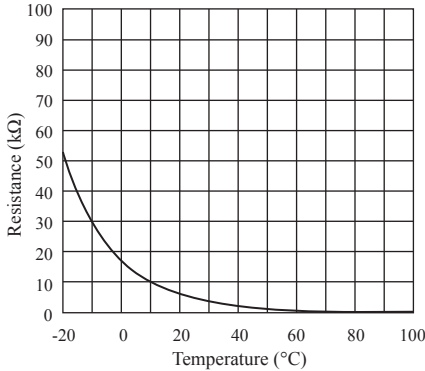
* 2 E52-1 to -6: 1 to 6-time flash, E52-7 to -9: Keep flashing,

1. Applicable Model	5. Troubleshooting	
All models	Diagnosis	Countermeasure
2. Error detection method	Save the Mente PC data of 30 minutes before stopping Is the connector of the anomalous sensor connected properly? NO YES Are the characteristics of sensor OK? *3 NO YES	
3. Condition of error displayed	• Check the operation status and record it. • Check it occurs soon after power ON or during operation or during stopping. • Check sensing value. • Compare the temperature shown in mentePC data to the acutal temperature measured with thermometer. Insert the connector securely.	
4. Presumable cause	• Broken sensor harness or the internal wire of sensing section (Check the molded section as well.) • Disconnection of sensor harness connection (connector) • Control PCB anomaly *3 Check several times to prove any poor connection. [Temperature-resistance characteristics] Hot water temperature sensor for unvented cylinder (Tht-1 to -9) Resistance (kΩ) Temperature (°C) 100 90 80 70 60 50 40 30 20 10 0 -20 0 20 40 60 80 100	
	Replace the hot water temperature sensor for unvented cylinder (Tht-1 to -9). Replace the control PCB of heat pump water heater.	

Note:

Error code	LED	Green	Red	Content
Remote control: E53 * 1 7-segment display: E53-1, -3	Heat pump water heater	Keep flashing	* 2	Suction pipe temperature sensor (Tho-S1) anomaly Injection inlet temperature sensor (Tho-INJ1) anomaly

* 1 E53-1: Tho-S1, E53-3: Tho-INJ1
* 2 E53-1: 1-time flash, E53-3: 3-time flash

1. Applicable Model All models	5. Troubleshooting <table border="1"> <thead> <tr> <th>Diagnosis</th><th>Countermeasure</th></tr> </thead> <tbody> <tr> <td> Save the Mente PC data of 30 minutes before stopping <pre> graph TD A[Save the Mente PC data of 30 minutes before stopping] --> B{Is the connector of the anomalous sensor connected properly?} B -- NO --> C[Insert the connector securely.] B -- YES --> D{Are the characteristics of sensor OK? *3} D -- NO --> E[Replace temperature sensor (Tho-S1, Tho-INJ1).] D -- YES --> F[Replace the control PCB of heat pump water heater.] </pre> *3 Check several times to prove any poor connection. [Temperature-resistance characteristics] Suction pipe temperature sensor (Tho-S1) Injection inlet temperature sensor (Tho-INJ1)  </td><td> - Check the operation status and record it. - Check it occurs soon after power ON or during operation or during stopping. - Check sensing value - Compare the temperature shown in mentePC data to the actual temperature measured with thermometer. Insert the connector securely. Replace temperature sensor (Tho-S1, Tho-INJ1). Replace the control PCB of heat pump water heater. </td></tr> </tbody> </table>	Diagnosis	Countermeasure	Save the Mente PC data of 30 minutes before stopping <pre> graph TD A[Save the Mente PC data of 30 minutes before stopping] --> B{Is the connector of the anomalous sensor connected properly?} B -- NO --> C[Insert the connector securely.] B -- YES --> D{Are the characteristics of sensor OK? *3} D -- NO --> E[Replace temperature sensor (Tho-S1, Tho-INJ1).] D -- YES --> F[Replace the control PCB of heat pump water heater.] </pre> *3 Check several times to prove any poor connection. [Temperature-resistance characteristics] Suction pipe temperature sensor (Tho-S1) Injection inlet temperature sensor (Tho-INJ1) 	- Check the operation status and record it. - Check it occurs soon after power ON or during operation or during stopping. - Check sensing value - Compare the temperature shown in mentePC data to the actual temperature measured with thermometer. Insert the connector securely. Replace temperature sensor (Tho-S1, Tho-INJ1). Replace the control PCB of heat pump water heater.
Diagnosis	Countermeasure				
Save the Mente PC data of 30 minutes before stopping <pre> graph TD A[Save the Mente PC data of 30 minutes before stopping] --> B{Is the connector of the anomalous sensor connected properly?} B -- NO --> C[Insert the connector securely.] B -- YES --> D{Are the characteristics of sensor OK? *3} D -- NO --> E[Replace temperature sensor (Tho-S1, Tho-INJ1).] D -- YES --> F[Replace the control PCB of heat pump water heater.] </pre> *3 Check several times to prove any poor connection. [Temperature-resistance characteristics] Suction pipe temperature sensor (Tho-S1) Injection inlet temperature sensor (Tho-INJ1) 	- Check the operation status and record it. - Check it occurs soon after power ON or during operation or during stopping. - Check sensing value - Compare the temperature shown in mentePC data to the actual temperature measured with thermometer. Insert the connector securely. Replace temperature sensor (Tho-S1, Tho-INJ1). Replace the control PCB of heat pump water heater.				
2. Error detection method Detection of anomalously low temperature (resistance) of temperature sensor (Tho-S1, Tho-INJ1)					
3. Condition of error displayed If the sensor detects -50°C or lower temperature for 5 seconds continuously					
4. Presumable cause - Broken sensor harness or the internal wire of sensing section (Check the molded section as well.) - Disconnection of sensor harness connection (connector) - Control PCB anomaly					

Note:

Error code	LED	Green	Red	Content
Remote control: E54 * 1 7-segment display: E54-1, -2, -3	Heat pump water heater	Keep flashing	* 2	High pressure/Intermediate pressure/ Low pressure sensor anomaly (PSH/PSM/PSL)

* 1 E54-1: Low pressure sensor, E54-2: High pressure sensor, E54-3: Intermediate pressure sensor

* 2 E54-1: 1-time flash, E54-2: 2-time flash, E54-3: 3-time flash

1. Applicable Model	5. Troubleshooting
All models	
2. Error detection method	Diagnosis
Detection of anomalous pressure (resistance) of PSL/PSM/PSH [High pressure 0 - 14MPa Intermediate pressure 0 - 10MPa Low pressure 0 - 10MPa]	Save the Mente PC data of 30 minutes before stopping Check the data of 30 minutes before stopping Does anomalous pressure occur? YES Is the connection of connector of the anomalous sensor to the control PCB OK? NO Insert the connector of sensor securely and restart operation. YES Reset the power source and restart operation Is the pressure value indicated on MentePC same as that measured with pressure gauge? * YES Does the same error recur? YES No anomaly in pressure sensor & its control. Suspect other causes which can cause pressure anomaly. (I.E, Lack of supply water, lack of CO₂ gas and etc...). NO Temporary malfunction by noise. If noise source can be specified, take a measure. NO Measure the output voltage of sensor Is the measured output voltage of sensor same as that shown in following characteristics? YES Replace control PCB. NO Replace sensor. [Output characteristics of high pressure sensor] (Up to 15MPa) [Output characteristics of intermediate /low pressure sensor] (Up to 10MPa) Pressure sensor output voltage : To measure between Black-White
3. Condition of error displayed	
If the pressure sensor detects anomalous output voltage for 20 seconds continuously after turning power ON. Or if the pressure sensor detects anomalous output voltage for 5 seconds continuously within 2 minutes to 2 minutes and 20 seconds after the compressor ON.	
4. Presumable cause	
• Broken sensor harness • Disconnection of sensor harness connection (connector) • Sensor anomaly • Control PCB anomaly • Bad installation condition • Insufficient water volume • Insufficient refrigerant amount	

Note:

Error code	LED	Green	Red	Content
Remote control: E55 7-segment display: E55-1	Heat pump water heater	Keep flashing	1-time flash	Under-dome temperature sensor (Tho-C1) anomaly

1. Applicable Model All models	5. Troubleshooting <table border="1"> <thead> <tr> <th>Diagnosis</th><th>Countermeasure</th></tr> </thead> <tbody> <tr> <td> Save the Mente PC data of 30 minutes before stopping <pre> graph TD A[Save the Mente PC data of 30 minutes before stopping] --> B{Is the connector of the anomalous sensor connected properly?} B -- NO --> C[Insert the connector securely.] B -- YES --> D{Are the characteristics of sensor OK? *1} D -- NO --> E[Replace the control PCB of heat pump water heater.] D -- YES --> F[] </pre> *1 Check several times to prove any poor connection. [Temperature-resistance characteristics] Under-dome temperature sensor (Tho-C1) <table border="1"> <caption>Approximate data points from the graph</caption> <thead> <tr> <th>Temperature (°C)</th> <th>Resistance (kΩ)</th> </tr> </thead> <tbody> <tr><td>-20</td><td>50</td></tr> <tr><td>0</td><td>20</td></tr> <tr><td>20</td><td>10</td></tr> <tr><td>40</td><td>5</td></tr> <tr><td>60</td><td>2</td></tr> <tr><td>80</td><td>1</td></tr> <tr><td>100</td><td>0.5</td></tr> </tbody> </table> </td><td> • Check the operation status and record it. • Check it occurs soon after power ON or during operation or during stopping. • Check sensing value • Compare the temperature shown in mentePC data to the actual temperature measured with thermometer. Replace under-dome temperature sensor (Tho-C1). Replace the control PCB of heat pump water heater. </td></tr> </tbody> </table>	Diagnosis	Countermeasure	Save the Mente PC data of 30 minutes before stopping <pre> graph TD A[Save the Mente PC data of 30 minutes before stopping] --> B{Is the connector of the anomalous sensor connected properly?} B -- NO --> C[Insert the connector securely.] B -- YES --> D{Are the characteristics of sensor OK? *1} D -- NO --> E[Replace the control PCB of heat pump water heater.] D -- YES --> F[] </pre> *1 Check several times to prove any poor connection. [Temperature-resistance characteristics] Under-dome temperature sensor (Tho-C1) <table border="1"> <caption>Approximate data points from the graph</caption> <thead> <tr> <th>Temperature (°C)</th> <th>Resistance (kΩ)</th> </tr> </thead> <tbody> <tr><td>-20</td><td>50</td></tr> <tr><td>0</td><td>20</td></tr> <tr><td>20</td><td>10</td></tr> <tr><td>40</td><td>5</td></tr> <tr><td>60</td><td>2</td></tr> <tr><td>80</td><td>1</td></tr> <tr><td>100</td><td>0.5</td></tr> </tbody> </table>	Temperature (°C)	Resistance (kΩ)	-20	50	0	20	20	10	40	5	60	2	80	1	100	0.5	• Check the operation status and record it. • Check it occurs soon after power ON or during operation or during stopping. • Check sensing value • Compare the temperature shown in mentePC data to the actual temperature measured with thermometer. Replace under-dome temperature sensor (Tho-C1). Replace the control PCB of heat pump water heater.
Diagnosis	Countermeasure																				
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Temperature (°C)	Resistance (kΩ)																				
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0	20																				
20	10																				
40	5																				
60	2																				
80	1																				
100	0.5																				
2. Error detection method Detection of anomalously low temperature (resistance) of temperature sensor. (Tho-C1)																					
3. Condition of error displayed If the sensor detects -50°C or lower temperature for 5 seconds continuously																					
4. Presumable cause • Broken sensor harness or the internal wire of sensing section (Check the molded section as well.) • Disconnection of sensor harness connection (connector) • Control PCB anomaly																					

Note:

Error code	LED	Green	Red	Content
Remote control: E56 7-segment display: E56-1	Heat pump water heater	Keep flashing	1-time flash	Power transistor temperature sensor (Tho-P1) anomaly

1. Applicable Model All models	5. Troubleshooting <table border="1"> <thead> <tr> <th>Diagnosis</th><th>Countermeasure</th></tr> </thead> <tbody> <tr> <td> Save the Mente PC data of 30 minutes before stopping <pre> graph TD A[Save the Mente PC data of 30 minutes before stopping] --> B{Is the connector of the anomalous sensor connected properly?} B -- NO --> C[Insert the connector securely.] B -- YES --> D{Are the characteristics of sensor OK? *3} D -- NO --> E[Replace power transistor temperature sensor (Tho-P1).] D -- YES --> F[Replace the control PCB of heat pump water heater.] </pre> *3 Check several times to prove any poor connection. [Temperature-resistance characteristics] Power transistor temperature sensor (Tho-P1) <table border="1"> <caption>Approximate data points from the graph</caption> <thead> <tr> <th>Temperature (°C)</th> <th>Resistance (kΩ)</th> </tr> </thead> <tbody> <tr><td>0</td><td>180</td></tr> <tr><td>20</td><td>100</td></tr> <tr><td>40</td><td>60</td></tr> <tr><td>60</td><td>30</td></tr> <tr><td>80</td><td>15</td></tr> <tr><td>100</td><td>5</td></tr> <tr><td>120</td><td>2</td></tr> <tr><td>140</td><td>1</td></tr> </tbody> </table> </td><td> • Check the operation status and record it. • Check it occurs soon after power ON or during operation or during stopping. • Check sensing value • Compare the temperature shown in mentePC data to the actual temperature measured with thermometer. Insert the connector securely. Replace power transistor temperature sensor (Tho-P1). Replace the control PCB of heat pump water heater. </td></tr> </tbody> </table>	Diagnosis	Countermeasure	Save the Mente PC data of 30 minutes before stopping <pre> graph TD A[Save the Mente PC data of 30 minutes before stopping] --> B{Is the connector of the anomalous sensor connected properly?} B -- NO --> C[Insert the connector securely.] B -- YES --> D{Are the characteristics of sensor OK? *3} D -- NO --> E[Replace power transistor temperature sensor (Tho-P1).] D -- YES --> F[Replace the control PCB of heat pump water heater.] </pre> *3 Check several times to prove any poor connection. [Temperature-resistance characteristics] Power transistor temperature sensor (Tho-P1) <table border="1"> <caption>Approximate data points from the graph</caption> <thead> <tr> <th>Temperature (°C)</th> <th>Resistance (kΩ)</th> </tr> </thead> <tbody> <tr><td>0</td><td>180</td></tr> <tr><td>20</td><td>100</td></tr> <tr><td>40</td><td>60</td></tr> <tr><td>60</td><td>30</td></tr> <tr><td>80</td><td>15</td></tr> <tr><td>100</td><td>5</td></tr> <tr><td>120</td><td>2</td></tr> <tr><td>140</td><td>1</td></tr> </tbody> </table>	Temperature (°C)	Resistance (kΩ)	0	180	20	100	40	60	60	30	80	15	100	5	120	2	140	1	• Check the operation status and record it. • Check it occurs soon after power ON or during operation or during stopping. • Check sensing value • Compare the temperature shown in mentePC data to the actual temperature measured with thermometer. Insert the connector securely. Replace power transistor temperature sensor (Tho-P1). Replace the control PCB of heat pump water heater.
Diagnosis	Countermeasure																						
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100	5																						
120	2																						
140	1																						
2. Error detection method Detection of anomalously low temperature (resistance) of power transistor temperature sensor. (Tho-P1)																							
3. Condition of error displayed Under the condition of 0°C or higher of outdoor air temperature, if the sensor detects disconnection for 20 seconds continuously within 30 seconds after 10 minutes has elapsed since compressor ON, it makes the compressor stopped. After 3 minutes, compressor restarts automatically. And then if this error is detected 3 times within 40 minutes, it makes error stop.																							
4. Presumable cause • Broken sensor harness or the internal wire of sensing section (Check the molded section as well.) • Disconnection of sensor harness connection (connector) • Control PCB anomaly																							

Note:

Error code	LED	Green	Red	Content
Remote control: E58 7-segment display: E58-1	Heat pump water heater	Keep flashing	1-time flash	Compressor anomaly by loss of synchronism

1. Applicable Model	5. Troubleshooting				
All models	<table border="1"> <thead> <tr> <th>Diagnosis</th><th>Countermeasure</th></tr> </thead> <tbody> <tr> <td> Save the Mente PC data of 30 minutes before stopping Check the data 30 minutes before stopping Is this the first time to start up within 1 hour after the power ON? YES → NO → ※Refer to "Note:" Is the winding wire resistance and the meggar check of motor insulation of compressor OK? YES → NO → Is the connection of cylinder cable normal? (Disconnection, contact failure & etc...) YES → NO → Are there any maintenance history to replace inverter PCB? YES → NO → Is the DIP switch setting of inverter PCB collect? YES → NO → Do you have an inverter checker for judging inverter PCB anomaly? * See checking method on page 197. YES → NO → Is the checked result of inverter PCB OK? YES → NO → Turn the power source OFF and check the 2nd layer of the control * * Measure the resistance of power transistor module (Does it short circuited?) Short circuited → Normal → </td><td> • Check the operation status and record it. There is a possibility that the liquid refrigerant is migrated in the compressor. Wait for about one hour with keeping the power source and then restart operation. (In order to evaporate the liquid refrigerant migrated in the compressor by power source to the crankcase heater.) Replace compressor. Insert the connector securely. Set the setting collectly. Replace power transistor. Replace inverter PCB. Replace power transistor Check the short-circuit of power transistor by disconnecting the cable of compressor. Check the resistance of P-U, P-V, P-W, N-U, N-V, N-W and P-N. (See page 197 for details.) Replace inverter PDB. </td></tr> </tbody> </table>	Diagnosis	Countermeasure	Save the Mente PC data of 30 minutes before stopping Check the data 30 minutes before stopping Is this the first time to start up within 1 hour after the power ON? YES → NO → ※Refer to "Note:" Is the winding wire resistance and the meggar check of motor insulation of compressor OK? YES → NO → Is the connection of cylinder cable normal? (Disconnection, contact failure & etc...) YES → NO → Are there any maintenance history to replace inverter PCB? YES → NO → Is the DIP switch setting of inverter PCB collect? YES → NO → Do you have an inverter checker for judging inverter PCB anomaly? * See checking method on page 197. YES → NO → Is the checked result of inverter PCB OK? YES → NO → Turn the power source OFF and check the 2nd layer of the control * * Measure the resistance of power transistor module (Does it short circuited?) Short circuited → Normal →	• Check the operation status and record it. There is a possibility that the liquid refrigerant is migrated in the compressor. Wait for about one hour with keeping the power source and then restart operation. (In order to evaporate the liquid refrigerant migrated in the compressor by power source to the crankcase heater.) Replace compressor. Insert the connector securely. Set the setting collectly. Replace power transistor. Replace inverter PCB. Replace power transistor Check the short-circuit of power transistor by disconnecting the cable of compressor. Check the resistance of P-U, P-V, P-W, N-U, N-V, N-W and P-N. (See page 197 for details.) Replace inverter PDB.
Diagnosis	Countermeasure				
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2. Error detection method					
When E58 is displayed on the 7-segment LED display					
3. Condition of error displayed					
If this anomaly is established 4 times within 15 minutes					
4. Presumable cause					
- Insufficient communication hours before start operation. (Start operation without power source to the crankcase heater in advance) - Compressor anomaly					

Note: If the same error does not reappear, continue to get data with Mente PC.

※ Winding wire resistance : 0.726Ω (20℃) Motor insulation resistance : Several tens MΩ

Error code	LED	Green	Red	Content
Remote control: E59 7-segment display: E59-1	Heat pump water heater	Keep flashing	1-time flash	Compressor startup failure

1. Applicable Model	5. Troubleshooting				
All models	<table border="1"> <thead> <tr> <th>Diagnosis</th><th>Countermeasure</th></tr> </thead> <tbody> <tr> <td> Save the Mente PC data of 30 minutes before stopping ↓ Check the data 30 minutes before stopping ↓ Is The power source voltage OK? Specifications: AC 380/400/415V 50Hz±5% NO → YES ↓ Are all pressures equalized during 3 minutes delay before compressor starts up? NO → YES ↓ Is there disconnection of power cables connected to the compressor terminal? YES → NO ↓ Startup compressor by test run mode under the condition of no pressure difference ↓ Does it start? YES → NO ↓ Is the inverter output OK? (Check by inverter checker) YES → NO → </td><td> • Check the operation status and record it. Check the power source voltage and correct it. Is the capillary tube that returns oil from the oil separator blocked? Is SV-OIL1 in normal operation? Check and replace SV-OIL1 coil if necessary. (※Refer to “Note”.) Does EEV actuate normally? (When the DIP switch SW5-7, 8 is switched ON, EEV becomes open or close.) (See page 155 for detail.) Replace the power cable (If there is a problem on the terminal of compressor, replace compressor.) Wait and see. Replace inverter PCB or power transistor. (Check the inverter PCB with inverter checker. If inverter PCB is OK, replace power transistor.) Replace compressor. </td></tr> </tbody> </table>	Diagnosis	Countermeasure	Save the Mente PC data of 30 minutes before stopping ↓ Check the data 30 minutes before stopping ↓ Is The power source voltage OK? Specifications: AC 380/400/415V 50Hz±5% NO → YES ↓ Are all pressures equalized during 3 minutes delay before compressor starts up? NO → YES ↓ Is there disconnection of power cables connected to the compressor terminal? YES → NO ↓ Startup compressor by test run mode under the condition of no pressure difference ↓ Does it start? YES → NO ↓ Is the inverter output OK? (Check by inverter checker) YES → NO →	• Check the operation status and record it. Check the power source voltage and correct it. Is the capillary tube that returns oil from the oil separator blocked? Is SV-OIL1 in normal operation? Check and replace SV-OIL1 coil if necessary. (※Refer to “Note”.) Does EEV actuate normally? (When the DIP switch SW5-7, 8 is switched ON, EEV becomes open or close.) (See page 155 for detail.) Replace the power cable (If there is a problem on the terminal of compressor, replace compressor.) Wait and see. Replace inverter PCB or power transistor. (Check the inverter PCB with inverter checker. If inverter PCB is OK, replace power transistor.) Replace compressor.
Diagnosis	Countermeasure				
Save the Mente PC data of 30 minutes before stopping ↓ Check the data 30 minutes before stopping ↓ Is The power source voltage OK? Specifications: AC 380/400/415V 50Hz±5% NO → YES ↓ Are all pressures equalized during 3 minutes delay before compressor starts up? NO → YES ↓ Is there disconnection of power cables connected to the compressor terminal? YES → NO ↓ Startup compressor by test run mode under the condition of no pressure difference ↓ Does it start? YES → NO ↓ Is the inverter output OK? (Check by inverter checker) YES → NO →	• Check the operation status and record it. Check the power source voltage and correct it. Is the capillary tube that returns oil from the oil separator blocked? Is SV-OIL1 in normal operation? Check and replace SV-OIL1 coil if necessary. (※Refer to “Note”.) Does EEV actuate normally? (When the DIP switch SW5-7, 8 is switched ON, EEV becomes open or close.) (See page 155 for detail.) Replace the power cable (If there is a problem on the terminal of compressor, replace compressor.) Wait and see. Replace inverter PCB or power transistor. (Check the inverter PCB with inverter checker. If inverter PCB is OK, replace power transistor.) Replace compressor.				
2. Error detection method					
When it fails to change over to the operation for rotor position detection of compressor motor					
3. Condition of error displayed					
If the compressor fails to startup 20 times (10 patterns × 2 times) continuously.					
4. Presumable cause					
• Anomalous power source voltage • Faulty component for refrigerant circuit • Inverter PCB anomaly • Disconnection of power cable and/or poor connection of connector • Compressor anomaly (Motor or bearing) • Power transistor anomaly					

Note: If the same error does not reappear, continue to get data with Mente PC.

※Winding wire resistance $1250\Omega \pm 10\%$ (20°C)

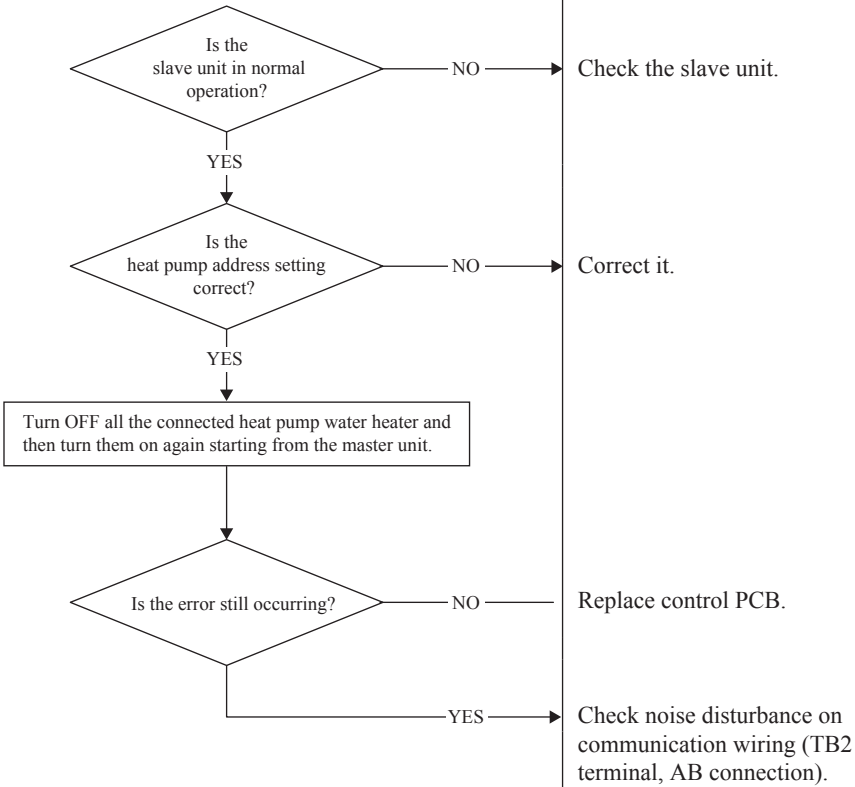
Error code	LED	Green	Red	Content
Remote control: E60 7-segment display: E60-1	Heat pump water heater	Keep flashing	1-time flash	Rotor position detection failure

1. Applicable Model	5. Troubleshooting				
All models	<table border="1"> <thead> <tr> <th>Diagnosis</th><th>Countermeasure</th></tr> </thead> <tbody> <tr> <td> <pre> graph TD A[Save the mente PC data of 30 minutes before stopping] --> B{Is power source voltage OK?} B -- NO --> C[Correct it.] B -- YES --> D[Reset the power source and restart operation] D --> E{Can the compressor startup?} E -- NO --> F{Does E59 occur?} F -- YES --> G[Correct it according to the troubleshooting procedure of E59.] F -- NO --> H{Does E42 occur?} H -- YES --> I[Correct it according to the troubleshooting procedure of E42.] H -- NO --> J[Replace compressor.] E -- YES --> K{Are the sound and vibration of the compressor normal?} K -- NO "anomalous sound and vibration" --> L[Check the insulation resistance and coil resistance of compressor. If necessary, replace compressor.] K -- YES --> M{Is it operated normally without occurrence of E60?} M -- NO --> N[Replace inverter PCB or power transistor. (Check the inverter PCB with inverter checker. If inverter PCB is OK, replace power transistor.)] M -- YES --> O[Temporary malfunction by noise. If noise source can be specified, take a measure.] </pre> </td><td> • Check the operation status and record it. </td></tr> </tbody> </table>	Diagnosis	Countermeasure	<pre> graph TD A[Save the mente PC data of 30 minutes before stopping] --> B{Is power source voltage OK?} B -- NO --> C[Correct it.] B -- YES --> D[Reset the power source and restart operation] D --> E{Can the compressor startup?} E -- NO --> F{Does E59 occur?} F -- YES --> G[Correct it according to the troubleshooting procedure of E59.] F -- NO --> H{Does E42 occur?} H -- YES --> I[Correct it according to the troubleshooting procedure of E42.] H -- NO --> J[Replace compressor.] E -- YES --> K{Are the sound and vibration of the compressor normal?} K -- NO "anomalous sound and vibration" --> L[Check the insulation resistance and coil resistance of compressor. If necessary, replace compressor.] K -- YES --> M{Is it operated normally without occurrence of E60?} M -- NO --> N[Replace inverter PCB or power transistor. (Check the inverter PCB with inverter checker. If inverter PCB is OK, replace power transistor.)] M -- YES --> O[Temporary malfunction by noise. If noise source can be specified, take a measure.] </pre>	• Check the operation status and record it.
Diagnosis	Countermeasure				
<pre> graph TD A[Save the mente PC data of 30 minutes before stopping] --> B{Is power source voltage OK?} B -- NO --> C[Correct it.] B -- YES --> D[Reset the power source and restart operation] D --> E{Can the compressor startup?} E -- NO --> F{Does E59 occur?} F -- YES --> G[Correct it according to the troubleshooting procedure of E59.] F -- NO --> H{Does E42 occur?} H -- YES --> I[Correct it according to the troubleshooting procedure of E42.] H -- NO --> J[Replace compressor.] E -- YES --> K{Are the sound and vibration of the compressor normal?} K -- NO "anomalous sound and vibration" --> L[Check the insulation resistance and coil resistance of compressor. If necessary, replace compressor.] K -- YES --> M{Is it operated normally without occurrence of E60?} M -- NO --> N[Replace inverter PCB or power transistor. (Check the inverter PCB with inverter checker. If inverter PCB is OK, replace power transistor.)] M -- YES --> O[Temporary malfunction by noise. If noise source can be specified, take a measure.] </pre>	• Check the operation status and record it.				
2. Error detection method					
Detection of the compressor rotor position After starting up, the rotor position can not be detected again.					
3. Condition of error displayed					
If this anomaly occurs 4 times within 15 minutes					
4. Presumable cause					
• Compressor anomaly • Inverter PCB anomaly • Anomalous power source voltage • Power transistor anomaly					

Note: If the same error does not reappear, continue to get data with Mente PC.

Error code	LED	Green	Red	Content
Remote control: E61 7-segment display: E61-1, 2, 3 *1	Heat pump water heater	Keeps flashing	*1	Communications error between the master unit and slave units

*1 E61-1: Between master unit and slave unit 1 / 1-time flash E61-2: Between master unit and slave unit 2 / 2-time flash
E61-3: Between master unit and slave unit 3 / 3-time flash

1.Applicable model All models	5.Troubleshooting and countermeasure	
2.Error detection method E61-1,2,3 is displayed on 7-segment LED.	Diagnosis	Countermeasure
3. Condition of error displayed When the communication between master unit and slave units of heat pump water heater is not established.	 <pre> graph TD D1{Is the slave unit in normal operation?} -- NO --> C1[Check the slave unit.] D1 -- YES --> D2{Is the heat pump address setting correct?} D2 -- NO --> C2[Correct it.] D2 -- YES --> P1[Turn OFF all the connected heat pump water heater and then turn them on again starting from the master unit.] P1 --> D3{Is the error still occurring?} D3 -- NO --> C3[Replace control PCB.] D3 -- YES --> C4[Check noise disturbance on communication wiring (TB2 terminal, AB connection).] </pre>	
4.Presumable cause • Communication wiring anomaly • Control PCB anomaly		

Note:

Error code	LED	Green	Red	Content
Remote control: E63 7-segment display: E63	Heat pump water heater	Keep flashing	1-time flash	Emergency stop

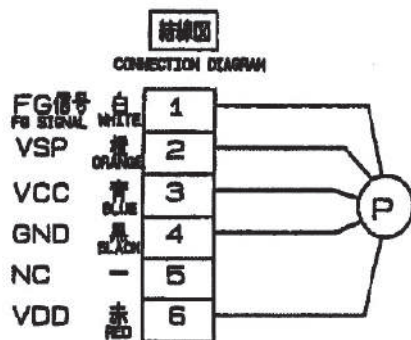
1. Applicable model	5. Troubleshooting			
All models	Diagnosis		Countermeasure	
2. Error detection method	Save the Mente PC data of 30 minutes before stopping <pre> graph TD A[Save the Mente PC data of 30 minutes before stopping] --> B{Is the setting of emergency stop by remote control valid?} B -- NO --> C[Replace control PCB.] B -- YES --> D{Does the contact signal input to CnT contact on the control PCB?} D -- NO --> E[Replace control PCB.] D -- YES --> F[Check the cause for occurring emergency stop. (It is better to have the data of 30 minutes before stopping for checking.)] </pre>		• Check the operation status and record it. • Check it occurs soon after power ON or during operation or during stopping.	
3. Condition of error displayed	Same as above			
4. Presumable cause	• Occurrence of emergency stop factor			

Note: The heat pump water heater detected the emergency stop signal sends the command to make [All stop].

Error code	LED	Green	Red	Content
Remote control: E64 7-segment display: E64	Heat pump water heater	Keep flashing	1-time flash	Water pump anomaly (1) In case the motor does not rotate

1. Applicable Model	5. Troubleshooting				
All models	<table border="1"> <thead> <tr> <th>Diagnosis</th><th>Countermeasure</th></tr> </thead> <tbody> <tr> <td> When starting operation after the power ON, does the pump motor run? YES → It is normal. NO → Is AC220-240V±5% detected between L1 and N on the TB1? NO → Check the power source voltage and correct it. YES → Is AC200V±10% detected between 3 and 4 on the TB2? NO → Check the wiring harness from control PCB to water pump PCB. If there is a problem, rectify it. If not, replace noise filter PCB. YES → 3 minutes later after the power OFF, disconnect the connector CN1 on the water pump PCB connected to the water pump and then start operation after the power ON. Is DC280V±10% detected between 4P (Black) and 6P(Red) connector CN1 on the water pump PCB? NO → Replace water pump PCB. Is the LED2 on control PCB flashing? NO → Replace control PCB. YES → Check DC voltage between 3P of CNPUM1 on the control PCB and C48GND (located just left below the control PCB). Less than DC2V → Control PCB can get Vsp control → Replace water pump PCB. DC5V → Is DC5V detected between 4P of CNPUM1 and C48GND on the control PCB? NO → Replace control PCB. YES → Is the wiring connected to water pump PCB & control PCB normal? NO → Replace the wiring → Replace water pump PCB. YES → Is the rotation speed of water pump motor normalized? NO → Replace water pump motor. YES → End </td><td></td></tr> </tbody> </table>	Diagnosis	Countermeasure	When starting operation after the power ON, does the pump motor run? YES → It is normal. NO → Is AC220-240V±5% detected between L1 and N on the TB1? NO → Check the power source voltage and correct it. YES → Is AC200V±10% detected between 3 and 4 on the TB2? NO → Check the wiring harness from control PCB to water pump PCB. If there is a problem, rectify it. If not, replace noise filter PCB. YES → 3 minutes later after the power OFF, disconnect the connector CN1 on the water pump PCB connected to the water pump and then start operation after the power ON. Is DC280V±10% detected between 4P (Black) and 6P(Red) connector CN1 on the water pump PCB? NO → Replace water pump PCB. Is the LED2 on control PCB flashing? NO → Replace control PCB. YES → Check DC voltage between 3P of CNPUM1 on the control PCB and C48GND (located just left below the control PCB). Less than DC2V → Control PCB can get Vsp control → Replace water pump PCB. DC5V → Is DC5V detected between 4P of CNPUM1 and C48GND on the control PCB? NO → Replace control PCB. YES → Is the wiring connected to water pump PCB & control PCB normal? NO → Replace the wiring → Replace water pump PCB. YES → Is the rotation speed of water pump motor normalized? NO → Replace water pump motor. YES → End	
Diagnosis	Countermeasure				
When starting operation after the power ON, does the pump motor run? YES → It is normal. NO → Is AC220-240V±5% detected between L1 and N on the TB1? NO → Check the power source voltage and correct it. YES → Is AC200V±10% detected between 3 and 4 on the TB2? NO → Check the wiring harness from control PCB to water pump PCB. If there is a problem, rectify it. If not, replace noise filter PCB. YES → 3 minutes later after the power OFF, disconnect the connector CN1 on the water pump PCB connected to the water pump and then start operation after the power ON. Is DC280V±10% detected between 4P (Black) and 6P(Red) connector CN1 on the water pump PCB? NO → Replace water pump PCB. Is the LED2 on control PCB flashing? NO → Replace control PCB. YES → Check DC voltage between 3P of CNPUM1 on the control PCB and C48GND (located just left below the control PCB). Less than DC2V → Control PCB can get Vsp control → Replace water pump PCB. DC5V → Is DC5V detected between 4P of CNPUM1 and C48GND on the control PCB? NO → Replace control PCB. YES → Is the wiring connected to water pump PCB & control PCB normal? NO → Replace the wiring → Replace water pump PCB. YES → Is the rotation speed of water pump motor normalized? NO → Replace water pump motor. YES → End					
2. Error detection method					
When it detects anomalous difference between the rotation speed command and the actual rotation speed of water pump. Or when it detects anomalous actual rotation speed.					
3. Condition of error displayed					
- If the rotation speed difference is 500min⁻¹ or more - If anomalous actual rotation speed is detected for 1 minute continuously.					
4. Presumable cause					
- Water pump anomaly - Control PCB anomaly - Power source or power PCB anomaly - Water pump PCB anomaly					

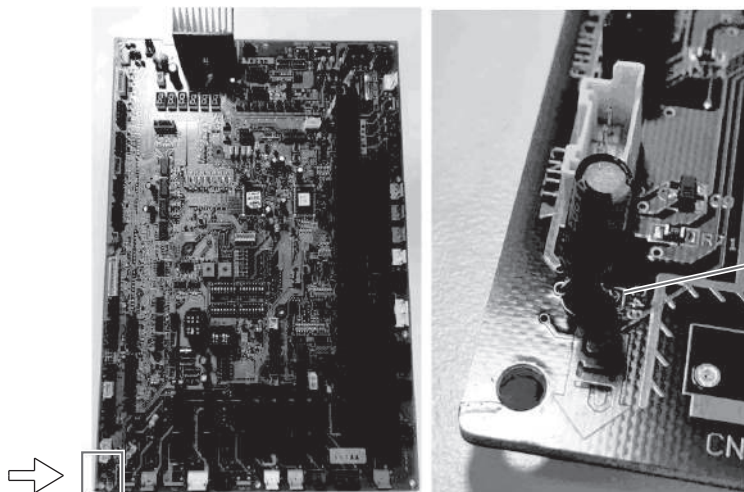
Note: Refer connection diagram, measurement point with resistance value for water pump to next page.
See detail location of C48GND at next page.



Measurement point		Measurement value (Reference value)
Tester +	Tester -	
VDD	GND	393.6kΩ
VCC	GND	24.9kΩ
VSP	GND	559.6kΩ
FG	GND	O.L

This value will change depending on the measurement device and ambient temperature, so please use this table for just a reference.

Detail location of C48GND



Right side with square mark means GND.

Error code	LED	Green	Red	Content
Remote control: E64 7-segment display: E64	Heat pump water heater	Keep flashing	1-time flash	Water pump anomaly (2) In case the motor rotates at anomously high speed (Disable to control rotation speed or rotate at max speed)

1. Applicable Model	5. Troubleshooting
All models	Diagnosis
	<pre> graph TD D1{Is the LED2 on control PCB flashing?} -- NO --> C1[Replace control PCB.] D1 -- YES --> D2{Is DC5V(Hi) or DC1V(Lo) or lower detected between 1P and 2P of CNPUM1 on the control PCB?} D2 -- YES --> C2[Replace water pump PCB] D2 -- NO --> C3[Replace control PCB.] C3 --> D3{Is the rotation speed of water pump motor normalized?} D3 -- YES --> C4[It's normal.] D3 -- NO --> C5[Replace water pump motor.] </pre> FG signal for rotaion speed control is anomalous
	Countermeasure
	Replace control PCB. It's normal. Replace water pump motor. End
2. Error detection method	
3. Condition of error displayed	
4. Presumable cause	

Note:

Error code	LED	Green	Red	Content
Remote control: E89 7-segment display: E89	Heat pump water heater	Keep flashing	1-time flash	Communication error between CPU of control PCBs

1. Applicable Model	5. Troubleshooting	
All models	Diagnosis	Countermeasure
2. Error detection method	<pre> graph TD Q1{Are the wiring harnesses and cables passing above the CPU?} -- YES --> C1[CPU may be malfunctioned by the influence of wiring. Rearrange to keep wiring away from the circumference of CPU.] Q1 -- NO --> Q2{Is the J-pin inserted to JPX2? And is JP11 opened?} Q2 -- YES --> S1[After disconnect the J-pin from JPX2 and short the JP11, rewrite the software program of IC1 and IC2 to the latest version. Or replace the ROM to the latest version one] Q2 -- NO --> Q3{After inserting the J-pin to JPX2 and opening the JP11, does E89 recur?} Q3 -- YES --> S1 Q3 -- NO --> C2[IC2 is in software rewriting mode.] S1 --> Q4{Does E89 recur?} Q4 -- NO --> C3[Software program version before rewritten was unmatched.] Q4 -- YES --> C4[Control PCB anomaly → Replace control PCB.] </pre>	
When the communication between CPUs is interrupted for a certain period of time		
3. Condition of error displayed		
If it occurs 4 times within 15 minutes		
4. Presumable cause		
- Noise - Mixing of software versions - Control PCB anomaly		

Note:

Error code	LED	Green	Red	Content
Remote control: No display 7-segment display: No display	Heat pump water heater	Keep flashing	Stay OFF	It can operate but no hot water comes out (1)

1. Applicable Model	5. Troubleshooting				
All models	<table border="1"> <thead> <tr> <th>Diagnosis</th><th>Countermeasure</th></tr> </thead> <tbody> <tr> <td> <pre> graph TD A[Check the installation condition of heat pump water heater] --> B[Check availability to operate heat pump water heater and the operating condition of heat pump water heater] B --> C[Check whether hot water comes out Check the water circuit from heat pump water heater to cylinder. Check the water pressure of feed water circuit and the water volume] C --> D{Is the inlet water temperature 40°C or lower?} C --> E[Go to page 191.] C --> F[Go to page 190.] D -- YES --> G{Is the supply hot water temperature not able to reach to the temperature set by remote control?} D -- NO --> H[If the inlet feed water temperature is 40°C or higher, there is a case not to obtain the required hot water amount. If using the water other than the clean water, be sure to suppress increase in temperature of inlet feed water. *When the hot water amount is almost 100%, the inlet feed water temp may increase temporarily. Replace remote control.] G -- YES --> I{Is the remote control normal?} G -- NO --> J[Collect the operation data of heat pump water heater] I -- YES --> K{Is it out of normal operation range?} I -- NO --> L[Check water circuit Go to pages 190 and 191.] J --> K K -- YES --> M[Collect the operation data of heat pump water heater and check no problem on the heat pump water heater] K -- NO --> L M --> L </pre> </td><td> Insufficient capacity due to short circuit of air circulation. Check excessive heat load of hot water. Check whether the feed water is supplied or not. Check power source. (voltage, frequency) Collect the operation data by setting the conditions to operate the compressor with remote control. Check heat pump water heater. Check water circuit. If the inlet feed water temperature is 40°C or higher, there is a case not to obtain the required hot water amount. If using the water other than the clean water, be sure to suppress increase in temperature of inlet feed water. *When the hot water amount is almost 100%, the inlet feed water temp may increase temporarily. Replace remote control. Check insufficient capacity by protection control. Check the status of functional components temperature sensor, pressure sensor, compressor, EEV (body, coil) Check insufficient refrigerant and leak of refrigerant. Check water circuit Go to pages 190 and 191. </td></tr> </tbody> </table>	Diagnosis	Countermeasure	<pre> graph TD A[Check the installation condition of heat pump water heater] --> B[Check availability to operate heat pump water heater and the operating condition of heat pump water heater] B --> C[Check whether hot water comes out Check the water circuit from heat pump water heater to cylinder. Check the water pressure of feed water circuit and the water volume] C --> D{Is the inlet water temperature 40°C or lower?} C --> E[Go to page 191.] C --> F[Go to page 190.] D -- YES --> G{Is the supply hot water temperature not able to reach to the temperature set by remote control?} D -- NO --> H[If the inlet feed water temperature is 40°C or higher, there is a case not to obtain the required hot water amount. If using the water other than the clean water, be sure to suppress increase in temperature of inlet feed water. *When the hot water amount is almost 100%, the inlet feed water temp may increase temporarily. Replace remote control.] G -- YES --> I{Is the remote control normal?} G -- NO --> J[Collect the operation data of heat pump water heater] I -- YES --> K{Is it out of normal operation range?} I -- NO --> L[Check water circuit Go to pages 190 and 191.] J --> K K -- YES --> M[Collect the operation data of heat pump water heater and check no problem on the heat pump water heater] K -- NO --> L M --> L </pre>	Insufficient capacity due to short circuit of air circulation. Check excessive heat load of hot water. Check whether the feed water is supplied or not. Check power source. (voltage, frequency) Collect the operation data by setting the conditions to operate the compressor with remote control. Check heat pump water heater. Check water circuit. If the inlet feed water temperature is 40°C or higher, there is a case not to obtain the required hot water amount. If using the water other than the clean water, be sure to suppress increase in temperature of inlet feed water. *When the hot water amount is almost 100%, the inlet feed water temp may increase temporarily. Replace remote control. Check insufficient capacity by protection control. Check the status of functional components temperature sensor, pressure sensor, compressor, EEV (body, coil) Check insufficient refrigerant and leak of refrigerant. Check water circuit Go to pages 190 and 191.
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2. Error detection method					
3. Condition of error displayed					
4. Presumable cause	- Insufficient capacity of heat pump water heater Heating capacity of heat pump water heater is not meet to the actual heat load Bad installation of equipments - Anomaly of heat pump water heater				

Note:

Error code	LED	Green	Red	Content
Remote control: No display 7-segment display: No display	Heat pump water heater	Keep flashing	Stay OFF	It can operate but no hot water comes out (2)

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2. Error detection method					
3. Condition of error displayed					
4. Presumable cause	- Anomaly of water circuit between the heat pump water heater and HW storage unit. - Piping failure in the HW storage unit				

Note:

Error code	LED	Green	Red	Content
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2. Error detection method					
3. Condition of error displayed					
4. Presumable cause					
• Insufficient supply water pressure • Too much pressure loss of water circuit					

Note:

Error code	LED	Green	Red	Content
Remote control: No display 7-segment display: No display	Heat pump water heater	Keep flashing	Stay OFF	Anomalous sound and vibration (1)

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4. Presumable cause					

Note:

Error code	LED	Green	Red	Content
Remote control: No display 7-segment display: No display	Heat pump water heater	Keep flashing	Stay OFF	Anomalous sound and vibration (2)

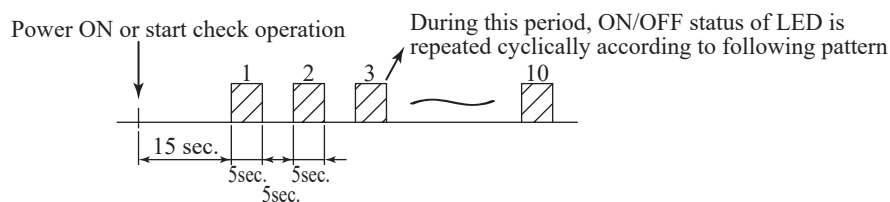
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2. Error detection method					
3. Condition of error displayed					
4. Presumable cause					

Note:

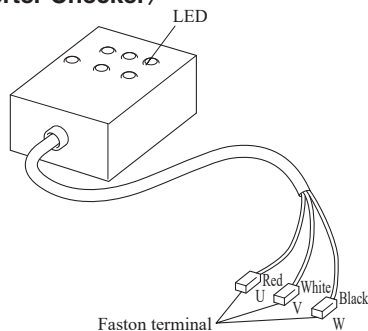
(1) Checking procedure of inverter PCB

- 1) Setup procedure of checker.
 - a) Power OFF (Turn off the breaker).
 - b) Remove the terminal cover of compressor and disconnect the wires (U, V, W) from compressor.
 - c) Connect the wires U (Red) , V (White) and W (Black) of checker to the terminal of disconnected wires (U, V, W) from compressor respectively.
- 2) Operation for judgment.
 - a) Power ON after SW10-4 on inverter PCB was turned ON.
 - b) After 15 seconds since the test operation has started, LED start ON/OFF for 5 seconds cyclically and it repeats 10 times.
 - c) Check ON/OFF status of 6 LED's on the checker.
 - d) Judge the PCB by ON/OFF status of 6 LED's on the checker.

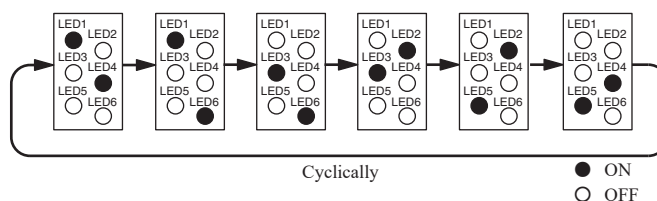
ON/OFF status of LED	If all of LED are ON/OFF according to following pattern	If all of LED stay OFF or some of LED are ON/OFF
Inverter PCB	Normal	Anomalous



- e) Be sure to turn off SW10-4 on inverter PCB, after finishing the check operation.

<Inverter Checker>

Connect to the terminal of the wires which are disconnected from compressor.

LED ON/OFF pattern**(2) Power transistor module terminal short circuit check procedure**

Disconnect the compressor wiring, then conduct a short circuit check.

P-U, P-V, P-W

N-U, N-V, N-W

Check between the P-N terminals.

Bring the tester probes in contact with the following places on each terminal.

P: Power transistor P terminal,

N: Power transistor N terminal,

U: End of red harness to compressor

V: End of white harness to compressor

W: End of black or blue harness to compressor

Check for a power transistor short circuit.

- When you do not have a diagnostic checker for judging if the inverter is defective, measure between the terminals of the power transistor parts, judge whether the power transistor is defective or not.
- Disconnect the compressor, then measure with the control incorporated.

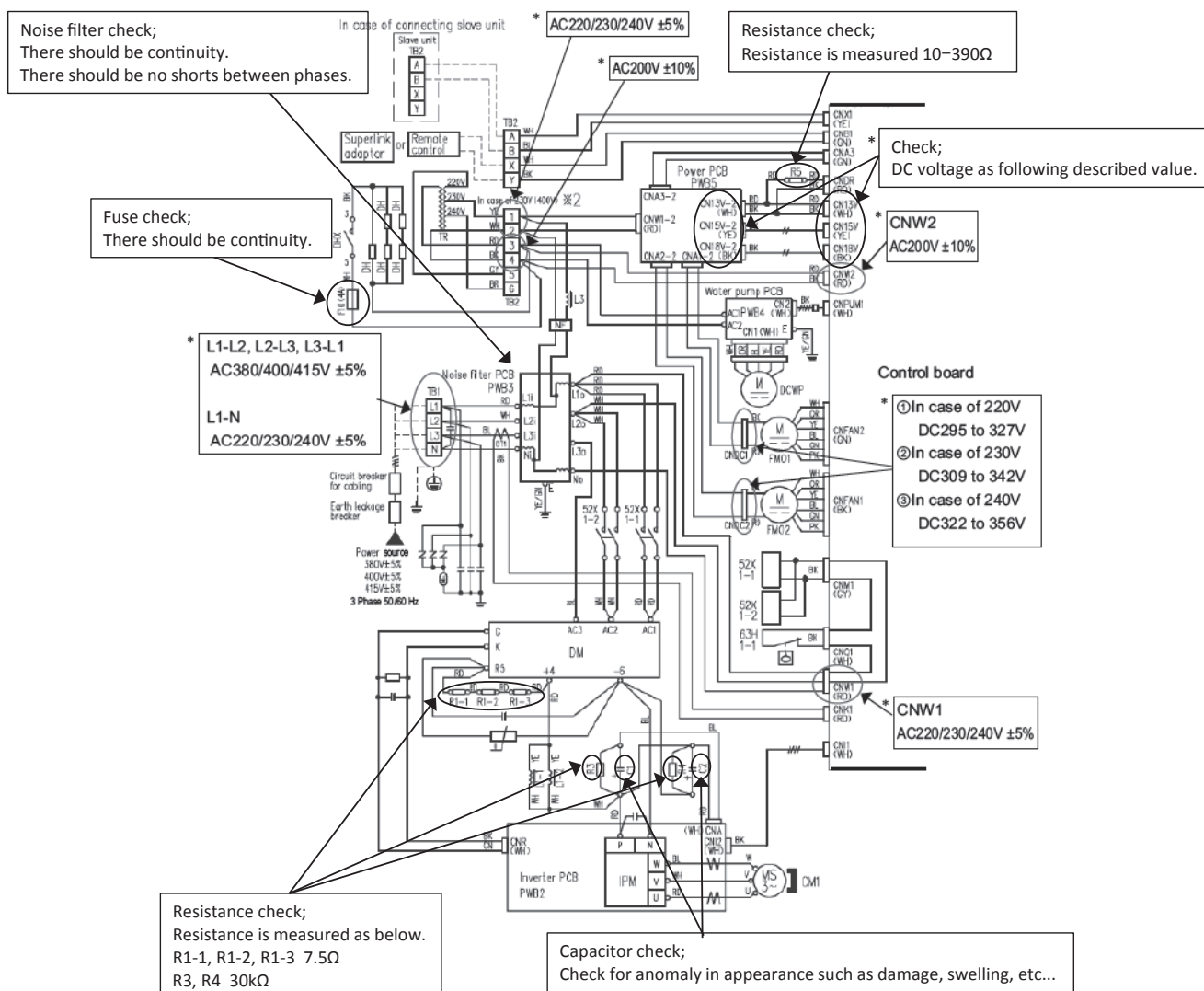
Tester		Normal value (Ω)
Terminal (+)	Terminal (-)	ESA30EH2
P	N	Scores of M
N	P	A few of M
P	U	Scores of M
P	V	Scores of M
P	W	Scores of M
N	U	Hundreds of K
N	V	Hundreds of K
N	W	Hundreds of K
U	P	Hundreds of K
V	P	Hundreds of K
W	P	Hundreds of K
U	N	Scores of M
V	N	Scores of M
W	N	Scores of M

If the measured values range from 0 - several $k\Omega$, there is a possibility that the elements are damaged, so replace the power transistor parts.

(3) Outdoor unit check points

Check items with the *mark when the power is ON.

Do not start the unit during checking for your safe.



4.4 Component replacement as a guide

For maintenance, check and preventive maintenance, please note implementation to replace components

We would like to ask all customers owning this product to have a periodical maintenance and to replace components by our authorized service man in order to maintain the safety of product and to keep its function in good condition.

In this table, the contents of periodical checking on the product under the general usage condition and its maintenance cycle and the estimated time to replacement of each components are shown.

Especially regarding the estimated time for replacement of components, it is decided depending on the water and air quality and setting time of hot water operation and etc.

Regarding the concrete maintenance and inspection, please consult with our distributor.

Component	Check point	Inspection cycle (Time/Year)**	Estimated time for replacement
Components of refrigeration circuit	Compressor	1	40,000 hours
	Heat exchanger (Evaporator)	1	10 years
	Gas cooler (water heat exchanger)	1*	10 years
	Solenoid valve	1	10 years
	EEV (Electronic expansion valve)	1	10 years
	Strainer	1	At heavy service
	Capillary tube	1	10 years
	Refrigerant pipe	1	10 years
	Relay	1	10 years
	Coil and body of solenoid Valve & EEV	1	25,000 hours
Components of electrical circuit	Crankcase heater	1	20,000 hours
	Anti-freezing heater (Drain pan, Water piping)	1	20,000 hours
	Fuse	1	5 years
	PCB (for Control, Inverter and Water pump)	1	10 years
	High pressure switch (63H1)	1	10 years
	Pressure sensors	1	10 years
	Terminal block	1	10 years
	Wiring and connector	1	10 years
	Capacitor	1	25,000 hours
	Cooling fan	1	10 years
Outdoor fan	Magnet contactor (52C)	1	25,000 hours
	Fan propeller	1	10 years
	Fan motor	1	20,000 hours
Components of water circuit	Water pump	1*	5 years
	Flow regulator (CW/FV1)	1*	5 years
	Motor valve (CW/FV2 to CW/FV5)	1*	5 years
	Pressure reducing valve	1*	5 years
	Check valve	1*	5 years
	Strainer	1*	Cleaning 2times/year

* Inspection period and replacement period are received much influence from the clean water quality to use for this hot water supply system.

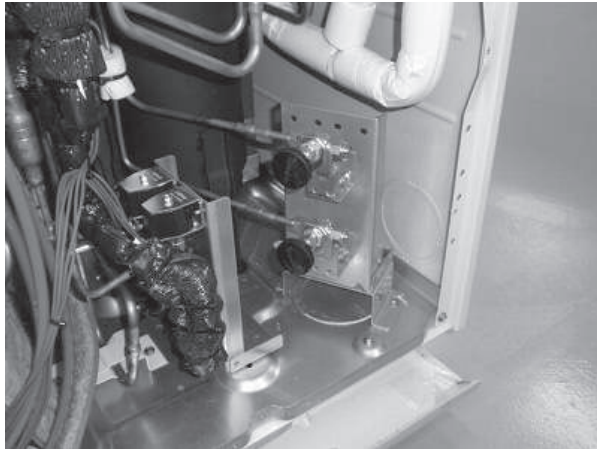
Please ask our distributor for details.

** It is recommendable to inspect at least one time / year.

4.5 Disassemble and reassemble method

(1) Compressor replacement procedure

(a) Purge CO₂ refrigerant.



Connect the charge hoses to the service valves and purge CO₂ refrigerant.

(It is available to purge CO₂ in the air)

Note 1) If purging refrigerant rapidly, the refrigerant may become frozen inside of service valve and cannot be purged.

In addition, refrigerant oil may also be purged.

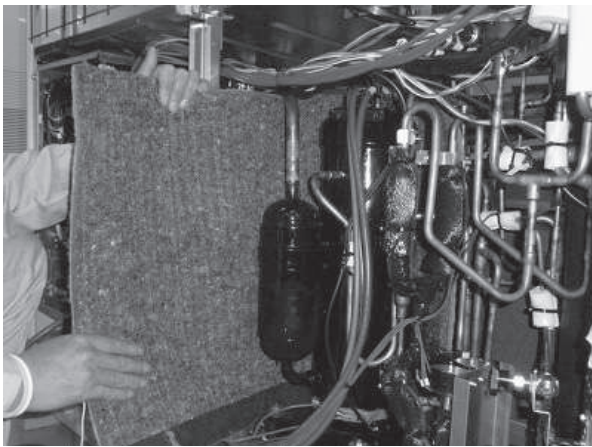
Therefore, be sure to purge the refrigerant through a proper adjustment.

Note 2) Be sure to check EEV fully opened.

*Check procedure: Power Off ⇒ On ⇒ Off

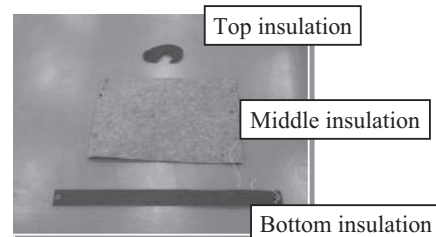
(b) Before dismounting compressor

1) Remove insulation jacket from compressor.



Remove the middle and bottom insulation from left side of compressor.

Remove top insulation first and bottom insulation and then middle insulation sequentially



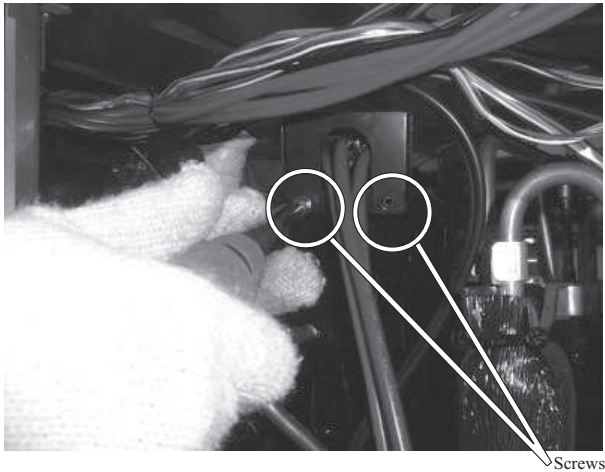
2) Remove the insulation of discharge piping.



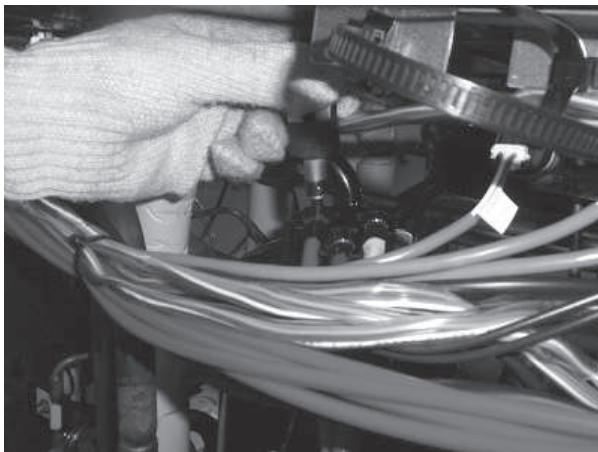
Be sure to remove the insulation neatly with consideration for reuse.

And remove it up to the position not to be burnt by brazing work.

3) Remove the power cables from compressor.

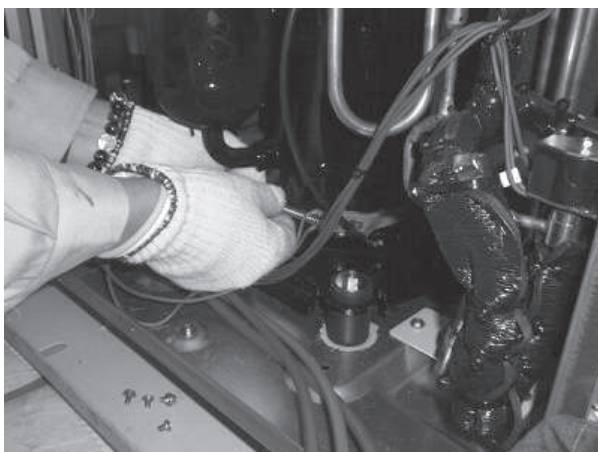


Loosen 2 screws and remove the terminal cover.

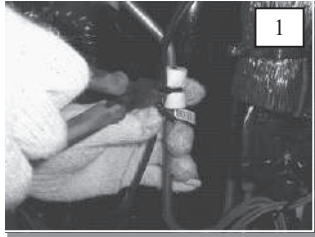


Loosen 3 screws and disconnect the power cables.
Note) Since the terminals are facing upward, it had better to use a stabilizing type screwdriver.

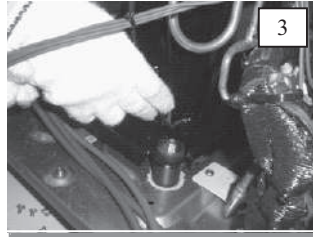
4) Remove the crankcase heater.



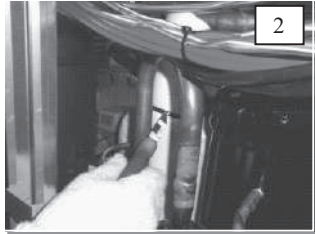
5) Remove temperature sensors.



Tho-INJ1



Tho-C1

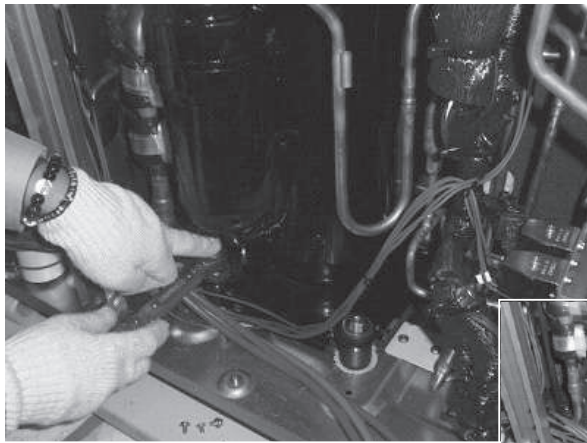


Tho-D1

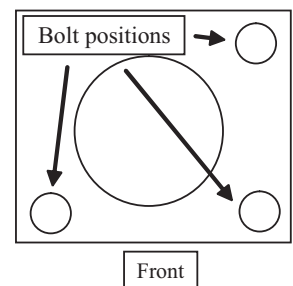
Remove 3 temperature sensors after removing insulations

1. Tho-INJ1 (Injection temperature sensor)
2. Tho-D1 (Discharge temperature sensor)
3. Tho-C1 (Under-dome temperature sensor)

6) Loosen 3 nuts of compressor mounting bolts.



Compressor is fixed with 2 bolts in front and 1 bolt in the rear.



7) Bind up wires and cables for compressor.

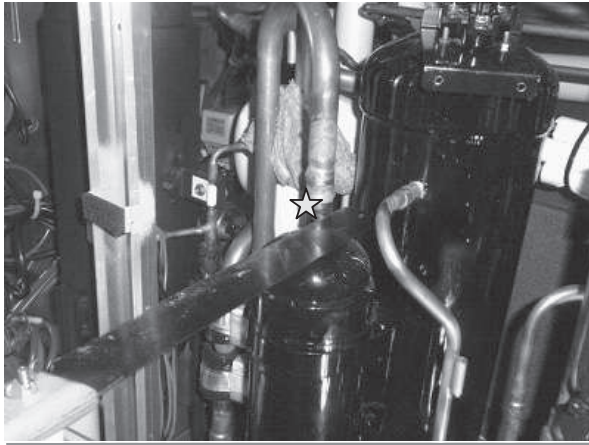


Bind up wires and cables in order not to get in the way of brazing work and replacing work of compressor.

(c) Dismounting compressor

1) Disconnect pipes by cutting.

① Suction pipe



Before disconnection work, be sure to check the residual pressure in the unit is 0MPa.

(It is very dangerous to brazing pipe too hastily.)

It is better to disconnect the pipe by cutting, because the pipe is thicker and the insertion depth of pipe is deeper. If research is required, cut the pipe as nearer as the brazing point in order to leave longer pipe on compressor side.

☆ Cutting position

Extract the remaining pipe from cutting point to brazing point by brazing.

② Discharge pipe

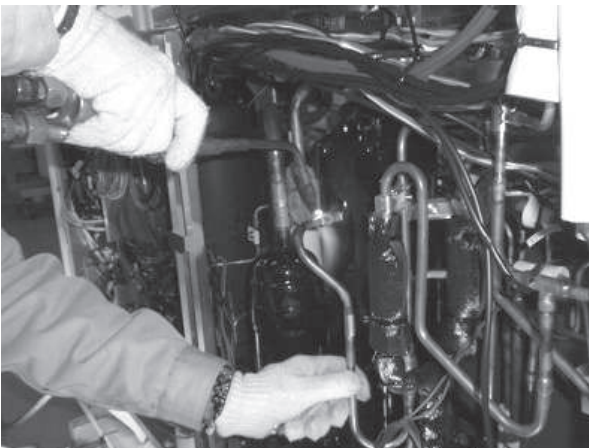


Cut the pipe in the same procedure as that for suction pipe.

☆ Cutting position

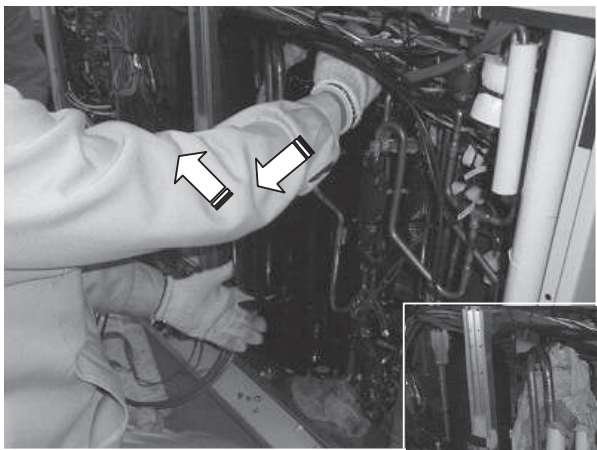
2) Disconnect a pipe by brazing.

③ Gas injection pipe



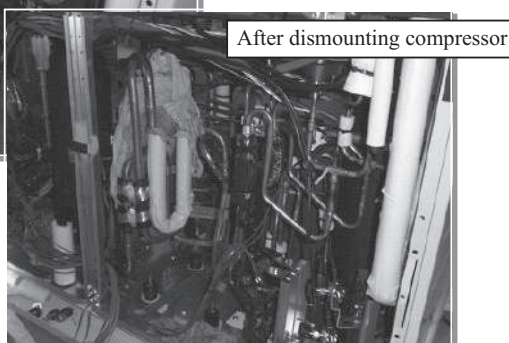
Gas injection pipe can be disconnected first by brazing, because this pipe is thin. However it is easier to disconnect it after cutting suction and discharge pipes.

3) Dismount the compressor.

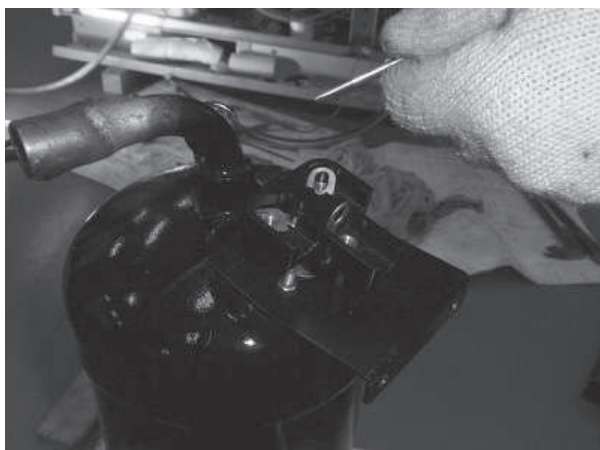


Incline the top of compressor to foreside and take it out obliquely upward.

Note) When taking out compressor, be careful not to hit it against the suction pipe located at the rear lower left side of compressor.



4) Dismount the terminal block from compressor.



Dismount the terminal block from the compressor in order to reuse it, because new compressor as spare part does not have it.

(d) Mounting new compressor

1) Mounting new compressor

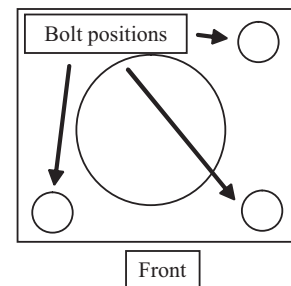


Place the new compressor on to the mounting base without hitting the suction pipe located at the rear lower left side of compressor.

2) Tighten the nuts of compressor mounting bolts.

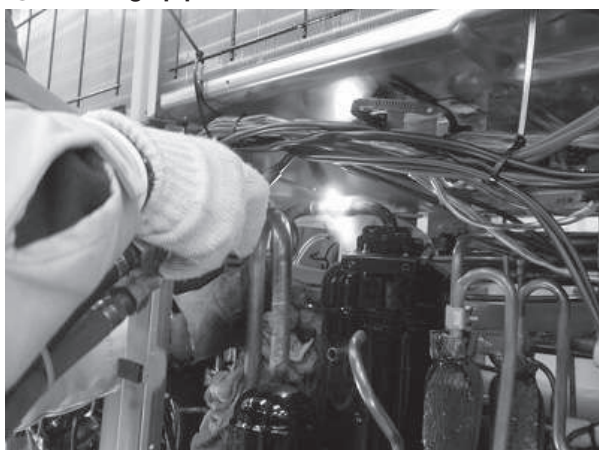


Place the new compressor in right position on the mounting bolts and tighten the nuts.



3) Brazing

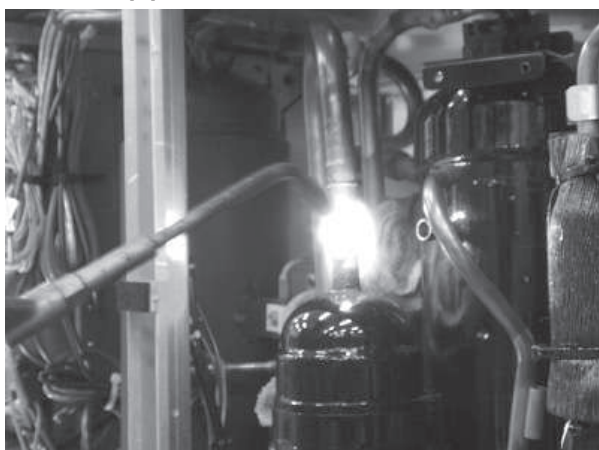
① Discharge pipe



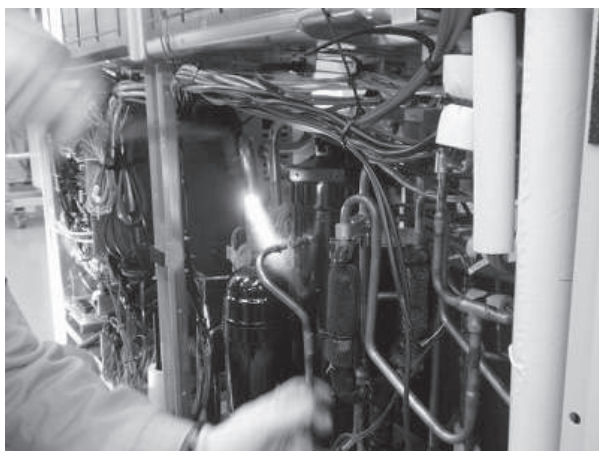
Be sure to do masking around the brazing place.
(The places not only around discharge pipe but also around suction pipe and gas injection pipe)

Note) Be careful to braze pipes without any gas leak later on, because the pipe is thicker and pipe insertion depth is deeper and then upper space is rather tight for brazing work.

② Suction pipe

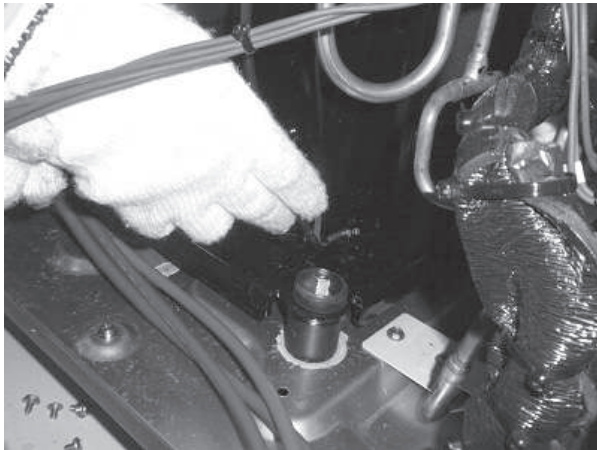


③ Gas injection pipe



(e) After mounting new compressor

1) Attach crank case heater and under-dome temperature sensor.



Be sure to attach them before wrapping the insulation jacket around the compressor.

2) Wrap the insulation jacket around the compressor.



Insert the insulation jacket from left side of compressor and wrap it around compressor.
And then band it in front of the compressor.

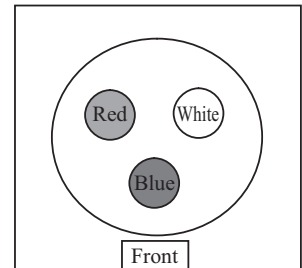
Note) Do not forget to put top insulation cover on the compressor.

3) Attach discharge pipe temperature sensor and gas injection temperature sensor.

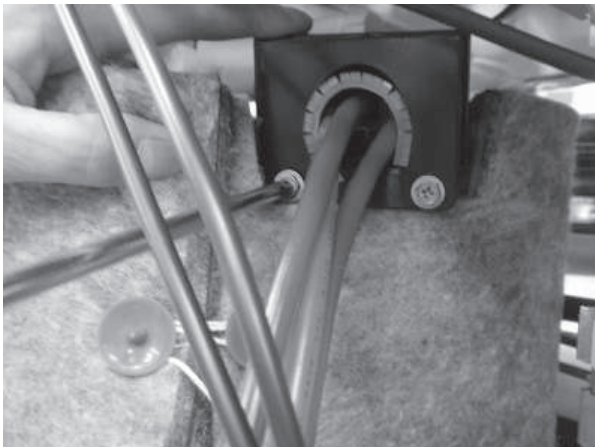


Put them back the way they were.

4) Connect the power cable to the compressor.



5) Attach terminal cover and bundling the wires.



Hook the back of terminal cover to the latch and tighten 2 screws.

The unbound wires shall be put back the way they were.

(f) Charge refrigerant.

- 1) Air tightness test should be done with N_2 gas by pressurizing up to 14MPa
 - 2) Evacuate the refrigerant pipes
 - 3) Charge CO_2 refrigerant
- * About 2 sets of $7m^3$ bomb are required.

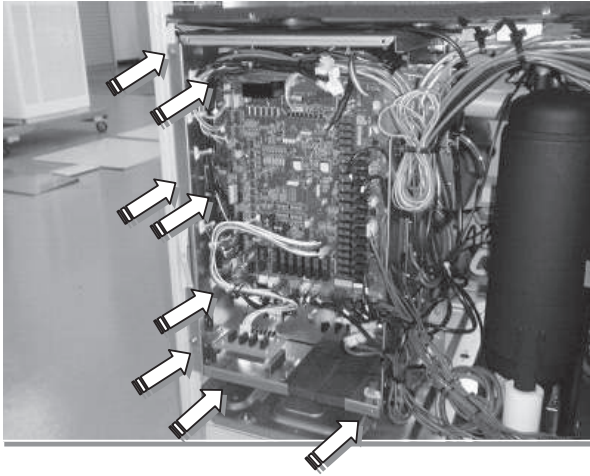
(g) Test run

- 1) Check whether the controls and sensors are normal.

(2) Inverter PCB replacement procedure

(a) Replacement work of inverter PCB (on the third layer)

1) Loosen screws.



The mounting board of the first layer (on the front) the second layer (on the back) can be removed like as opening door.

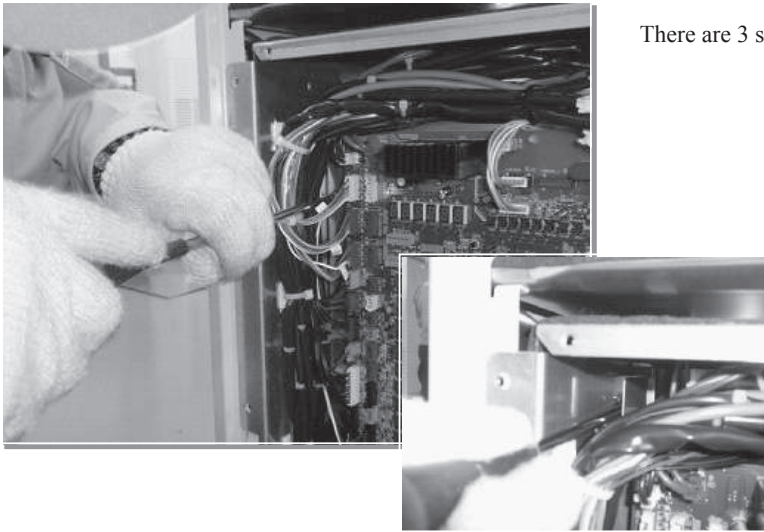
Loosen 8 screws (shown with white arrow)

Left side of control box : 3 screws

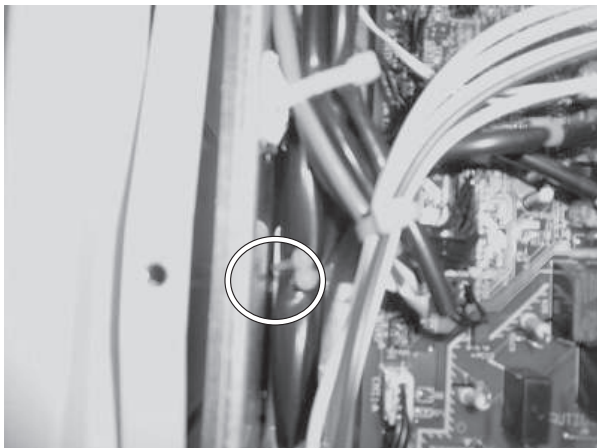
Inner left side of control box : 3 screws

Bottom side of control box : 2 screws

① Inside of control box

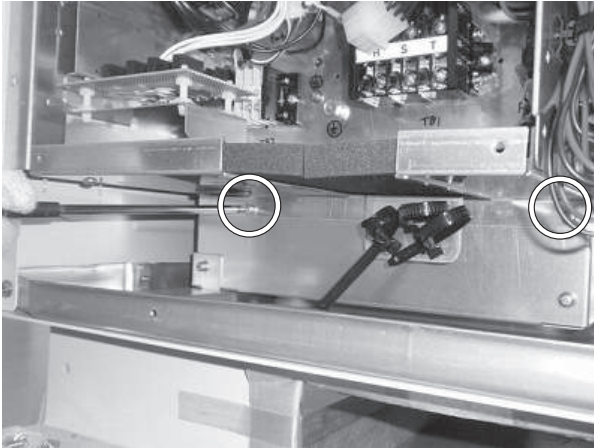


There are 3 screws at inner left side of control box.



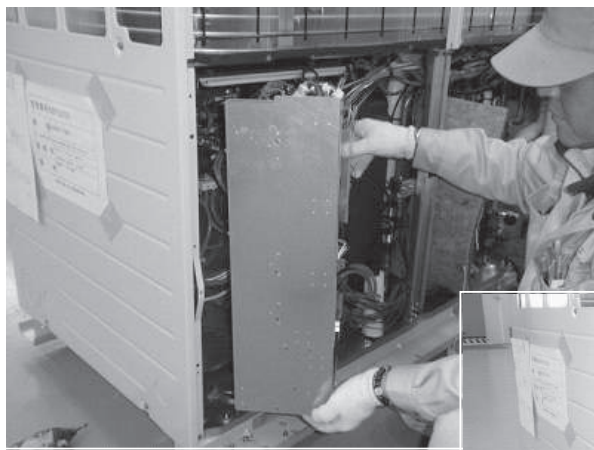
Be careful not to forget to loosen a center screw which is hidden by wiring.

② At the bottom of control box



There are 2 screws at the bottom of the control box.

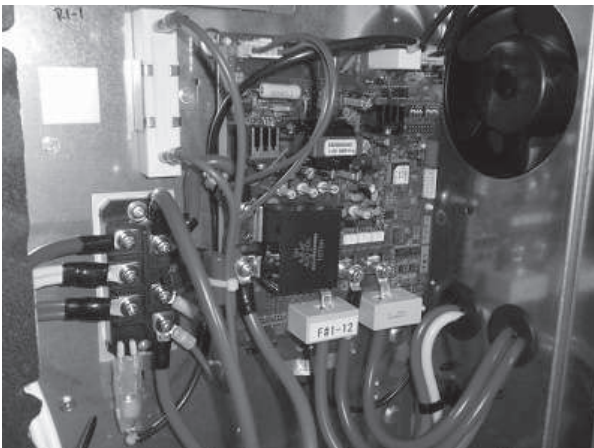
③ Open the mounting board of first and second layer.



This mounting board supported at right edge as supporting point can be opened from left side.



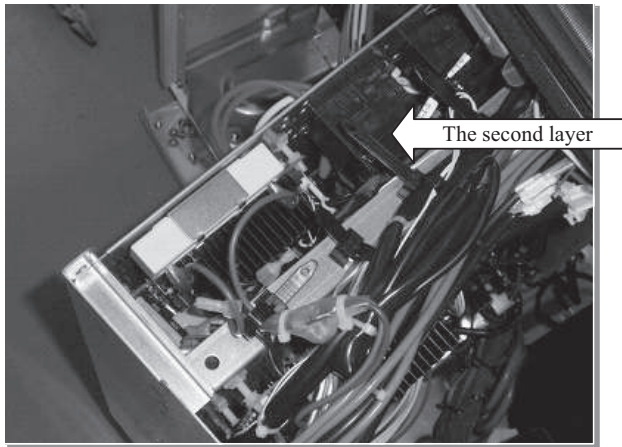
2) Inverter PCB



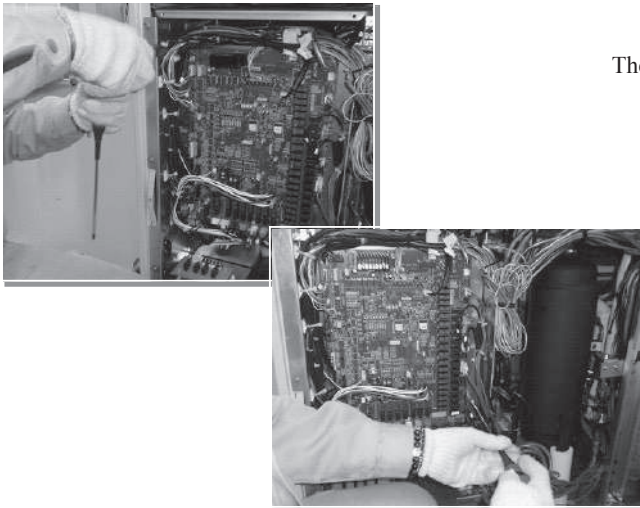
Following the process ① to ③ enables easy access to the inverter PCB without disconnecting wires.

(3) Replacement procedure of power PCB and water pump PCB

(a) Replacement work of power PCB (on the second layer)

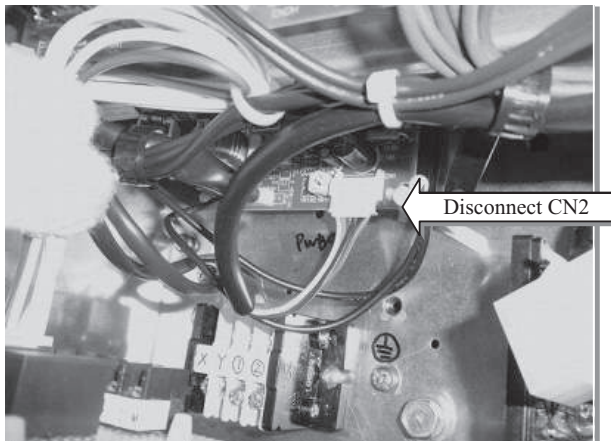


① Loosen 4 screws.



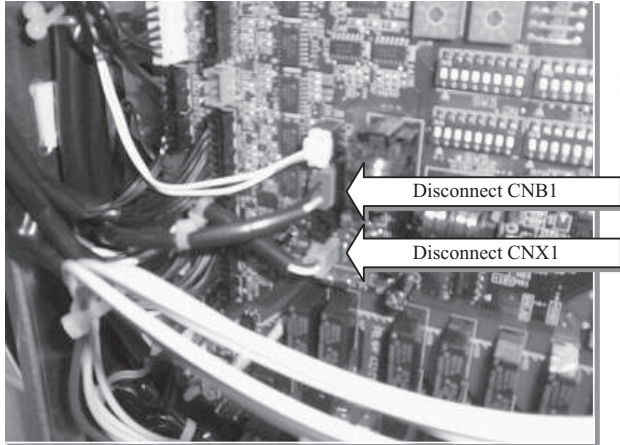
There are 4 screws at all corners of the first layer.

② Disconnect the wire going to the water pump PCB.



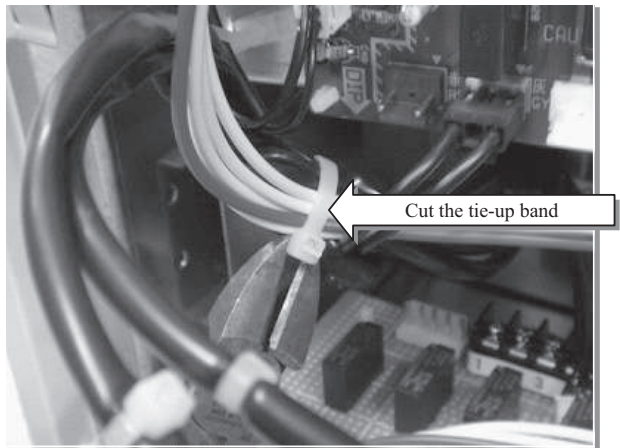
Disconnect CN2 connector on the water pump PCB.

③ Disconnect the wires going to control PCB.



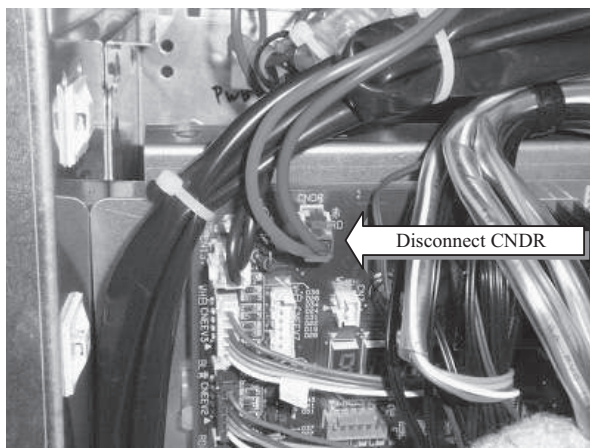
Disconnect CNB1 connector (Green) and CNX1 connector (Yellow) on the control PCB.

④ Cut the tie-up band.



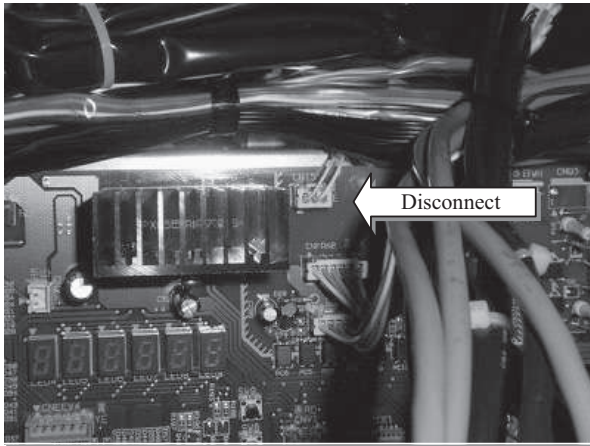
Cut the tie-up band

⑤ Disconnect the wire going to control PCB.



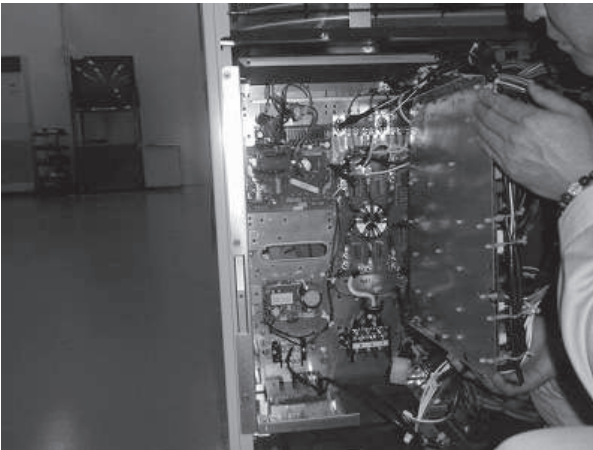
Disconnect CNDP connector (Red) at the upper left part of control PCB

⑦ Disconnect the wire going to control PCB.



Disconnect CN13V connector (White), CN15V connector (Yellow) and CN18V connector (Black) at the upper center part of control PCB. (Check the detailed position of connector with the wiring diagram or control PCB drawing)

⑧ Remove the first layer.



Following the process from ① to ⑦ enables to remove the first layer and to access power PCB.

(4) Dismounting water heat exchanger

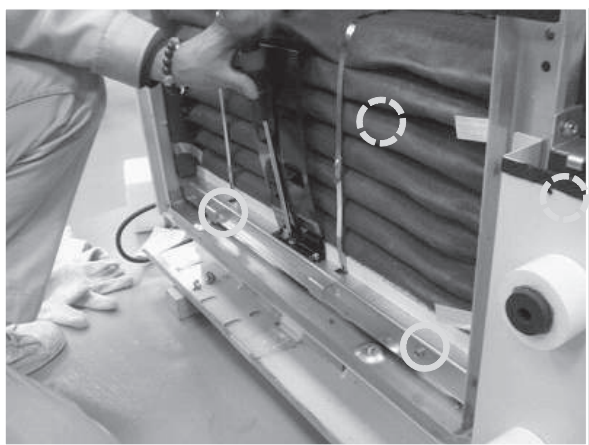
(a) Remove the insulation.



The insulation will be reused.



(b) Detach 4 screws(front side x 2 , back side x 2) from the base.

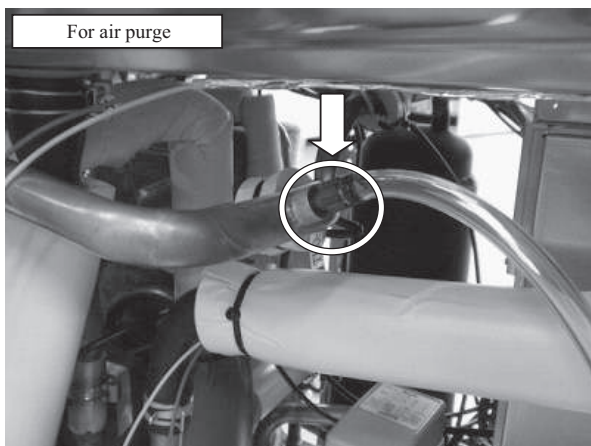


※It's no need to detach the insulation from the gas cooler.

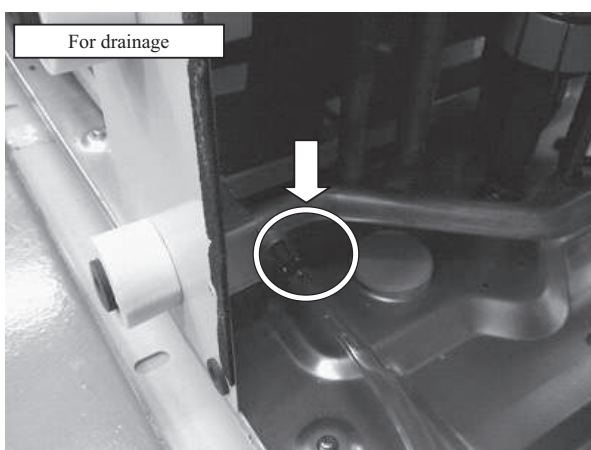
(5) Replacement procedure of water heat exchanger (Gas cooler)

(a) Removal of residual water in the water heat exchanger

1) Remove residual water in the water heat exchanger (from 2 ports).



Turn the air purge valve and drain valve to open fully and discharge residual water.



2) Turn the lever to open the flow regulator manually.

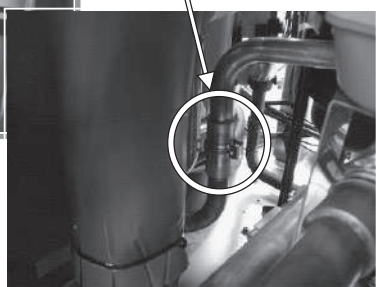
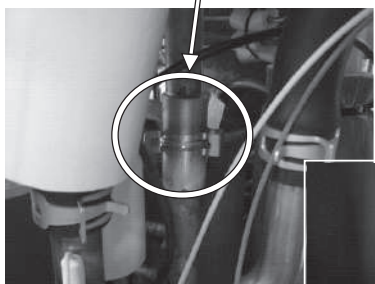
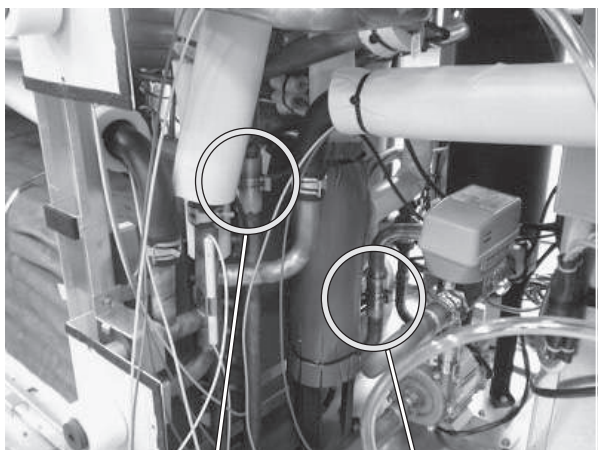


While pressing the button for switching to manual operation located at the bottom of the flow regulator, turn the lever to open ("O") side.

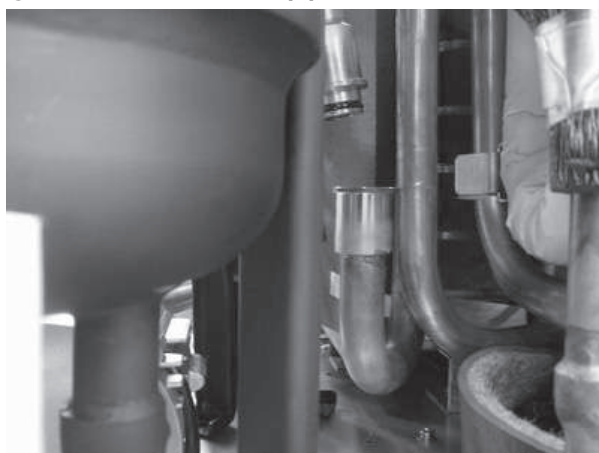
The flow regulator shall be open, when discharging residual water.

3) Disconnect the water pipes and ThoG1 sensor (at 2 positions).

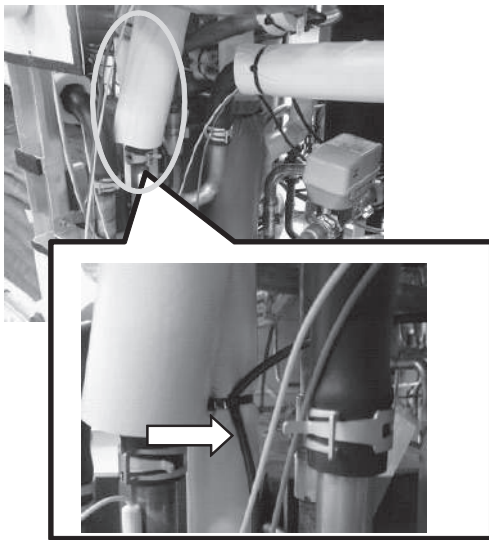
① The positions to disconnect



② Disconnect the water pipes.

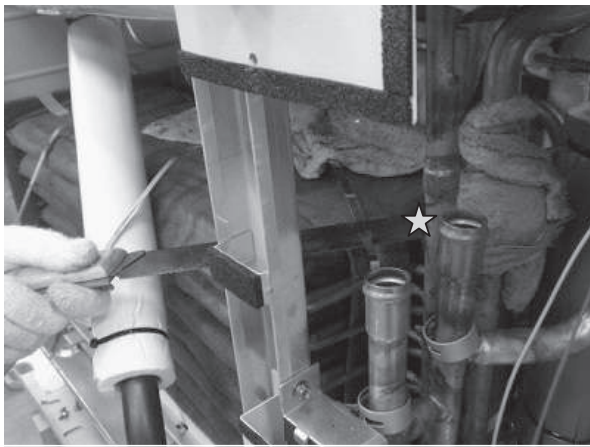


Extract the quick fastener (female side)

4) Disconnect ThoG1 sensor.

Detach the tie wrap band and insulation, and disconnect the ThoG1 sensor.

When disconnecting the sensor, be careful not to damage it.

5) Cut the refrigerant pipe of water heat exchanger.**① Inlet side of refrigerant pipe**

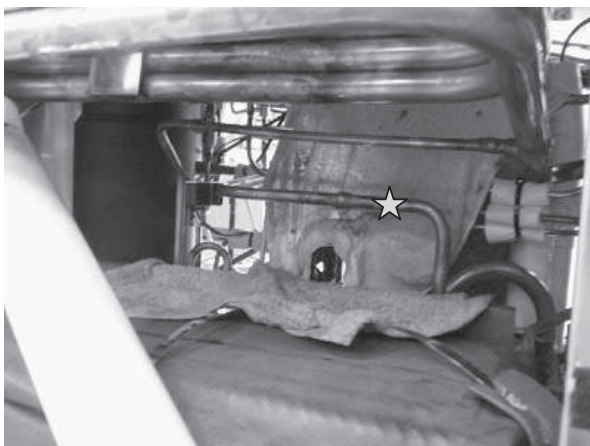
Before cutting the refrigerant pipe, remove the drain hose.

Before cutting the refrigerant pipe, be sure to check residual pressure in the water heat exchanger is 0MPa. (It is very dangerous to brazing pipe too hastily.)

It is better to disconnect the pipe by cutting, because the pipe is thicker and the insertion depth of pipe is deeper. If research of dismantled water heat exchanger is required, cut the pipe as nearer as the brazing point in order to leave longer pipe on water heat exchanger side.

☆ Cutting position

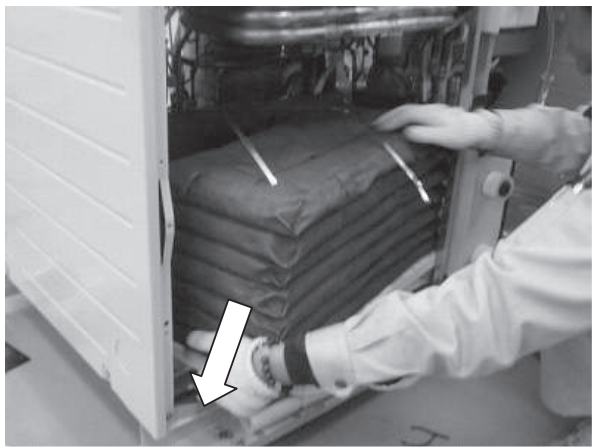
Extract the remaining pipe from cutting point to brazing point by brazing.

② Outlet side of refrigerant pipe

Cut the pipe in the same procedure as that for inlet side of refrigeration pipe.

☆ Cutting position

6) Dismount the water heat exchanger.



If the center pillar cannot be removed, pull out the water heat exchanger from left side by turning it anti-clockwise.

7) Clean the internal of new gas-cooler.

Before replacement, supply water (about 3L or more) to the internal of new gas cooler.

Tilt it several times to the left and right, and drainage.

If the water color is brown, repeat the above operation until the water will be clear.

8) Mount new water heat exchanger.

① Inlet side of refrigerant pipe



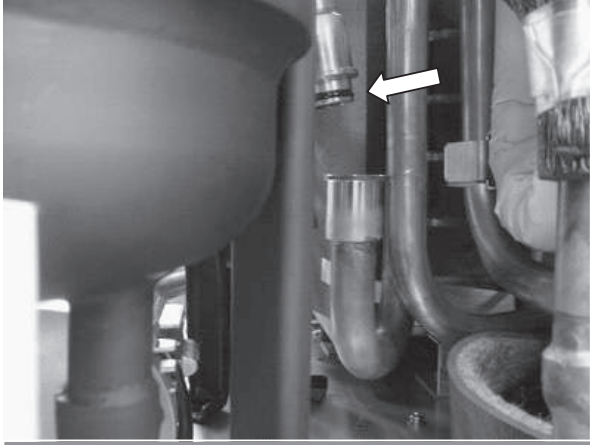
Be sure to do masking around the brazing place.
(The places not only around inlet side of refrigerant pipe but also around outlet side of refrigerant pipe.)

Note) Be careful to braise pipes without any gas leak later on, because the pipe is thicker and pipe insertion depth is deeper and then working space is rather tight for brazing work.

② Outlet side of refrigerant pipe



9) Connect the water pipe.



When connecting the water pipe, be sure to replace the O-ring to new one.

4.6 Cleaning procedure of CO₂ water heater gas cooler

Foreign matter, and scaling could build up inside the gas cooler of the unit in which CO₂ and water exchange heat. The amount of deposits depend on water quality. If it becomes too thick, it could effect flow rate and heating capacity. COP could drop or unstable control could also lead mismatch of hot water outlet temperature compared to the target temperature.

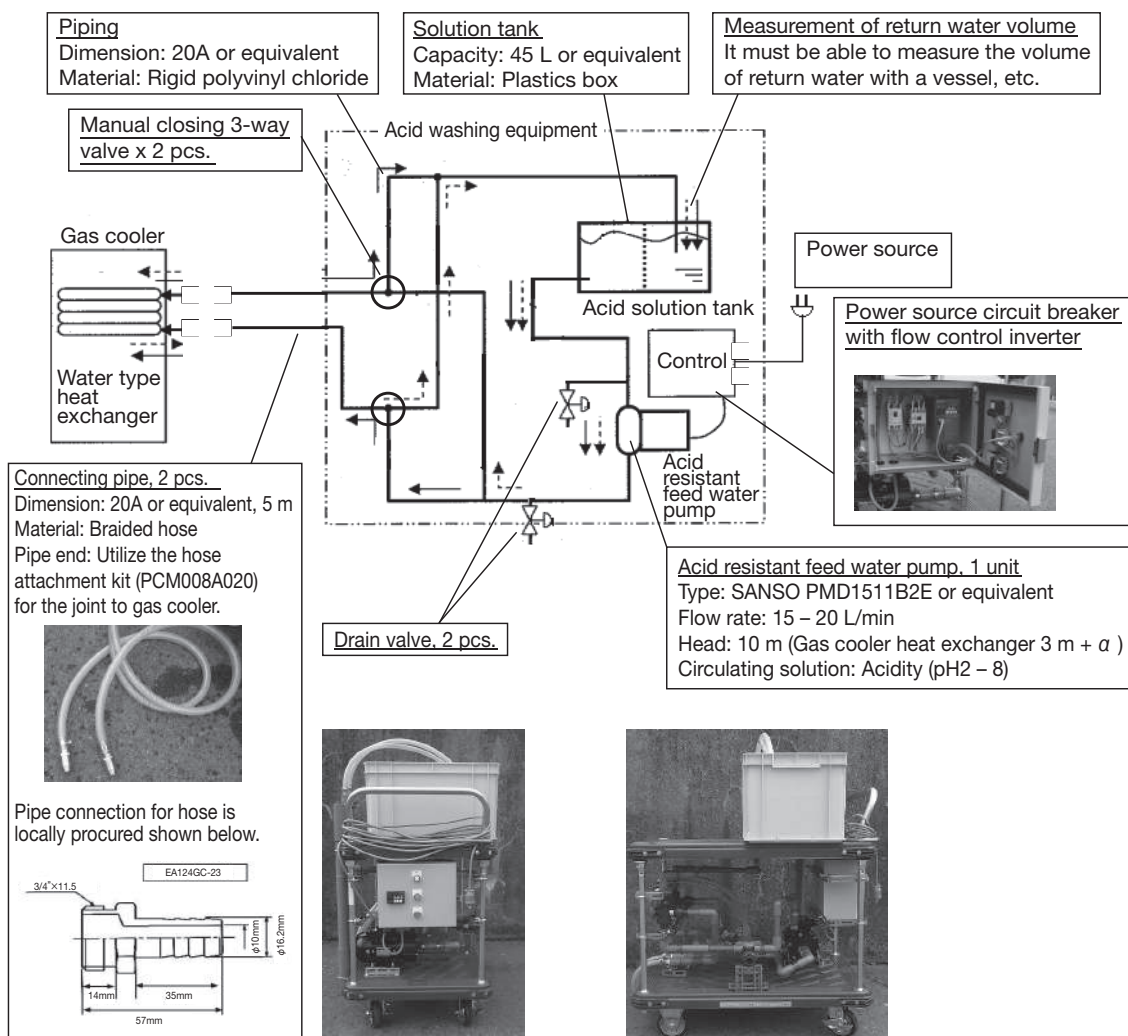
It is recommended to inspect operation data regularly, and wash the gas cooler as follows when deterioration of the mentioned performance due to scaling is detected.

(1) Necessary tools

- 1) Washing solution (Ex. Kuridine T-203, a product of Kurita Water Ind.)
Features: Food additive-base. Lowly corrosive to aluminum, SUS and copper materials. Safe to human body.
- 2) Neutralizer (Ex. Kuridine N, a product of Kurita Water Ind.)
Features: Powder in small bags for long term storage. Low toxicity.
- 3) Liquid waste vessel (Total recommendation: 100 L, 15 L × 6 times (Washing/neutralization))
- 4) pH meter or pH test paper
- 5) Protective equipment (Protective glasses, gloves, mask)
- 6) Measure (Circulation flow rate, solution concentration)
- 7) Hose attachment kit (PCM008A020) × 1 set
- 8) O ring (PCM925C002A) × 3 pcs., drain valve (PCM483D001) × 2 pcs.
- 9) Washing equipment (See following figure.)

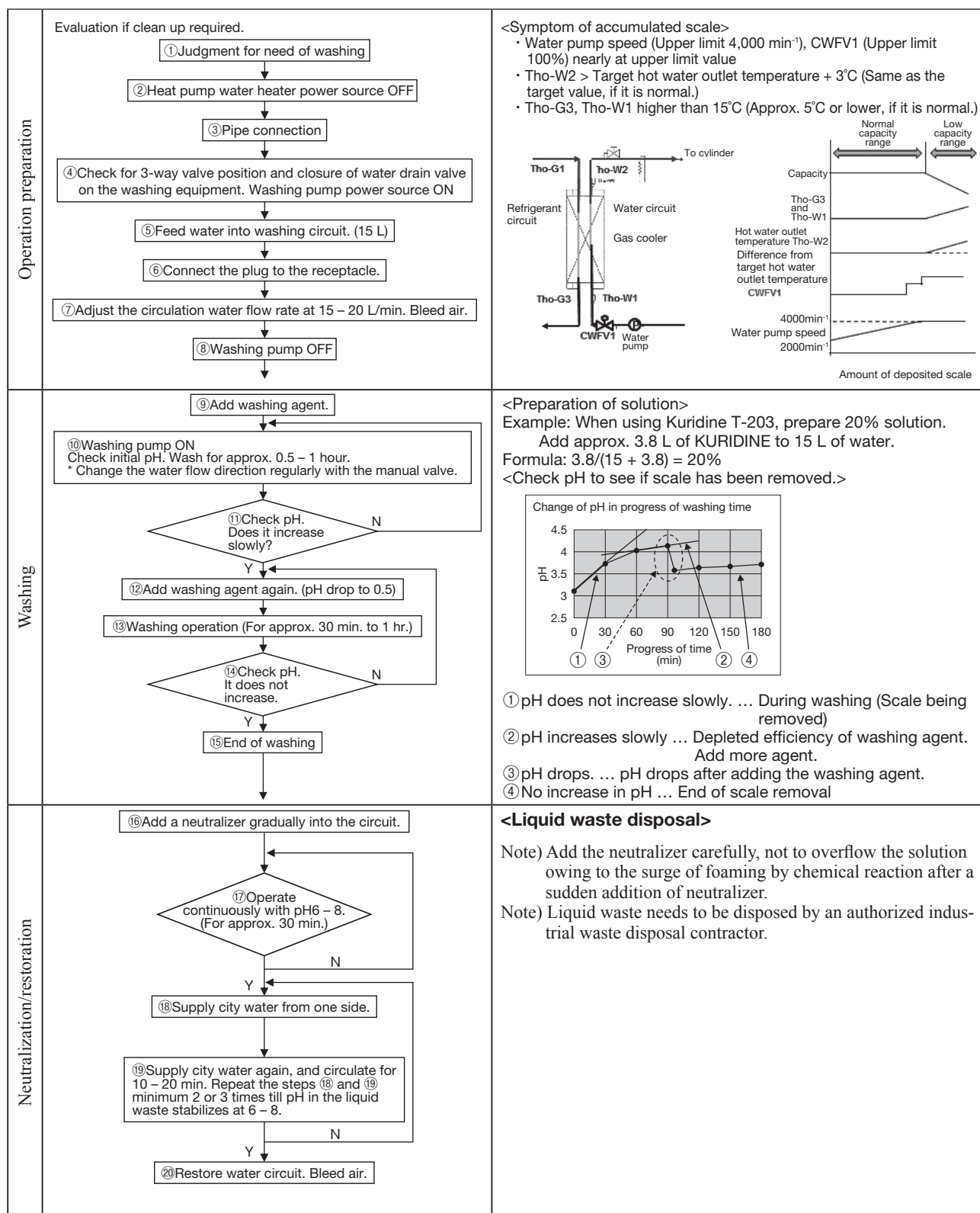
Example of acid washing

- Outline of circuit and parts are as shown below.
- Materials resistant to chemicals (acid)



(2) Cleaning procedure

The following chart shows the flow the steps required from evaluation for need of washing to end of clean up procedure.



(3) Cleaning instructions

1) Turn OFF the power source to the heat pump water heater.

2) Connect pipes.

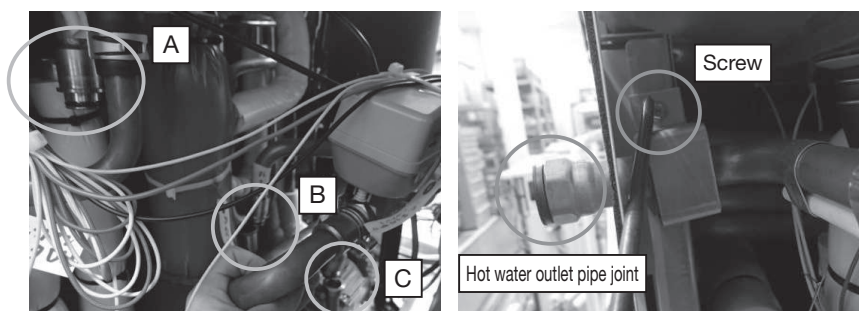
2-1) Remove the front panel (control BOX side) and the rear panels (2 pcs).



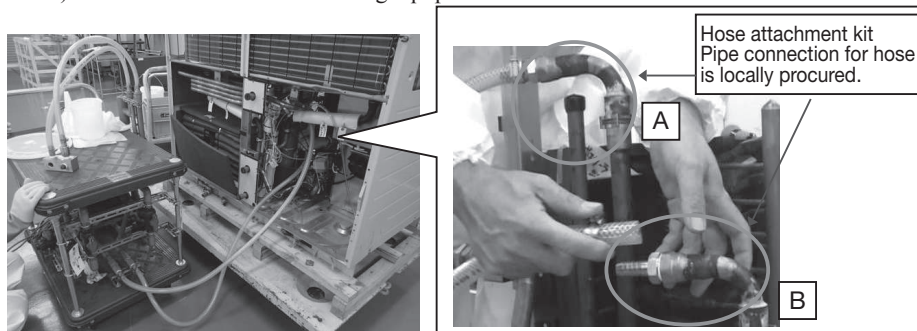
2-2) Remove the quick fasteners at A to C in the following figure.

Note) If it is difficult to remove at A, remove the joint and screw from the hot water outlet pipe in the figure at right.

Note) Remove the fastener at C in order to remove the same at B.



2-3) Connect hoses from the washing equipment to A and B.



Utilize the hose attachment kit (PCM008A020) to connect to the heat pump water heater (Gas cooler water pipe inlet and outlet).

Note) Provide the hoses, pipe connection for hose and clamps locally.

- 3) Set the washing equipment (provided locally). (Valve direction adjustment, water drain valve closure, etc.)
- 4) Feed water to the washing equipment and devices. (15 – 20 L)
 Note) Check for leak from the piping.
 Note) Capacity in the gas cooler piping is approx. 9L. Adjust the feed water quantity according to the washing cylinder.
- 5) Turning on the power source of the washing equipment, start the washing pump. Bleed air also from the piping at this time.
- 6) Adjust the circulation water volume at 15 – 20 L.
- 7) Turn OFF the washing pump.
- 8) Add the neutralizing agent.

Example: Prepare 20% solution of Kuridine T-203.

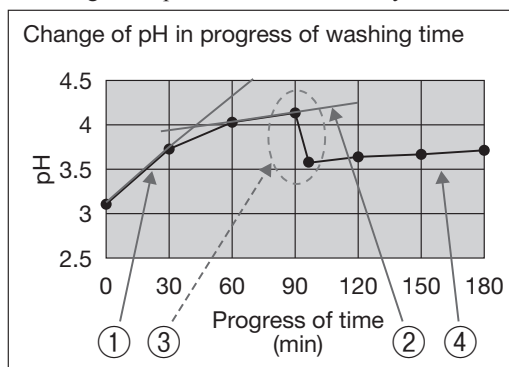
If the water is 15 L, add approx. 3.8 L of Kuridine T-203 (undiluted solution).

Note) Adjust the concentration of solution depending on the washing agent.



- 9) Check initial pH. Turn ON the washing pump, and operate it for 0.5 – 1.0 hr.
- 10) Check pH regularly during washing till the increase of pH slows down.
 - a) Does pH increase slowly? → Add more washing agent, and repeat the step (9).
 Note) Change the manual valve regularly to invert the flow direction of washing agent. (Once/30 – 60 min.)
 Note) Unless the flow direction can be inverted with the manual valve, drain washing agent before adding more agent, disconnect and reconnect outlet and inlet hoses, and return to the section (4).
 Or, continue to wash longer than normal.
 - b) pH does not increase. → Go to the section (11).

Repeating the above, complete the washing when pH does not increase any more.



- ① pH does not increase slowly. ... During washing (Scale being removed)
- ② pH increases slowly ... Depleted efficiency of washing agent. Add more washing agent.
- ③ pH drops. ... pH drops after adding the neutralizer.
- ④ No increase in pH ... End of scale removal

11) Add the neutralizer gradually to neutralize the solution in the piping. (To pH 6 – 8)

Note) Add the neutralizer carefully, gradually paying attention to the foam created chemical reaction, during the especially adding suddenly neutralizer.

Note) Take care to avoid the air foam being trapped in the water pump.

Note) When the neutralized condition has continued for 30 minutes at least while operating the water pump, the neutralization can be completed.



12) After completing the neutralization (to pH6 – 8), feed water from one side to push out the liquid waste to a vessel. When the washing solution has been purged completely, turn off the washing pump.

Note) Check the pH of drained solution once more to see if it is neutralized sufficiently. (To avoid dispose of an acidile solution)



13) Feed city water to the washing equipment and the gas cooler, and turn on the washing pump again to circulate water. About 10 – 20 minutes later, repeat the step (12).

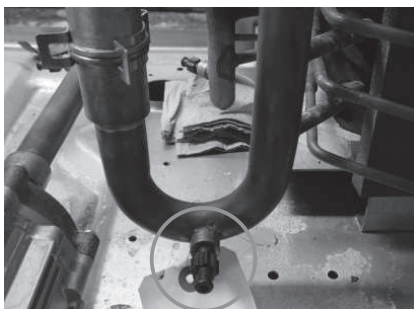
Repeat the above work at least 2 to 3 times. If the pH of liquid waste stabilizes at pH6 – 8, it can be judged that the washing solution has been removed from the circuit.

Note) Check again the pH of drained solution to see if it has been neutralized sufficiently.

14) Restore the water circuit as it was, and bleed air from the piping to complete the washing.

Be sure to have the liquid waste disposed by an authorized industrial waste disposal contractor, and obtain the certificate.

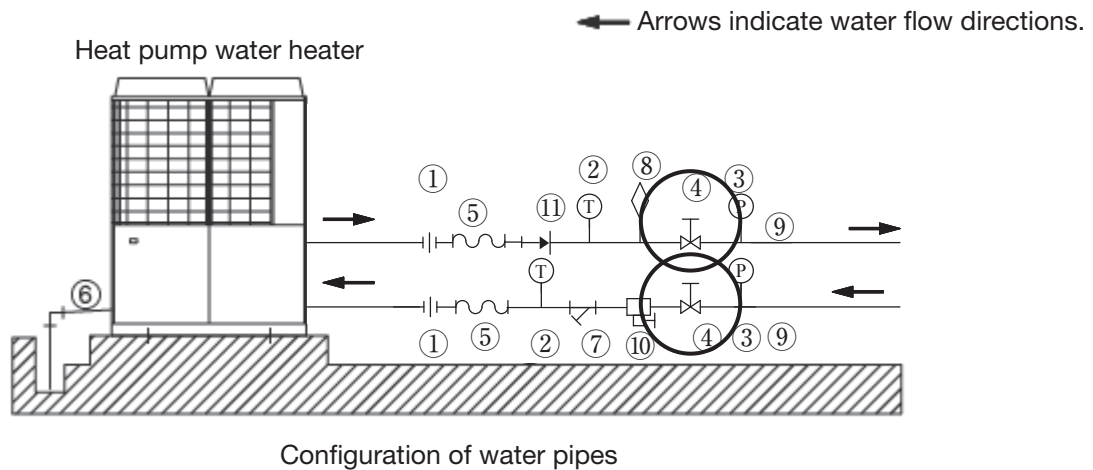
Note) After the washing, replace O rings (PCM925C002A, 3 pcs.) and the drain valves (PCM483D001, 2 pcs.).



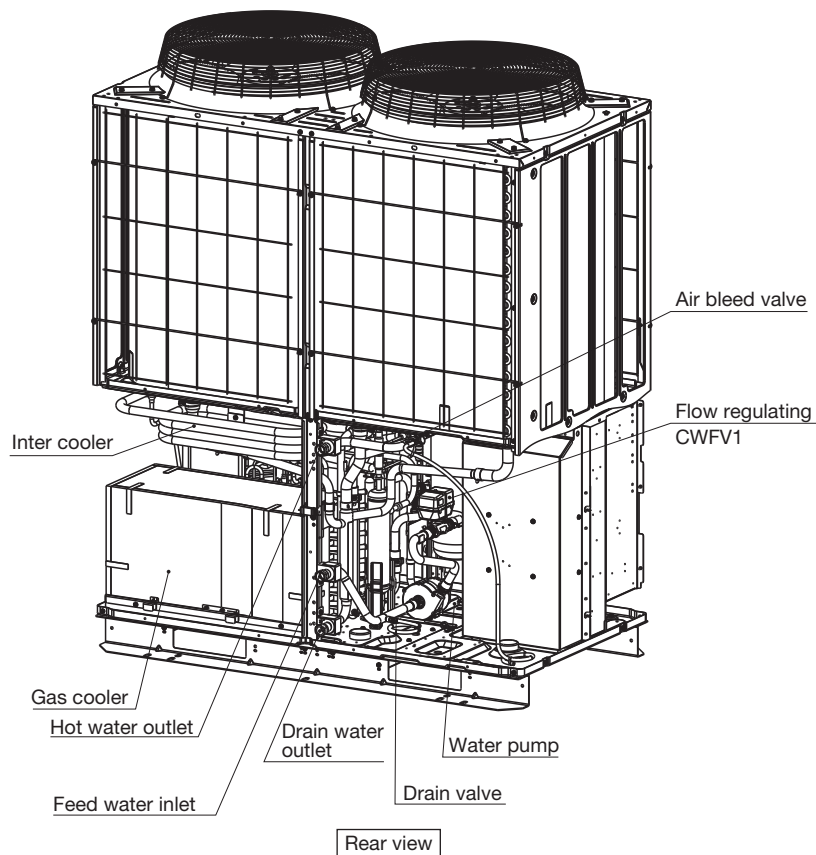
4.7. Method of draining water from gas cooler

If the heat pump water heater is left without power source in winter, water in the gas cooler may freeze, damaging the heat exchanger or causing problems at restart of operation. Please drain water from the gas cooler as follows prior leaving the unit deemerged for long time.

- 1) Close the valves at the hot water supply and the water supply pipe sides.

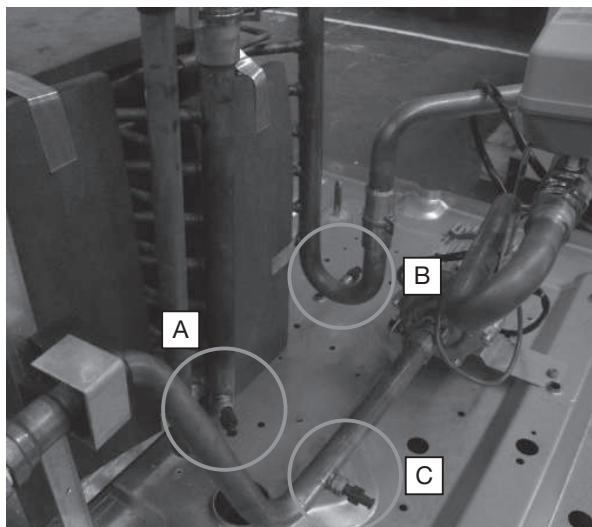


- 2) Remove the service panels both at the front and the rear.



Following instructions are based on a test unit equipped with the water piping only, to show better the relative positions of pipes and drain valves.

- 3) Open the drain valve C to drain water. Close the valve after draining.



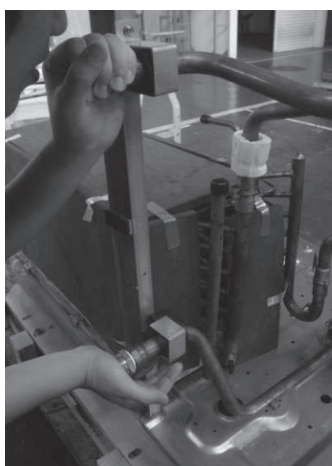
- 4) Disconnect the joints from the hot water supply and the water return pipe sides. Blow air from the hot water supply pipe joint till no water is forced out from the water return pipe any more.

* When using a nitrogen gas container, or other, always set the pressure no higher than 0.4 MPa.



- 5) Blow air from the hot water supply pipe side after opening the valve A and closing the return side by a hand. When water has been drained completely, close the valve A.

Repeat the same also on the valves B and C.



This is all for the water draining work. Restore the pipe connection after the work.

(Caution)

When water is charged again later, test run the water pump to bleed air securely before operating the unit. Please note that it may take time before the unit operation stabilizes.

4.8 7-segment display and compressor stop factor

(1) 7-segment code (P) list

Following list shows the codes used for the setting of option functions and for the adjustment of parameters at site.

For the methods to change settings, refer to the 7-segment setting procedure on the page 103 (8.4)(b).

Code No.	Data display	Data display range	Minimum unit	Remark
<Setting by service personnel>				
P20	Air heat exchanger fan snow protection control	0: (Factory default) 0-1	—	0: Fan snow protection control invalid (Factory default) 1: Fan snow protection control setting 1 valid
P21	Air heat exchanger fan snow protection control ON time setting	30: (Factory default) 10, 30-600 (sec)	30	
P22	Demand rate change value	OFF: (Normally) 000, 040, 060, 080	—	Setting value for 2-step demand input Ordinary demands are set with DIP switch.
P23	DC24V CNZ1 External output 1 function assignment	0: (Factory default) 0-20	1	0: Operation output 1: Error output 2: Compressor ON output 3: Fan ON output 4: Water shortage output 5: Water pump ON output 6: Anti-freezing circuit output 7: Defrost operation output 8: Hot water storage operation output 9: Heat retaining operation output 10: Anti-freezing operation output 11: Anti-freezing heater output 12: Water overflow output 13: Backup operation output 14: Remote control ON 15: Hot water amount output 16: Heating operation output (for space heating) 17~20: Spare
P24	DC24V CNZ2 External output 2 function assignment	1: (Factory default) 0-20	1	
P25	CNS1 function assignment	0: (Factory default) 0-20	1	0: Stop input (Master) 1: Demand input (Master) 2: Fan snow protection control input (Master/Slave independent) 3: Operation input (Operation/Normal) (Master) 4: Pause input (Pause/Normal) (Master) 5: 2-step demand input (Master) 6: Spare 7: Emergency stop (E63) 8: Start/Stop (Master) 9: Anti-legionella control input 10: Flow volume anomaly in heating operation 11~20: Spare
P26	CNS2 function assignment	1: (Factory default) 0-20	1	
P27	CNS3 function assignment	2: (Factory default) 0-20	1	
P28	CNG1 function assignment	3: (Factory default) 0-20	1	
P29	CNG2 function assignment	4: (Factory default) 0-20	1	
P30	Initial setting operation status	0: (Factory default) 0-2	1	0: Unfinished 1: Interruption 2: Completed
P31	CWV1 aperture correction value	0: (Factory default) -10~+10	2.50%	Range of auto correction by the primary setting operation is from -5 to +5. This is not to allow to change by manual.

Code No.	Data display	Data display range	Minimum unit	Remark
P32	AC200V system external output 1 function assignment (CNH3)	0: (Factory default) 0-20	1	0: Operation output 1: Error output 2: Compressor ON output 3: Fan ON output 4: Water shortage output 5: Water pump ON output 6: Anti-freezing circuit output 7: Defrost operation output 8: Hot water storage operation output 9: Heat retaining operation output 10: Anti-freezing operation output 11: Anti-freezing heater output 12: Water overflow output 13: Backup operation output 14: Remote control ON 15: Hot water amount output 16: Heating operation output (for space heating) 17-20: Spare
P33	AC200V system external output 2 function assignment (CNN2)	1: (Factory default) 0-2	1	
P34	AC200V system external output 3 function assignment (CNN13)	2: (Factory default) 0-2	1	
P47	Return hot water 3-way valve switching temperature	40: (Factory default) 0-90	5	Changes the switching temperature setting of the 3-way valve.
P77	Hot water storage amount reach/un-reach judgment temperature initializing	0: (Factory default)	1	Switches between the once-through and the circulation controls by the movement of 0→1 or 1→0 depending on the state of SW5-4.
P78	Hot water storage amount correction for hot water storage operation starting condition	5: (Factory default) 0-100	5	Changes the start condition when it starts to store hot water after using up hot water stored in the cylinder.
P79	Hot water storage amount correction for hot water storage operation ending condition	5: (Factory default) 0-100	5	When the hot water storage ending condition is corrected. Used, for example, when it is necessary to end just at 60%.
<Spare setting>				
P80	Number of CPU resets	0-255	1	
P81	Number of SL communication errors	0-255	1	
P82	Number of reset commands from remote control	0-255	1	
P83	Number of SFR errors	0-255	1	
P84	Number of remote control transmission disability errors	0-255	1	
P85	Number of sequence errors	0-255	1	
P86	Number of power source ONs	0-255	1	
P87	Number of task start errors	0-255	1	

(2) 7-segment code (C) list

Code No.	Contents of display	Data display range	Minimum unit	Remark
<Sensor & actuator>				
C00	CM1 operating frequency	0—130	1rps	
C01	CM2 operating frequency	0—130	1rps	
C02	Tho-A Outdoor air temperature	L _s -20—70	1℃	
C03	Tho-R1 Heat exchanger temperature1	L _s -20—70	1℃	
C04	Tho-R2 Heat exchanger temperature2	L _s -20—70	1℃	
C05	Tho-R3 Heat exchanger temperature3	L _s -20—70	1℃	
C06	Tho-R4 Heat exchanger temperature4	L _s -20—70	1℃	
C07	Tho-D1 Discharge pipe temperature (CM1)	L _s -25—150	1℃	
C08	Tho-D2 Discharge pipe temperature (CM2)	L _s -25—150	1℃	
C09	Tho-C1 Under-dome temperature (CM1)	L _s -30—90	1℃	
C10	Tho-C2 Under-dome temperature (CM2)	L _s -30—90	1℃	
C11	Tho-P1 Power transistor temperature (CM1)	L _s 10—140	1℃	
C12	Tho-P2 Power transistor temperature (CM2)	L _s 10—140	1℃	
C13	Tho-S1 Suction pipe temperature (CM1)	L _s -40—75	1℃	
C14	Tho-S2 Suction pipe temperature (CM2)	L _s -40—75	1℃	
C15	Tho-W1 Gas cooler water sensor (inlet)	L _s -40—75	1℃	
C16	Tho-W2 Gas cooler water sensor (outlet)	L _s -40—75	1℃	
C17	Tho-M1 Reciever inlet temperature sensor (CM1)	L _s -40—75	1℃	
C18	Tho-M2 Reciever inlet temperature sensor (CM2)	L _s -40—75	1℃	
C19	Tho-Inj1 Injection inlet temperature sensor (CM1)	L _s -40—75	1℃	
C20	Tho-Inj2 Injection inlet temperature sensor (CM2)	L _s -40—75	1℃	
C21	Tho-G1 Gas cooler inlet refrigerant temperature sensor (CM1)	L _s -25—150	1℃	
C22	Tho-G2 Gas cooler inlet refrigerant temperature sensor (CM2)	L _s -25—150	1℃	
C23	Tho-G3 Gas cooler inlet refrigerant temperature sensor (CM3)	L _s -40—75	1℃	
C24	Tho-G4 Gas cooler inlet refrigerant temperature sensor (CM4)	L _s -40—75	1℃	
C25	Tht-1 (Unvented cylinder)		1℃	
C26	Tht-2 (Unvented cylinder)		1℃	
C27	Tht-3 (Unvented cylinder)		1℃	
C28	Tht-4 (Unvented cylinder)		1℃	
C29	Tht-5 (Unvented cylinder)		1℃	
C30	Tht-6 (Unvented cylinder)		1℃	
C31	Tht-7 (Unvented cylinder)		1℃	
C32	Tht-8 (Unvented cylinder)		1℃	
C33	Tht-9 (Unvented cylinder)		1℃	
C34	Tht-Op1 (Vented cylinder)		1℃	
C35	Tht-Op2 (Vented cylinder)		1℃	
C36	Tht-Op3 (Vented cylinder)		1℃	
C37	WLS Water level sensor (Vented cylinder)	0—50	0.1kPa	
C38	CT1 Current (CM1)	0—50	1A	
C39	CT2 Current (CM2)	0—50	1A	
C40	Inverter secondary current1	0—50	1A	
C41	Inverter secondary current2	0—50	1A	
C42	High pressure sensor (CM1)	0—15	0.01MPa	
C43	High pressure sensor (CM2)	0—15	0.01MPa	
C44	Low pressure sensor (CM1)	0—8.5	0.01MPa	
C45	Low pressure sensor (CM2)	0—8.5	0.01MPa	
C46	Mid pressure sensor (CM1)	0—8.5	0.01MPa	
C47	Mid pressure sensor (CM2)	0—8.5	0.01MPa	
C48	Suction superheat (CM1)	0—50	0.1deg	
C49	Suction superheat (CM2)	0—50	0.1deg	
C50	FM01 Revolution speed	0—2550	10min ⁻¹	
C51	FM02 Revolution speed	0—2550	10min ⁻¹	
C52	EEVH1 Heating expansion valve opening pulse	0—500	1pulse	
C53	EEVH2 Heating expansion valve opening pulse	0—500	1pulse	
C54	EEVG1 Gas cooler expansion valve opening pulse	0—500	1pulse	
C55	EEVG2 Gas cooler expansion valve opening pulse	0—500	1pulse	
C56	Water pump revolution speed command	0—500	10min ⁻¹	
C57	Water pump revolution speed	0—500	10min ⁻¹	
C58	CWFFV1 opening	0—100	1%	
C59	CWFFV opening	0, 1 (0: Close, 1: Open)	—	Order of 100: CWFFV2
				Order of 10 : CWFFV3
				Order of 1 : CWFFV4

Code No.	Contents of display	Data display range	Minimum unit	Remark
C60	CWFV opening	0, 1 (0 : Close, 1 : Open)	—	Order of 100 : CWFV5
				Order of 10 : CWFV6
				Order of 1 : Spare
C61	"Pressure switch External input"	0, 1 (0 : Open circuit 1 : Short circuit)	—	Order of 100 : 63H1-1
				Order of 10 : 63H1-2
				Order of 1 : CNS1
C62	External input	0, 1 (0 : Open circuit 1 : Short circuit)	—	Order of 100 : CNS2
				Order of 10 : CNS3
				Order of 1 : CNG1
C63	External input External output	0, 1 (0 : Open circuit 1 : Short circuit)	—	Order of 100 : CNG2
				Order of 10 : Operation output (CNH)
				Order of 1 : Error output (CNY)
C64	External output	0, 1 (0 : Open circuit 1 : Short circuit)	—	Order of 100 : External output (CNZ1)
				Order of 10 : External output (CNZ2)
				Order of 1 : Spare
C65	Relay output (Heater)	0, 1 (0 : Open circuit 1 : Short circuit)	—	Order of 100 : CH1
				Order of 10 : CH2
				Order of 1 : DH
C66	Relay output (Heater)	0, 1 (0 : Open circuit 1 : Short circuit)	—	Order of 100 : H1
				Order of 10 : H2
				Order of 1 : Spare
C67	Relay output (Cooling fan for control)	0, 1 (0 : Open circuit 1 : Short circuit)	—	Order of 100 : Coolig fan1, 2
				Order of 10 : Ventilating fan
				Order of 1 : AC water pump
C68	Relay output (52X-1, 2)	0, 1 (0 : Open circuit 1 : Short circuit)	—	Order of 100 : 52X1-1, 2
				Order of 10 : 52X2-1, 2
				Order of 1 : Spare
C69	Relay output (Solenoid valve)	0, 1 (0 : Open circuit 1 : Short circuit)	—	Order of 100 : SV-inj1
				Order of 10 : SV-inj2
				Order of 1 : SVHG1
C70	Relay output (Solenoid valve)	0, 1 (0 : Open circuit 1 : Short circuit)	—	Order of 100 : SVHG2
				Order of 10 : SV-oil1
				Order of 1 : SV-oil2
C71	Number of connected unit	1-4	1unit	
C72	Capacity of connected unit	0-999	1kW	
C73	Accumulated compressor operating time (CM1)	0-655	100h	
C74	Accumulated compressor operating time (CM2)	0-655	100h	
C75	Accumulated water pump operating time	0-655	100h	
C76	Accumulated compressor operating time from the maintenance last time (CM1)	0-655	100h	
C77	Accumulated compressor operating time from the maintenance last time (CM2)	0-655	100h	
C78	Accumulated water pump operating time from the maintenance last time	0-655	100h	
C79	Operation mode	0-10	—	See next page.
C80	Target temperature to top up	0-99	1℃	
C81	Target hot water temperature	0-99	1℃	
C82	Target hot water amount	0-99	1℃	
C83	Rate of effective demand	0-100	1%	
C84	Hot water amount	0-127	1%	
C85	Spare	—	—	
<Control status>				
C86	Control status	0-127	1	
C87	Protection control status	0-127	1	
C88	Compressor stop factor	0-127	1	
C89	Compressor stop factor lapsed time	0-255	1	
C90	Protection control factor1	0-127	1	
C91	Protection control factor2	0-127	1	
C92	Protection control factor3	0-127	1	
C93	Compressor anomaly detection factor1	0-127	1	
C94	Compressor anomaly detection factor2	0-127	1	
C95	Compressor anomaly detection factor3	0-127	1	
<Others>				
C96	Data reset			
C97	Program · sub-version	0-991	—	
C98	Program · POL-version	0.00-9.99	0.01	
C99	Auto feed display	—	—	

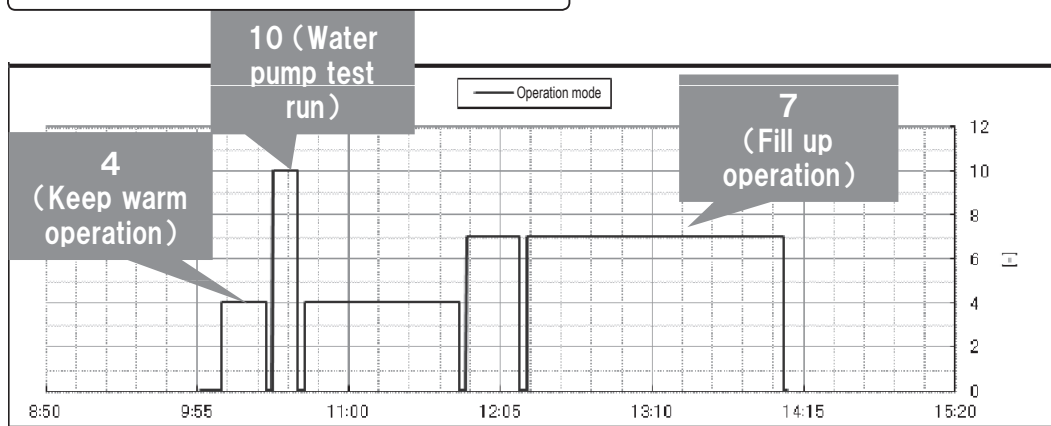
- Operation mode can be confirmed from Mente PC or 7-segment display (C79)

No.	Operation mode	Cylinder type		In case of day off setting
0	Stop	Vented	Available	Available
		Unvented		
1	Top up operation	Vented	Available	<u>Unavailable</u>
		Unvented		
4	Keep warm operation (Vented cylinder only)	Vented	Available	Available
		Unvented	<u>Unavailable</u>	
5	Anti-freezing operation (Water pump work only)	Vented	Available	Available (*1)
		Unvented		
7	Fill up operation	Vented	Available	Available
		Unvented		
8	Defrost operation (*2)	Vented		
		Unvented		
9	Primary setting operation	Vented		
		Unvented		
10	Water pump test run	Vented		
		Unvented		

(*1) After primary setting operation is done, this operation is available.

(*2) If ambient temperature is less than 3 degree, defrost operation will be started after finishing top up operation in night-time.

[Example of operation mode in Mente PC data]



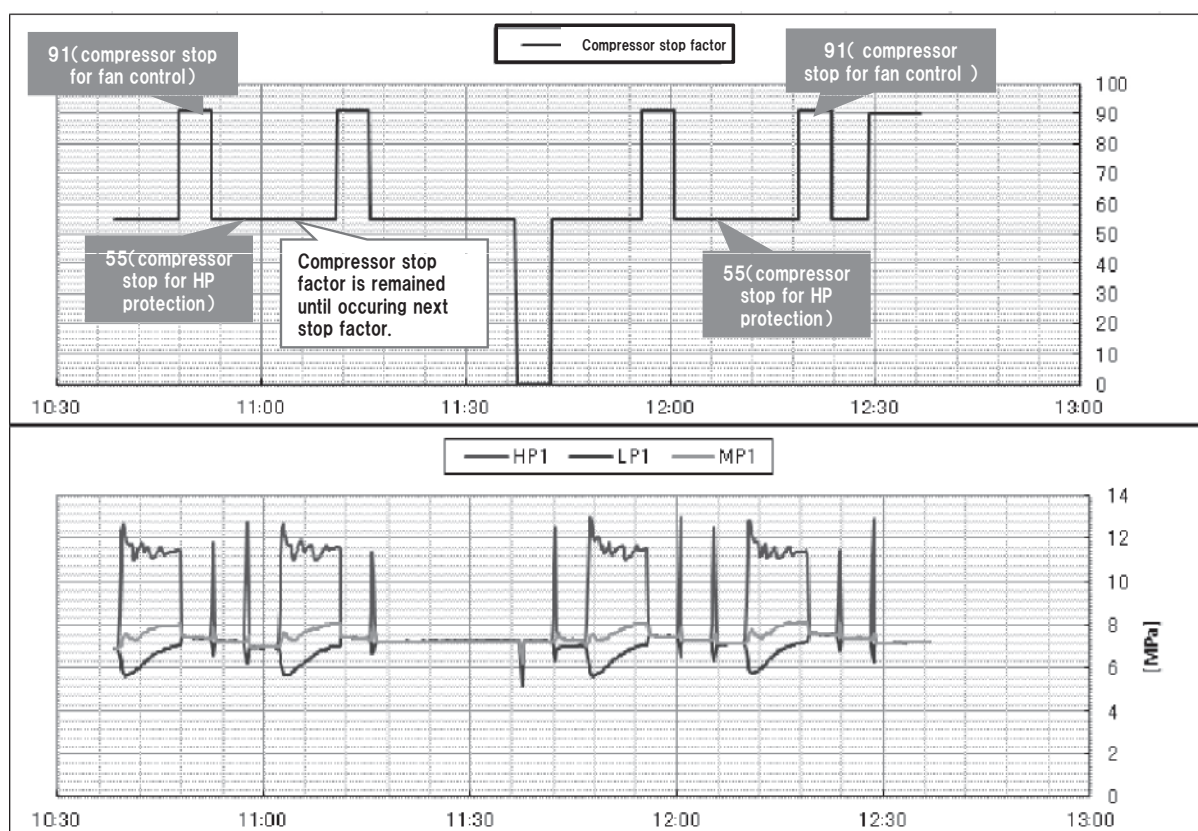
(3) Compressor stop factor

It can be confirmed the number of compressor stop factor from Mente PC or 7-segment display (C88).

Compressor stop factor is remained until occuring next stop factor.

[Example]

- (i) Compressor stop factor (55) is caused by HP protection control. This control is caused by lack of supply water due to pipe clogging.
- (ii) Compressor stop factor (91) is caused by outdoor fan control . (2 fan → 1fan)
This control can be seemed in hot season.



Compressor stop factor		Number
【Outdoor unit】 Disconnection / Short circuit (sensor, EEV)	When power ON	0
	Ambient temperature sensor	1
	Heat exchanger temperature sensor 1 (Tho-R1)	2
	Heat exchanger temperature sensor 2 (Tho-R2)	3
	Heat exchanger temperature sensor 3 (Tho-R3)	4
	Heat exchanger temperature sensor 4 (Tho-R4)	5
	Discharge pipe temperature sensor 1 (Tho-D1)	6
	Discharge pipe temperature sensor 2 (Tho-D2)	7
	Suction pipe temperature sensor 1 (Tho-S1)	8
	Suction pipe temperature sensor 2 (Tho-S2)	9
	Under-dome temperature sensor 1 (Tho-C1)	10
	Under-dome temperature sensor 1 (Tho-C2)	11
	Heat radiation fin temperature sensor1 /Power transistor temperature sensor1(Tho-P1)	12
	Heat radiation fin temperature sensor2 /Power transistor temperature sensor2(Tho-P2)	13
	High pressure sensor 1	14
	Low pressure sensor 1	15
	Intermediate pressure sensor 1	16
	High pressure sensor 2	17
	Low pressure sensor 2	18
	Intermediate pressure sensor 2	19
【Outdoor unit】 Disconnection / Short circuit (sensor, EEV)	Gas cooler water temperature sensor 1	20
	Gas cooler water temperature sensor 2	21
	Gas cooler temperature sensor 1	22
	Gas cooler temperature sensor 3	24
	Temp. sensor at inlet injection port	26
	Temp. sensor at inlet port of intermediate pressure receiver	28
	Disconnection of EEVH1	30
	Disconnection of EEVH2	31
	Disconnection of EEVG1	32
【Unvented Cylinder】 Disconnection / Short circuit (sensor, EEV)	Th1 for unvented cylinder	40
	Th2 for unvented cylinder	41
	Th3 for unvented cylinder	42
	Th4 for unvented cylinder	43
	Th5 for unvented cylinder	44
	Th6 for unvented cylinder	45
	Th7 for unvented cylinder	46
	Th8 for unvented cylinder	47
	Th9 for unvented cylinder	48
	Water level sensor for unvented cylinder	49
	Water temperature sensor for unvented cylinder	50

Compressor stop factor		Number
【System anomaly】	HP1 Anomaly ※ 63H1 activation, HP $\geq$ 14MPa	55
	LP1 Anomaly ※ LP $\leq$ 1.0MPa	57
	Td1 Anomaly ※ Td $\geq$ 135℃	59
	Open phase on power source, Reverse phase on power source	61
	CPU communication error	62
【System anomaly】	FMo1 anomaly	65
	FMo2 anomaly	66
	INV1 current cut	67
	INV1 power transistor overheat	69
	INV1 start-up failure	71
	INV1 communication error	73
	INV1 loss of synchronism	75
	Communication error between outdoor unit	77
	Active filter anomaly	78
【Water circuit anomaly】	Water pump anomaly Ex. Rotation of water pump $< 500 \text{ min}^{-1}$	80
	Inlet water temperature anomaly Ex1. Inlet water temperature $> 63^\circ\text{C}$ Ex2. In case, there is a temperature difference($\angle 10^\circ\text{C}$) in 10 minutes.	81
	Outlet water temperature anomaly Ex1. Outlet water temperature $\geq 98^\circ\text{C}$	82
	Overflow anomaly	83
	Anomaly of cut off the water supply Ex1. Gas cooler outlet refrigerant temperature $\geq 80^\circ\text{C}$	84
	Flow volume anomaly	85
【Control】	Normal stop (Operation is stopped without anomaly.)	90
	Stop for changing control Ex1. fan control(2fan $\rightarrow$ 1 fan)	91
	Stop for changing water circuit Ex. Normal operation $\rightarrow$ Keep warm operation(Vented cylinder only)	92

4.9 How to reset the accumulated water pump and compressor operating time

【Timing to be displayed about periodical check 1, 2 & oPE-1 – 3,11 – 13】

- Q-ton announce the maintenance code and periodic check by the cumulative operating time of the water pump and compressor. This announcement to the user can remind the maintenance check.
- The table shows the timing of maintenance code and periodic check. And also, it shows how to reset the cumulative operating time after periodic check

	7-segment display of accumulated operation time (*1)	Maintenance code		Display of remote control(*2)		How to reset
		oPE Code	Timing to be displayed	Display content	Timing to be displayed	
Water pump	C78 (Accumulated water pump operating time from last periodical check)	oPE-11(M11)	5,000h	Periodical check 1	20,000h	1. Set 7-segment display to parameter C78. 2. Change SW3-7 to ON (oPE counter resets) 3. Change SW3-7 to OFF (factory default)
		oPE-12(M12)	10,000h			
		oPE-13(M13)	20,000h			
Compressor	C76 (Accumulated compressor operating time from last periodical check(CM1))	oPE-1(M1)	5,000h	Periodical check 2	30,000h	1. Set 7-segment display to parameter C76. 2. Change SW3-7 to ON (oPE counter resets) 3. Change SW3-7 to OFF (factory default)
		oPE-2(M2)	10,000h			
		oPE-3(M3)	30,000h			

Note) *1: 100h units

*2: This function can be invalid by using SW6-4 to ON (from Main ROM ver.1.802)

【How to reset accumulated time of water pump and compressor after replacement】

- Accumulated time of water pump and compressor is counted. This info will be useful when servicing.
- If it is replaced, make sure to reset its accumulated time for future service.

	7-segment display of accumulated operation time (*1)	How to reset
Water pump	C75 (Accumulated water pump operating time)	Set the 7-segment to C75. Reset operation time by pressing the SW7 for 3 seconds.
Compressor	C73 (Accumulated compressor operating time(CM1))	Set the 7-segment to C73. Reset operation time by pressing the SW7 for 3 seconds.

Note) *1: 100h units

〈Reference〉

C70	Relay output (Solenoid valve)	0, 1 (0 : Open circuit) (1 : Short circuit)	—	Order of 100 : SVHG2 Order of 10 : SV-oil1 Order of 1 : SV-oil2
C71	Number of connected unit	1 — 4	1unit	
C72	Capacity of connected unit	0 — 999	1kW	
C73	Accumulated compressor operating time (CM1)	0 — 655	100h	
C74	Accumulated compressor operating time (CM2)	0 — 655	100h	
C75	Accumulated water pump operating time	0 — 655	100h	
C76	Accumulated compressor operating time from the maintenance last time (CM1)	0 — 655	100h	
C77	Accumulated compressor operating time from the maintenance last time (CM2)	0 — 655	100h	
C78	Accumulated water pump operating time from the maintenance last time	0 — 655	100h	
C79	Operation mode	0 — 10	—	See next page.
C80	Target temperature. to top up	0 — 99	1℃	
C81	Target hot water temperature.	0 — 99	1℃	
C82	Target hot water amount	0 — 99	1℃	
C83	Rate of effective demand	0 — 100	1%	

4.10 Reference for control PCB replacement

When changing control PCB, make sure to save/transfer below data as following below procedure.

No.	Item	Content
1	Target HW temperature	60 — 90℃
2	Accumulated compressor operating time	0 — 255
3	Accumulated water pump operating time	0 — 255

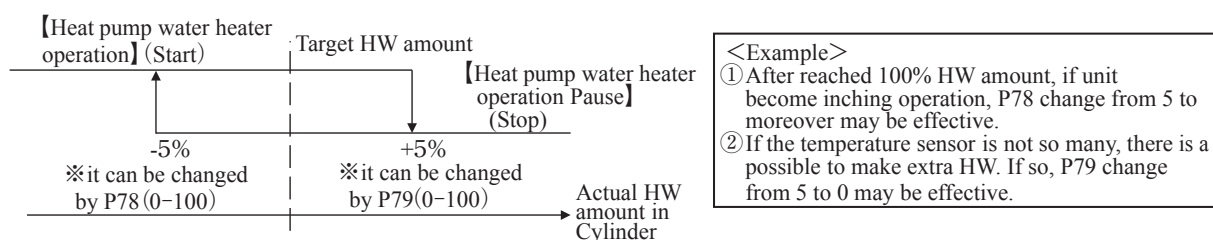
<Procedure for data save>

Menu ⇒ Service & maintenance (enter the PW) ⇒ Save HP unit setting
 ⇒ Save setting
 ※ If the multiple units are connected, all of unit data can be recorded.

<Procedure for data transfer >

Menu ⇒ Service & maintenance (enter the PW) ⇒ Save HP unit setting
 ⇒ Transferred the saved data
 ※ If the multiple units are connected, please select the unit.
 ※ During operation, this procedure is not allowed.

4.11 Operation start/stop condition



<Starting condition of normal operation>

Actual HW amount (= displayed in RC) + 5% < Target HW amount
 i.e.) If you want to start unit after run out of HW in cylinder, change the P78 value from 5 to 95.

<Ending condition of normal operation>

Actual HW amount (= displayed in RC) $\geq$ Target HW amount + 5%
 Or

Actual HW amount (= displayed in RC) $\geq$ 100% HW amount level

i.e.) If you want to stop the unit at reached actual HW amount as same as target HW amount, P79 value should be changed from 5 to 0.

Note) When you change P78/P79 value, make sure to record in commissioning report or service report.

Be sure to set P78 < target HW amount. If P78 $\geq$ target HW amount, heat pump will not start even if the actual HW amount reaches 0%.

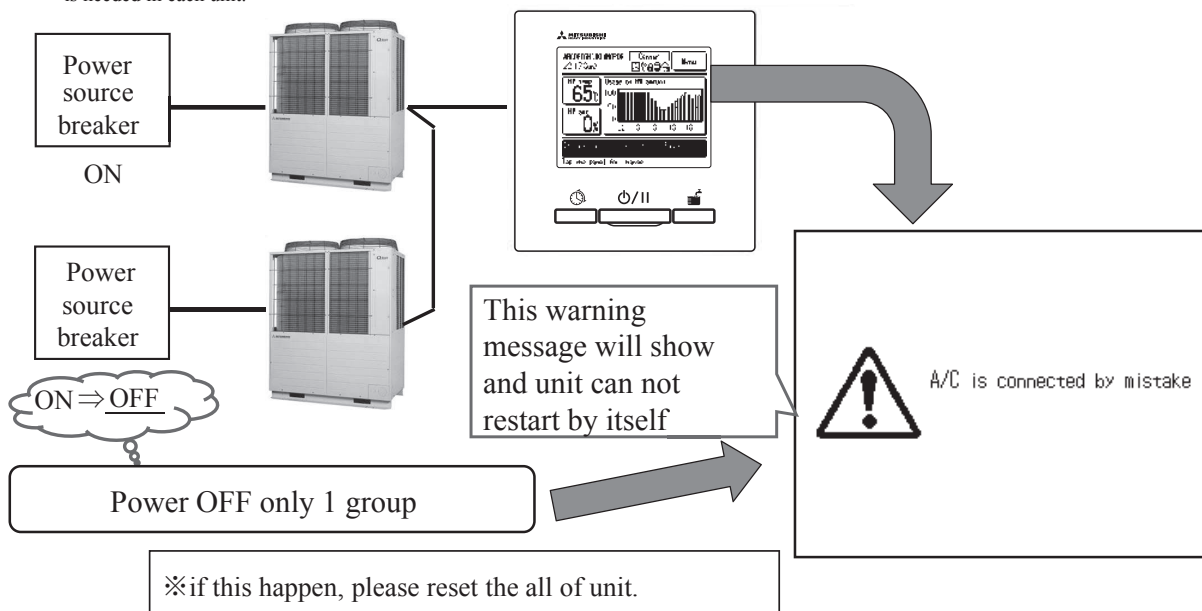
4.12 When power off in multiple unit system

(1) In case of 1 remote control & multiple units

(a) Prior to W23R-2.1

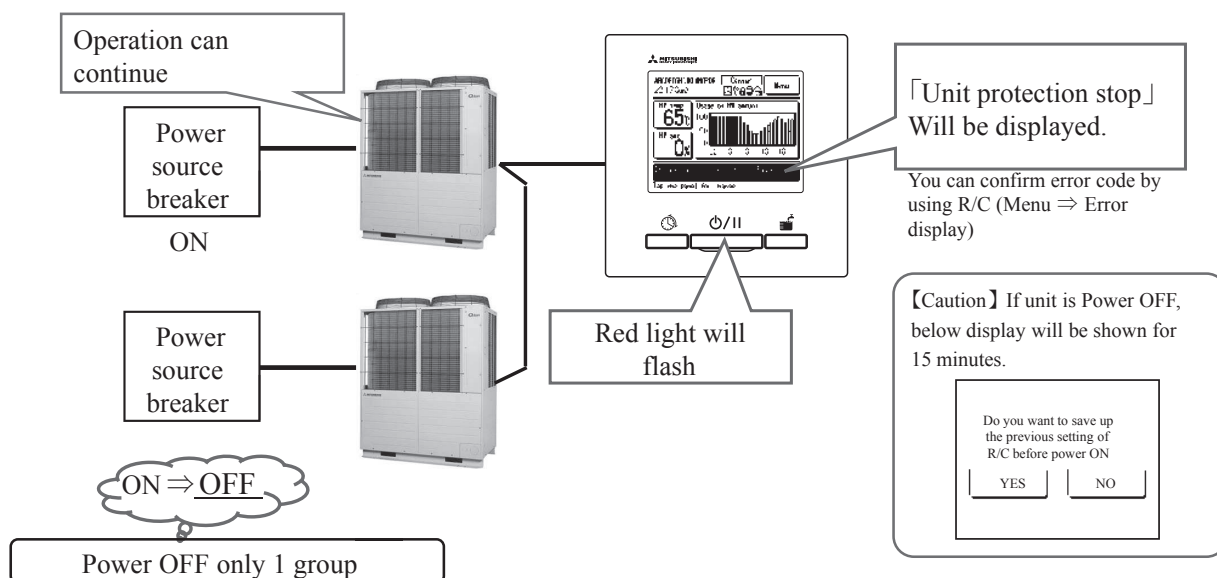
If 1 group is OFF in combination system, all of unit can not restart by itself.

※Power source breaker is needed in each unit.

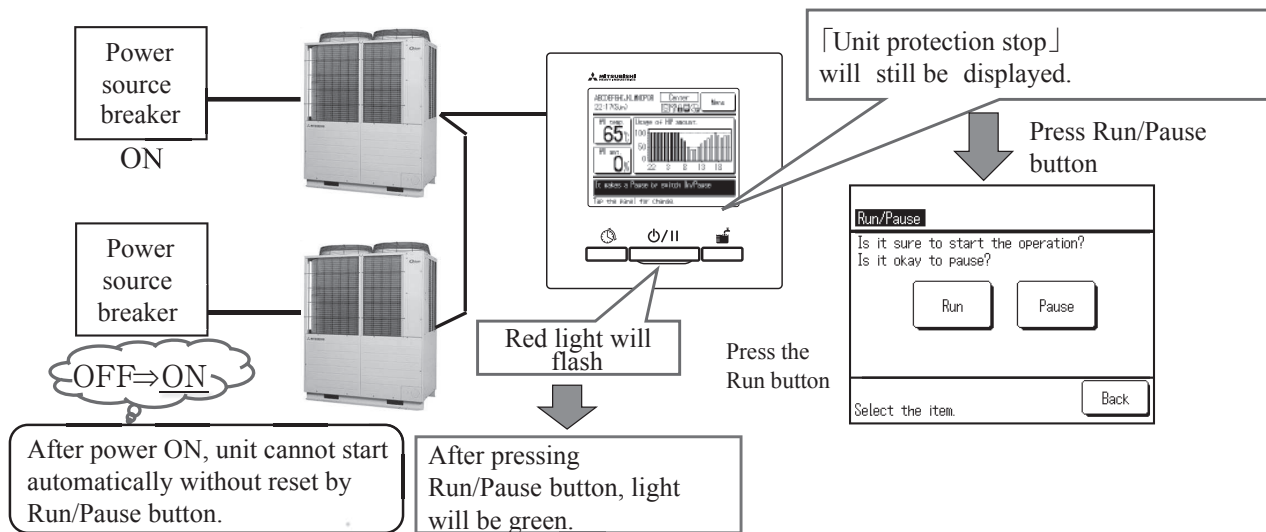


(b) W23R-2.2 or later

- ② At that time, E1 will be displayed and red light will flash because there is no communication with remote control and unit(Power OFF).

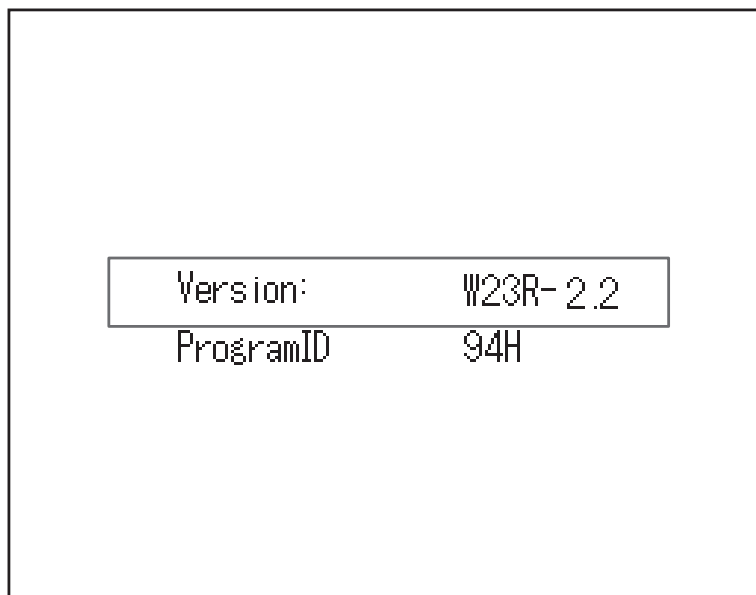


- ③ If the unit is power ON again, communication will re-start. But operation status will be stop.
- ④ Therefore please press Run/Pause button on R/C. At this time E1 will be reset.



(2) How to check R/C software version

※Below display will be shown after power ON
This issue will be solved from W23R-2.2 or later.



4.13 Additional information for tank temperature sensor connection

(1) Mounting method of temperature sensor

When attaching the temperature sensors on the hermetic type hot water cylinder, take the following cautions into consideration.

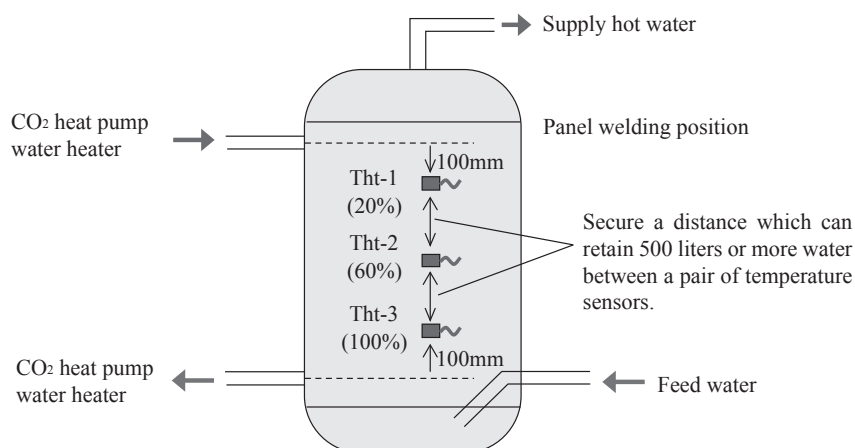
- Use aluminum adhesive tapes capable of withstanding temperatures higher than 90°C, with care to stick the sensors firmly to the surface of cylinder.
- Attach the sensors in the order of Tht-1, Tht-2 ..., starting from the hot water supply outlet. Hot water amounts corresponding to respective temperature sensors vary depending on the number of sensors.

TOTAL								
Sensor No.	2 pcs.	3 pcs.	4 pcs.	5 pcs.	6 pcs.	7 pcs.	8 pcs.	9 pcs.
Tht-1	20%	20%	20%	20%	10%	20%	10%	10%
Tht-2	100%	60%	50%	40%	30%	30%	20%	20%
Tht-3		100%	75%	60%	40%	40%	30%	30%
Tht-4			100%	80%	60%	50%	50%	40%
Tht-5				100%	70%	65%	60%	50%
Tht-6					100%	80%	70%	60%
Tht-7						100%	80%	70%
Tht-8							100%	80%
Tht-9								100%

- Attach the highest temperature sensor at about 100mm below the welding position of upper panel or connection for hot water returning from the heat pump water heater, whichever lower.
- Attach the lowest temperature sensor at about 100mm above the supply water inlet or connection of feed water pipe to the heat pump water heater, whichever higher.

When the supply water inlet goes down in the hot water cylinder, take as the standard the end of supply water pipe or incoming water pipe connection, whichever higher.

- Between the highest and lowest sensors, attach temperature sensors keeping the same distance from one to the next sensor. Take care also to adjust the number of sensors such that 500 liters or more water will be reserved between a pair of sensors, in order to prevent the inching operation.



AIR TO WATER HEAT PUMP



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